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SEWRPC Staff Memorandum

MALLARD LAKE SURVEY, MILWAUKEE COUNTY, WISCONSIN

December 23, 2025

In an effort to build upon SEWRPC Planning Report No. 42, A *Regional Natural Areas and Critical Species Habitat Protection and Management Plan for the Southeastern Wisconsin Region*, Commission staff secured grant funding from the Wisconsin Coastal Management Program ("WCMP") to assist with natural area and aquatic site inventory, protection, and management plan development. The goals of the project include increasing the regional capacity to update existing biological inventories, completing inventories lacking surveys, and incorporating data into ecological restoration plans. Commission staff identified Milwaukee County lakes that had very little or no water quality or biotic information collected to conduct aquatic plant surveys, water quality monitoring, aquatic invasive species surveys, shoreline surveys, and/or sediment surveys. The data collected on the lakes surveyed are being summarized in brief reports that are made available to the public. The data and reporting are intended to help establish the ecological status of the waterbodies to assist in management strategies to protect and restore them so that they can continue to serve Milwaukee County and its residents. Four lakes (Jackson Park Pond, McGovern Park Pond, Scout Lake, and Mallard Lake) were surveyed in the summer of 2025.

LAKE BACKGROUND INFORMATION

Mallard Lake (Lake) is a 17.6-acre drained lake located entirely in the City of Franklin within Milwaukee County, Wisconsin.[1] The Lake is located within the Wehr Nature Center's managed property within Whitnall Park (Park). Mallard Lake was constructed on a tributary to the Root River in the 1930s as a water feature within Whitnall Park through work by the Civilian Conservation Corps. The Milwaukee County Park Commission purchased 660 acres of farmland and unused fields to create Whitnall Park. Between 1933 and 1935, approximately 150,000 cubic yards of soil were dug to create the lake, which was supported by the creation of a dam in 1935 (see Figure 1).[2] The original lake depth is stated to have been fifteen feet deep. Per a 1970 survey of the Lake by WDNR, Mallard Lake attained a maximum depth of approximately ten feet

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[1] *Mallard Lake is referred to as Whitnall Park Pond (WBIC 7300) by the Wisconsin Department of Natural Resources (WDNR).*
[2] *More information regarding Mallard Lake's history can be found on the Wehr Nature Center's Youtube channel: https://www.youtube.com/@wehrnaturecenter*

with a mean depth of six feet and a volume of 94 acre-feet (see Figure 2).[3] The lake is an impoundment of Tess Corners Creek that drains to the Root River and into Lake Michigan. The outlet dam on the northeastern shore creates the Whitnall Park Waterfall, which is a popular area with Park visitors. Three small islands are located within the lake. The public can access the Lake via a pier built in 2020 located on the lake's western shore as well as a 1.5-mile trail that loops around the Lake.[4] The WDNR reports panfish as present in the Lake while the 1964 publication *Surface Water Resources of Milwaukee County* states that bullhead, carp, and several species of sunfish constitute the lake fishery. This report also states that aquatic plant growth, algae, stunted panfish, and excessive fertility are major use issues.[5]

Although the Lake has not been the subject of a formal study by the Commission, Commission staff have assisted with studies supported by the Wehr Nature Center. Wehr Nature Center staff, the Friends of Wehr Nature Center, and others have noted increased sedimentation and decreased water quality in the Lake over time.[6] As the lake becomes shallower due to sedimentation, aquatic plant coverage has expanded substantially across the Lake with much of the surface colonized by water lilies. This sedimentation has been associated with greater impervious surface coverage in the watershed (shift from agricultural to suburban land use), degraded tributary stream conditions, and more intense precipitation events causing excessive runoff and erosion. In response, Milwaukee County staff and the Friends of Wehr Nature Center have worked with the Commission and a private engineering firm to study the erosion of tributary streams to the Lake and to design regenerative stormwater conveyance projects to reduce this erosion and the corresponding sediment transport to the Lake. Lake sedimentation is discussed in more detail later in this report.

Using the WDNR Watershed Explorer (WEx) tool, Commission staff delineated the lake's watershed and summarized the land use and pollutant loading information.[7] The lake has a 6,592.8-acre watershed that drains from both Waukesha and Milwaukee counties, covering residential, urban, agricultural, and other land use types (see Map 1). The watershed to lake ratio is 412:1 for Mallard Lake, a very large watershed for the lake's size that may contribute significant sedimentation and other pollutant loading from the watershed. Tess Corners Creek, the tributary to Mallard Lake, is currently listed as an impaired waterbody due to phosphorus levels.[8] This, combined with a close proximity to the Whitnall Park golf course, may increase the pollutant loading to the Lake. Commission staff utilized the Wisconsin in-lake Suite Modeling (WiLMS) component of WEx to model phosphorus loads to the Lake based on watershed land uses (Table 1). As most phosphorus transported to lakes is bound to soil particles, these estimates could be considered a proxy for sediment loading sources as well. Row crop agriculture is predicted to be the predominant phosphorus loading source, contributing 766 pounds (44.5% of the total phosphorus).[9] Additionally, residential areas constitute 52.7 percent of the land use in the Mallard Lake watershed and contributes 610 pounds of phosphorus to the Lake a year. Of the 610 pounds contributed, high-density urban areas contribute over a third of the phosphorus, though only making up 4.6 percent of residential land.

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[3] *https://apps.dnr.wi.gov/water/waterDetail.aspx?WBIC=7300*

[4] *https://www.wehrnaturecenter.com/visit/*

[5] *Wisconsin Conservation Department,* Surface Water Resources of Milwaukee County, *1964.*

[6] *Friends of Wehr Nature Center, "What's Going on With Wehr's Lake?", August 25, 2023. https://www.friendsofwehr.org/what-is-going-on-with-wehrs-lake*

[7] *https://dnr-wisconsin.shinyapps.io/WaterExplorer/*

[8] *https://apps.dnr.wi.gov/water/waterDetail.aspx?key=9965*

[9] *Erosion from the aforementioned tributary streams may be an additional potential phosphorus and sediment source to the Lake that are not directly captured in the WiLMS model.*

SURVEY FINDINGS

Commission staff worked with the Wehr Nature Center to complete the Mallard Lake survey on July 21st, 2025.[10] This work included an aquatic plant survey, water quality measurements, sediment depths and identification of aquatic invasive species (AIS). Weather conditions were warm and sunny with mild wind. The lake's water clarity was poor and the water had a green tint with algal scums, duckweed, and watermeal covering the surface. Most of the Lake was surrounded by vegetative buffers along the shoreline, with some woody vegetation along the southern end of the Lake. However, there were areas that had manicured turf extending nearly to the water's edge, particularly on the southeastern shore of the Lake abutting the Whitnall Park Golf Course. Developing a vegetative buffer between the golf course and the lake's edge would help reduce runoff and nutrient loading from the lake's watershed. Native mussels, fish, and several native bird species were observed during the survey (see Figure 3). Notably, zebra mussels (*Dreissena polymorpha*), an invasive mussel species common in many lakes in southeastern Wisconsin, were not observed during the survey.

Commission staff completed a point-intercept aquatic plant survey of the lake using a grid provided by Wisconsin Department of Natural Resources (WDNR) (see Figure 4). At each survey point, Commission staff recorded the water depth, sediment type, and the qualitative abundance of each species observed as well as all aquatic plants combined. Photos and specimens were collected for each observed aquatic plant species. Accumulated sediment depths were recorded at select survey points. Water quality measurements, including a Secchi disk reading and profiles of temperature, dissolved oxygen, dissolved oxygen saturation, pH, PSI, and mVORP were measured using a Hanna Instruments meter at the lake's deep hole site.

Aquatic Plant Observations

Commission staff observed 18 aquatic plant species during the point-intercept survey: fifteen native species and three invasive species (Table 2). This species richness is fairly high for a lake of this size, particularly for a constructed waterbody. The total littoral vegetation coverage, or the percentage of aquatic plant occurrence in depths that were shallower than the maximum depth of plants, was 97.3. Hence, nearly the entire surface area of the Lake is covered by aquatic plant growth. The maximum depth of colonization by plants was nine feet, which was also the recorded maximum depth of the Lake. The average rake fullness was 2.43 (see Map 2). High nutrient loading, particularly total phosphorus, contributed from the large watershed and high proportion of shallow littoral areas favor the abundant aquatic plant growth conditions within this Lake. The top five most common species observed were, in order of abundance within vegetated areas: coontail (*Ceratophyllum demersum*, 85.7 percent), waterweed (*Elodea canadensis*, 72.5 percent), small duckweed (*Lemna minor*, 61.4 percent), large duckweed (*Spirodela polyrhiza*, 56.1 percent), and watermeal (*Wolffia* spp., 56.1 percent). As described earlier in this report, white water lily (Nymphaea odorata) also covers a substantial portion of the Lake with observations at 19.8 percent of all survey points visited. This count is an underestimate as several areas of the Lake were too shallow and too heavily vegetated with white water lily to visit during the aquatic plant survey (see points labeled as "Not Sampled" on Map 2. Many of these aquatic plant species are associated with eutrophic (nutrient-rich) conditions, which, along with the abundant aquatic plant growth, suggests that there is substantial phosphorus loading to the Lake.

Three invasive aquatic plant species were observed during the Mallard Lake survey, all of which had been previously reported to the WDNR: Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*), and flowering rush (*Butomus umbellatus*). All these species were observed at relatively few survey points within the Lake, with Eurasian watermilfoil being the most common at 19.39

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[10] *Jeff Veghlan, the Wehr Nature Center Land Manager, provided access and helped to organize the survey while intern Kayla Peirick assisted Commission staff with fieldwork.*

percent of littoral points. First observed in Mallard Lake in 2013, flowering rush is an NR 40 restricted species that Wehr Nature Center staff actively manage through manual removal techniques.[11] There is no other aquatic plant management on Mallard Lake at this time.

Water Quality

It is the understanding of Commission staff that Mallard Lake has recorded Secchi depths in recent years, but otherwise had not been previously sampled for water quality.[12] Commission staff have endeavored to provide as much insight as possible on the Lake's water quality using the available data from the 2025 survey within the context of the lake characteristics and origin.

Temperature and Dissolved Oxygen

Seasonal air temperature fluctuation and varying amounts of sunshine influence lake temperatures, causing waters to mix and stratify seasonally. In spring and fall, most lakes are well mixed and therefore are the same temperature from the water surface to the lake bottom. In summer, surface water warms and becomes more buoyant than underlying cooler water. Commission staff measured water temperatures through a depth profile of the lake, taken at the deep hole site, located in the northwestern end of the Lake (see Figure 5). Water temperatures ranged from 17.93 to 22.73°C (64.27 to 72.91°F). Mallard Lake did not exhibit a pattern of stratification, and the Lake instead likely experiences constant mixing of waters throughout the summer. All water temperatures measured are indicative of healthy conditions for warmwater fish species found in Southeastern Wisconsin.[13]

Dissolved oxygen (DO) levels are one of the most critical factors affecting the living organisms of a lake ecosystem. DO is generally higher at the surface of a lake where there is an interchange between the water and atmosphere, stirring by wind action (which aids in atmospheric oxygen diffusion into the surface waters at the air-water interface), and oxygen production by plant and algae photosynthesis. Metabolic processes, such as bacterial decomposition and respiration by aquatic organisms, consume oxygen and decrease DO concentrations. Dissolved oxygen was reported both in ppm (parts per million) and milligrams per liter (mg/l), as well as percent saturation. While ppm measures the amount of oxygen in a volume of water, interchangeable with mg/l, the percentage of dissolved oxygen reports the relative amount of oxygen the water could hold at a given temperature and air pressure. When water is holding as much oxygen as can be absorbed, it is 100% saturated. Oxygen saturation values above 100%, called supersaturation, occur when the water contains a higher concentration of dissolved oxygen than is normally soluble at ambient conditions of temperature and pressure. Supersaturation can occur when photosynthesis is releasing oxygen faster than can be used, indicative of algae blooms or eutrophic conditions.

A minimum DO concentration of 5 mg/l is considered necessary for survival of most species of fish. Commission staff measured dissolved oxygen concentrations ranging from 1.04 to 11.44 mg/l[14] (see Figure 5), generally decreasing with depth. Percent saturation of DO showed similar data patterns, ranging from 11.5 to 130.4 percent throughout the water column. The lowest depths of the lake were nearly anoxic and would not be supportive of fish or other aquatic life. The anoxic levels recorded are likely a result of the respiration of sediments at bottom of the lake consuming (reducing) the dissolved oxygen concentrations. Oxygen supersaturation, recorded at a depth of three feet, is probably caused by high intensities of photosynthesis of both algae and aquatic plant growth. As 140 percent saturation and higher can cause fish

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[11] *More information on flowering rush and appropriate management techniques can be found at the following link: https://dnr.wisconsin.gov/topic/Invasives/fact/FloweringRush.*

[12] *https://apps.dnr.wi.gov/water/waterDetail.aspx?WBIC=7300*

[13] *docs.legis.wisconsin.gov/code/admin_code/nr/100/102.pdf#page=18.*

[14] *Conversion of units from ppm to mg/l is a direct conversion of 1:1.*

kills, the recorded supersaturation conditions are also likely stressful to fishes at the opposite extreme. Anoxia and oxygen supersaturation within the water column of the Lake have two implications. First, because these dissolved oxygen samples were only collected during the day, the dissolved oxygen concentrations data presented here may be less representative of average concentrations and more typical of maximum concentrations achieved during diurnal periods. More samples should be taken at different times of the day to quantify the fluctuations in DO levels and determine more average conditions. Second, respiration by the same algae and aquatic plants may cause steep declines in dissolved oxygen concentration at night when photosynthesis cannot occur due to lack of light that may cause dissolved oxygen to drop to near zero. Anoxia and oxygen supersaturation, along with daily rapid fluctuations in oxygen levels are all stressful to fish. These conditions are a likely indicator of an enriched nutrient status within the Lake, likely contributing to the presence of the most tolerant fish species. Incoming sediment and nutrient loading may exacerbate present supersaturation and anoxic conditions, decreasing habitat viability for fishes and other aquatic macroinvertebrates within the Lake.

Water Clarity

Water clarity, or transparency, provides an indication of overall water quality—the greater the clarity, the better the water quality. In most Southeastern Wisconsin lakes, water clarity is influenced by the abundance of algae and suspended sediment. Water clarity generally varies throughout the year as algal populations increase and decrease in response to changes in lake temperature, sunlight, and nutrient availability. Large rainfall events can also influence water clarity, with sediment-induced clarity declines caused by heavy runoff. Clarity is measured using a Secchi disk, a black-and-white, eight-inch-diameter disk. This disk is lowered into the water until it is no longer visible, at which point the depth is recorded, and then it is raised until visible again, when depth is recorded again. The average of these depths is called the "Secchi depth." Commission staff measured a Secchi depth of three feet at the deep hole site, which is indicative of poor water clarity. Wehr Nature Center staff conducted another Secchi depth measurement on July 10, 2025 of 2.25 feet.[15] Despite the low water clarity measured via Secchi depth, there is clearly enough clarity to sustain aquatic plants as indicated by the abundant coverage throughout almost the entirety of the Lake.

pH

The acidity of water is measured using the pH scale, a logarithmic measure of the hydrogen ion concentration on a scale of 0 to 14. Pure water has a pH of 7, neutral on the pH scale. In Wisconsin lakes, pH can range anywhere from 4.5 in some acid-bog lakes to 8.4 in hard water, marl lakes.[16]

Many chemical and biological processes are affected by pH, as are the solubility and availability of many substances. Different organisms can tolerate different ranges of pH, with most preferring ranges between about 6.5 and 8.0. Although moderately acidic (slightly below a pH of 7) does not usually harm fish, as pH drops to 6.5 or lower, some species can be adversely affected, especially during spawning. In addition, many metals are more soluble in water with low pH than they are in water with high pH and can be released from lake sediment if present under low pH conditions. A waterbody's pH can be affected by acids released by decomposition of organic material, underlying soil and bedrock type, and photosynthesis of aquatic plants, phytoplankton, and algae. Additionally, external factors such as pollutants contained in discharges from point sources and in stormwater runoff can also affect the waterbody's pH.

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[15] *Personal communication between Commission and Wehr Nature Center staff in December 2025.*

[16] *Wisconsin Department of Natural Resources, Byron Shaw, Christine Mechenich, and Lowell Klessig, Understanding Lake Data: www.uwsp.edu/cnr-ap/UWEXLakes/Documents/ecology/shoreland/background/understanding%20lake%20data.pdf.*

The pH of Mallard Lake ranged from 7.03 to 8.37 and was more alkaline near the surface before subtly decreasing with depth (see Figure 5). This pattern is most likely due to higher concentrations of carbonic acid that forms in the anoxic waters in the bottom of the waterbody. Like most lakes in southeastern Wisconsin (mean pH of 8.1), Mallard Lake is a slightly basic waterbody.[17]

Other Parameters

Commission and nature center staff recorded PSI and mVORP values as detected in the suite of the Hanna Instruments meter (see Figure 5). PSI refers to 'pound-force per square inch' or the amount of pressure in the water. These values typically increase with depth due to hydrostatic pressure. PSI was fairly consistent through the water column, slightly increasing with depth.

mVORP refers to the oxidation-reduction potential (ORP), measured in millivolts (mV), which reports the electron transfer capacity by measuring oxidizing or reducing agents. The unique combination of dissolved solutes in the water (i.e. chlorine, decaying matter, hydrogen, oxygen) swing the redox value to be positive or negative. A high ORP typically signifies higher oxygen content that can support biochemical processes in a lake ecosystem. Lower ORP values can indicate eutrophication, high nutrient content that consumes the oxygen to lead to anoxic conditions. The mVORP values of Mallard Lake remained relatively positive until seven feet of depth, correlating to observed anoxic conditions at those depths.

Sediment

As described earlier in the report, sedimentation in Mallard Lake is an ongoing issue of concern for Wehr Nature Center staff.[18] Originally constructed with a maximum depth of 15 feet, the WDNR survey indicated a maximum depth of 10 feet in 1970, suggesting that sedimentation has been occurring since the Lake's construction. As part of the natural aging process, all lake basins gradually fill with sediment. This sediment is primarily derived from the following processes.

- **Sediment carried to a lake by actively flowing water**. Erosion over broad expanses of upland areas is typically the primary source of such sediment to most lakes. This sediment is generally funneled to lakes through tributary streams. In some cases, general overland flow around the lake and shoreline erosion can also be significant contributors to a lake's overall sediment load. Much of the sediment carried to lake basins by moving water is comprised of inorganic gravel, sand, silt, and clay. Lakes with large watersheds, significant land and/or shoreline disturbance can lead to the accumulation of large amounts of sediment to be deposited into the lake bottom each year. Coarser-grained sediments (i.e., silt, sand, and gravel) commonly accumulate near the point where moving water enters a lake. In contrast, portions of lakes well offshore, or otherwise distant from moving water, accumulate clay-size sediment. The actual amount of sediment entering lake basins is highly dependent on lake- and watershed-specific factors and is therefore highly variable.

  Lake sediment loads are most often estimated using models. If quantitative sediment information exists, it often is based upon sporadic sampling and may not adequately represent overall sediment load since the amount of sediment carried by flowing waters is highly dependent on flow conditions, seasons, and other factors. Furthermore, in most cases, samples quantify only suspended sediment load. Rivers and streams also transport sediment as bedload. Bedload is sediment that is too heavy for flowing water to suspend and instead moves near the streambed in response to flowing water.

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[17] *R.A. Lillie and J.W. Mason,* Limnological Characteristics of Wisconsin Lakes*, Wisconsin Department of Natural Resources Bulletin No. 138, 1983.*

[18] *Friends of Wehr Nature Center, 2023, op. cit.*

Very few studies quantify bedload. However, studies in Wisconsin and nearby states generally suggest that bedload commonly transports a mass of sediment equal to between 25 percent and 400 percent of the mass transported as suspended load.[19,20] Therefore, if lake managers are interested in the *total* mass of sediment transported by flowing water to lakes, bedload must be considered.

- **Sediment originating in a lake comprised of dead plants and animals**. All aquatic plants, algae, diatoms, fish, and other aquatic life eventually die and settle to the lake bottom. When the supply of such material exceeds the ability for material to be decomposed and removed from the lake bottom, organic deposits form. These deposits are commonly termed muck or peat. Muck is deposited throughout lake basins while peat is general confined to riparian wetlands. The amount of these materials deposited within lakes is highly variable and is highly dependent upon the level of lake nutrient enrichment.

Water Depth and Sediment Type

Commission staff recorded the water depth as well as sediment type at each point-intercept grid survey point. Recorded water depths ranged from one to nine feet, with an average depth of five feet (see Map 3). However, many of the shallowest areas were heavily vegetated and were not visited during the survey, indicating that the average lake depth is shallower than the recorded five foot average. The deepest areas of the Lake were near the outlet dam while the shallowest areas were in the southern end near the outflow from the Lake's main tributary stream. This pattern of water depths is observed in many riverine impoundments and is consistent with observations that the Lake has been filling with accumulated sediment from this tributary.

Mallard Lake sediment was largely organic muck, with muck observed at 99 survey points and sand observed at only two survey points (points 35 and 102, which are located on the northwest sides of two of the Lake's islands). These observations somewhat correspond with those recorded in the 1970 WDNR survey of the Lake, where muck covered most of the main body of the Lake while the nearshore areas consisted of sand or rock (see "Mk.", "Sd." and "Rk.", notation, respectively, on Figure 2. Some of these formerly sandy and rocky areas may have since been covered by accumulated soft sediments. Additionally, some of these areas such as the former beach site, may have been too shallow or heavily vegetated to survey.

Commission staff surveyed flocculent sediment depths in Mallard Lake using a seven-foot-long hollow plastic tube marked in inches to the top. At selected points from the point-intercept survey, the pole was lowered until it hit the current Lake bottom, and a depth measurement was recorded. The pole was then pushed down once more to break through accumulated sediment until it could not be pushed further, called the point of refusal, and another measurement was made. Accumulated sediment was calculated by subtracting the point of refusal measurement from the current Lake bottom depth.

Out of the 34 sediment depths collected, accumulated sediment depths ranged from zero to 4.3 feet (see Map 4). The highest amount of accumulated sediment was seen in the southern end on the lake near the inlet tributary; some of this area was too shallow to navigate using the Commission's canoe due to the accumulation of flocculent sediment. This area was marked as being between 3 and 5 feet deep in 1970 but

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[19]Ladewig, Matthew David, Sediment Transport Rates in the Lower Muskegon River and Tributaries, Master of Science Thesis: Department of Natural Resources and Environment, University of Michigan, August 2006.

[20]Williams, Garnett P. and David L. Rosgen, Measured Total Sediment Loads (Suspended Loads and Bedloads) for 93 United States Streams, United States Geological Survey Open-File Report 89-67, 1989.

was less than a half-foot deep during the Commission's visit in 2025. This tributary has been previously identified as a significant source of sediment into the Lake and is an area of ongoing study and restoration planning (see Figure 6). Other high accumulation areas were on the western side of the Lake, which may correspond with the primary flow of water through the impoundment.

Due to Mallard Lake's large watershed with both agricultural and urbanized land uses, high sediment accumulation is unsurprising. As only a limited number of sediment depths were taken, the total sediment load to Mallard Lake is unable to be confidently quantified. More studies should be conducted for an accurate assessment, particularly if dredging the Lake to restore water depth is considered as a management option. It can be assumed that with a presently high biomass, sediment accumulation will continue to rise and may lead to further nutrient enrichment of the Lake. With a high percentage of agricultural phosphorus loading in the watershed, ensuring that agricultural landowners are utilizing best management practices, such as reduced tillage and cover crops, could help enhance the water quality of the Lake. Likewise, residential areas can reduce phosphorus loading by enhancing infiltration of stormwater via rain gardens, diversions, and stormwater detention ponds.

In closer proximity to the Lake in the watershed, steep slopes (classified here as greater than or equal to 9 percent gradient) surround Mallard Lake and its tributary (see Map 5). Steep slopes can cause erosion that intensifies nutrient runoff and sedimentation into the Lake. Implementing and/or enhancing vegetative riparian buffers around the Lake would be beneficial in lessening nutrient runoff, particularly near the abutting Milwaukee County Parks golf course on the Lake's east side. Golf courses can contribute high phosphorus loads through turf grass maintenance and high fertilizer usage, further intensified by the steep slopes with flows directed to the tributary. Best management practices can be employed for the courses through soil testing to minimize excess fertilizer applications as well as bagging grass clippings.[21] Regenerative stormwater conveyance techniques, such as those proposed for the Lake's tributary, can be effective in reducing streambank and bed erosion and mitigating sediment loading from intense precipitation events (see Figure 6). Implementing these phosphorus and sediment load reduction practices would slow the lake sedimentation, prolong the lifespan of any dredging efforts in the Lake, and enhance the Lake's water quality.

SUMMARY

Mallard Lake provides both ecological and aesthetic value to Milwaukee County and should be actively managed to provide these benefits for future generations. Key takeaways from the findings detailed in this report include:

- A total of 18 aquatic plants were observed in Mallard Lake, a high species richness for the Lake's size. Aquatic plants were observed in 97.3 percent of the points surveyed, and aquatic plants were found up to the maximum depth of the Lake. The invasive species Eurasian watermilfoil, curly leaf pondweed, and flowering rush were observed in the 2025 survey.
- Although no fishery survey has been conducted on this Lake, temperature and dissolved oxygen concentrations indicate that only the most tolerant fish species would likely be able to survive in this waterbody.
- The watershed to lake ratio for Mallard Lake is 412:1, a very large watershed for the Lake's size which may be a part of the ongoing concern of sedimentation and nutrient loading. The Lake's inlet, Tess Corners Creek, is listed as impaired for phosphorus. Regenerative stormwater conveyance plans have been drafted for the area and should be pursued to address this concern.

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[21] Shaddox, Travis W., et al. "Nutrient Use and Management Practices on United States Golf Courses." HortTechnology, Vol. 33, No. 1, 2023, pp. 79–97.

- Surrounding lands have been identified as high contributors of nutrients and sediment to the Lake and include agricultural lands, high-density urban residential areas, and the abutting golf course. Targeted best management strategies should be used to decrease sedimentation and nutrient loading. These strategies may include but are not limited to: reduced tillage and cover crops on agricultural lands; enhancing infiltration of stormwater via rain gardens, diversions, and stormwater detention ponds in residential areas; and developing a vegetative buffer between the lake's edge golf course.
- Originally constructed with a maximum depth of 15 feet in the 1930s, the WDNR survey indicated a maximum depth of 10 feet in 1970. A maximum depth of 9 feet was recorded in the 2025 survey. Accumulated sediment depths from sampled points ranged from zero to 4.3 feet. The highest amount of accumulated sediment was seen in the southern end on the lake near the inlet tributary.

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TABLES

Table 1
WiLMS Nonpoint Phosphorus Loading Output for the Mallard Lake Watershed

Land Use Class	Area of Land Use Class (acres)	Percent of Watershed	Low Phosphorus export (kg/ha)	Likely P Phosphorus export (kg/ha)	High P Phosphorus export (kg/ha)	Phosphorus Load (lbs) (Lower est. – Higher est.)
Rural Res (> 1 Ac)	3,032	45.99	0.05	0.10	0.25	271 (135 - 676)
Forest	1,091	16.55	0.05	0.09	0.18	88 (49 - 175)
Row Crop Ag	859	13.03	0.50	1.00	3.00	766 (383 – 2,299)
Pasture/Grass	790	11.98	0.10	0.30	0.50	211 (70 – 352)
Wetlands	312	4.74	0.10	0.10	0.10	28 (28 – 28)
MD Urban (1/4 Ac)	285	4.32	0.30	0.50	0.80	127 (76 – 203)
HD Urban (1/8 Ac)	158	2.4	1.00	1.50	2.00	212 (141 – 282)
Lake Surface	64	0.97	0.10	0.30	1.00	17 (6 – 57)
Total	**6,591**	**100.0**	**2.20**	**3.89**	**7.83**	**1,720 (889 – 4,074)**

Note: Information obtained from the WiLMS Nonpoint Phosphorus Loading tool found at: https://dnr-wisconsin.shinyapps.io/WaterExplorer/

Source: SEWRPC

Table 2
Ecological Significance of Aquatic Plant Species in Mallard Lake: July 2025

Species Name	Ecological Significance
Butomus umbellatus (flowering rush)	Provides cover for waterfowl; can crowd out native species with higher wildlife value.
Ceratophyllum demersum (coontail)	Provides good shelter for young fish and supports insects valuable as food for fish and ducklings.
Chara spp. (muskgrass)	Excellent producer of fish food, especially for young trout, bluegills, small and largemouth bass, stabilizes bottom sediments, and has softening effect on the water by removing lime and carbon dioxide.
Elodea canadensis (waterweed)	Provides shelter and support for insects which are valuable as fish food.
Heteranthera dubia (water stargrass)	Provides food and shelter for fish, locally important food for waterfowl.
Lemna minor (small duckweed)	Provides food for waterfowl. Rapidly absorbs nutrients from water column.
Lemna trisulca (forked duckweed)	Provides food for fish and waterfowl; provides habitat for fish and herptiles.
Myriophyllum spicatum (Eurasian watermilfoil)	Invasive species that can cause navigation issues. Provides habitat for fish.
Nymphaea odorata (white water lily)	Seeds consumed by waterfowl while rhizoids consumed by mammals.
Potamogeton amplifolius (large-leaf pondweed)	Offers shade, shelter and foraging for fish; valuable food for waterfowl.
Potamogeton crispus (curly-leaf pondweed)	Provides habitat for aquatic life in winter and spring; midsummer die-off creates sudden habitat loss and releases nutrients into the water column.
Potamogeton foliosus (leafy pondweed)	Provides food for waterfowl and habitat for aquatic invertebrates.
Sagittaria latifolia (large arrowhead)	Provides food for waterfowl, muskrat, beaver, and deer.
Sparganium emersum (short-stemmed bur-reed)	Provides food for waterfowl and muskrats; invertebrate habitat.
Spirodela polyrhiza (large duckweed)	Consumed by waterfowl; provides shade and cover for aquatic life.
Stuckenia pectinata (sago pondweed)	Most important pondweed for ducks as food source. Provides food and shelter for young fish.
Vaccinium spp. (berry-producing shrubs)	Fruits provide food source for waterfowl.
Wolffia spp. (watermeal)	Food source for waterfowl. Can be indicator of nutrient enrichment.

Note: Information obtained from A Manual of Aquatic Plants by Norman C. Fassett, University of Wisconsin Pressure; Guide to Wisconsin Aquatic Plants, Wisconsin Department of Natural Resources; Through the Looking Glass: A Field Guide to Aquatic Plants, Wisconsin Lakes Partnership, University of Wisconsin – Extension; and U.S. Forest Service; Encyclopedia Brittanica.

Source: SEWRPC

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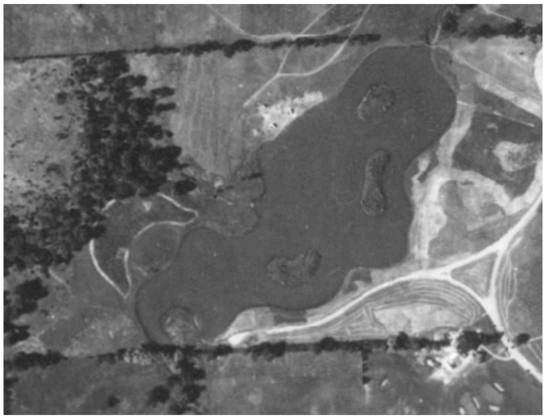
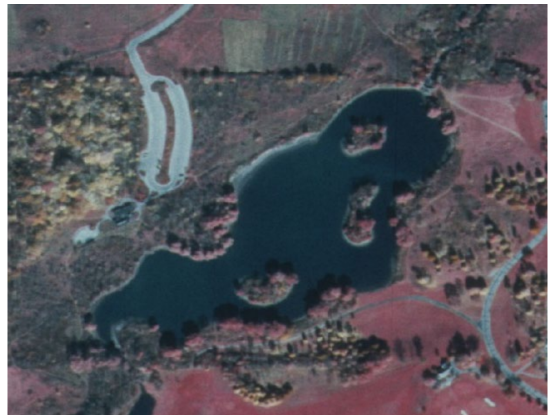
MALLARD LAKE SURVEY, MILWAUKEE COUNTY, WISCONSIN

FIGURES

Figure 1
Aerial Imagery of Mallard Lake: 1937, 1980, 2000, and 2022



1937 Aerial



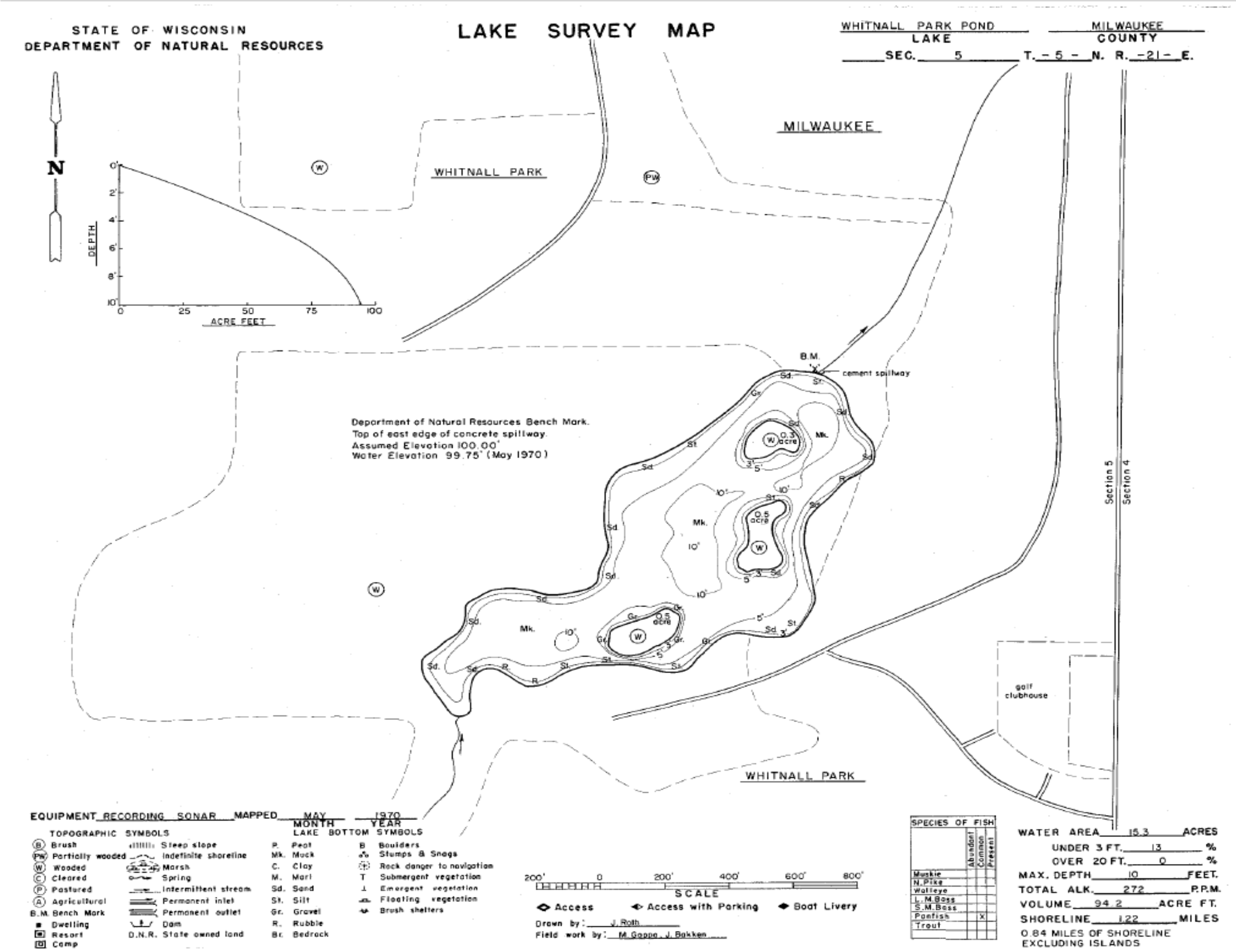
1980 Aerial

2000 Aerial

2022 Aerial

Source: Milwaukee County and SEWRPC

Figure 2
Mallard Lake Map: 1970

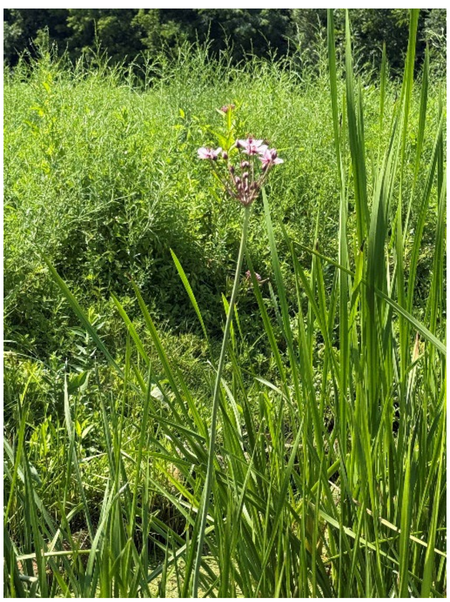


Source: Wehr Nature Center and WDNR

Figure 3
Images from Mallard Lake

Wehr Nature Center Staff Assisting in Survey

Native Mussel Found on Southern End of Lake

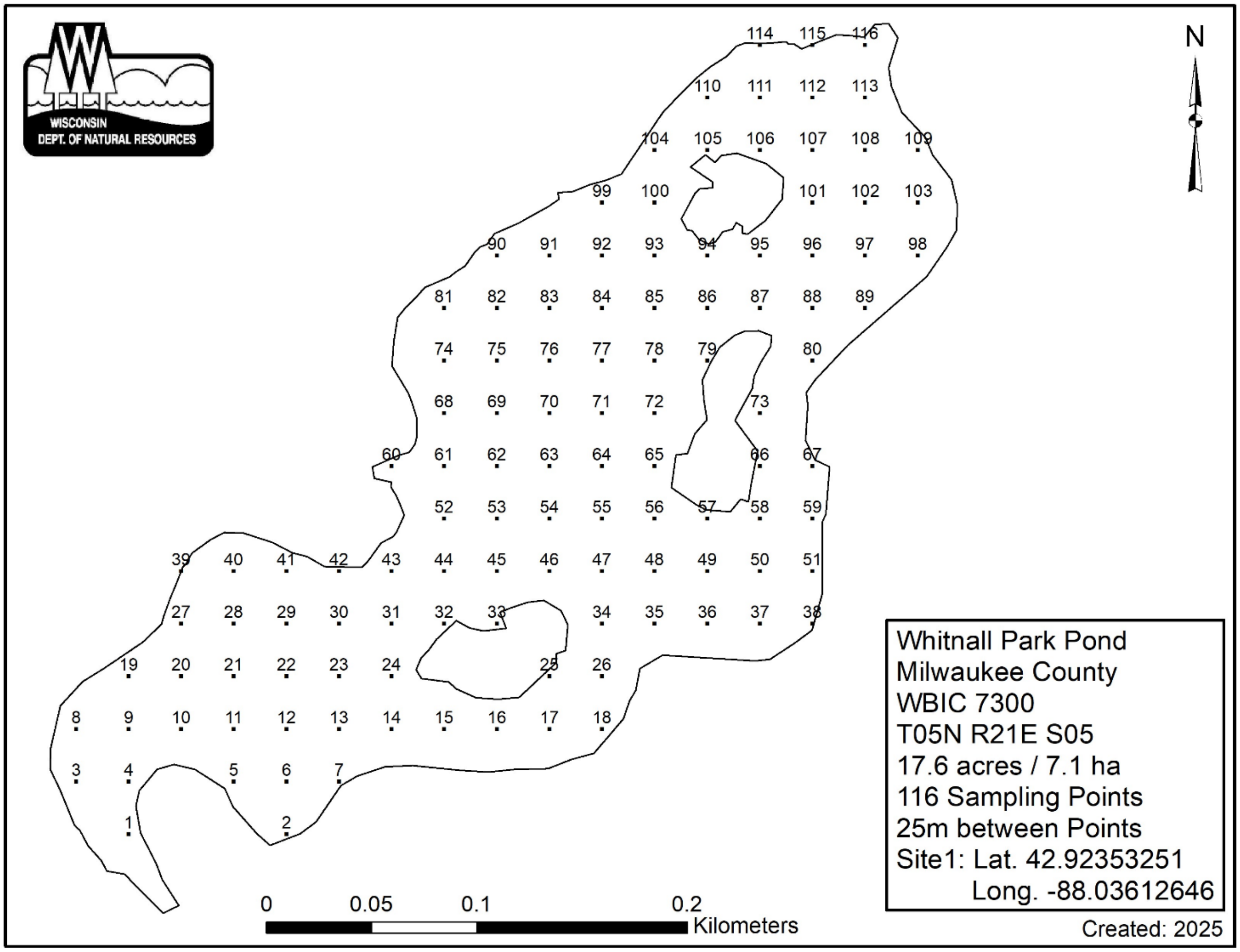


Flowering Rush (*Butomus umbellatus*)

Flocculent Sediment Depth in South End

Source: SEWRPC

Figure 4
PI Grid of Mallard Lake



Source: WDNR

Figure 5
Water Quality Profiles for Mallard Lake

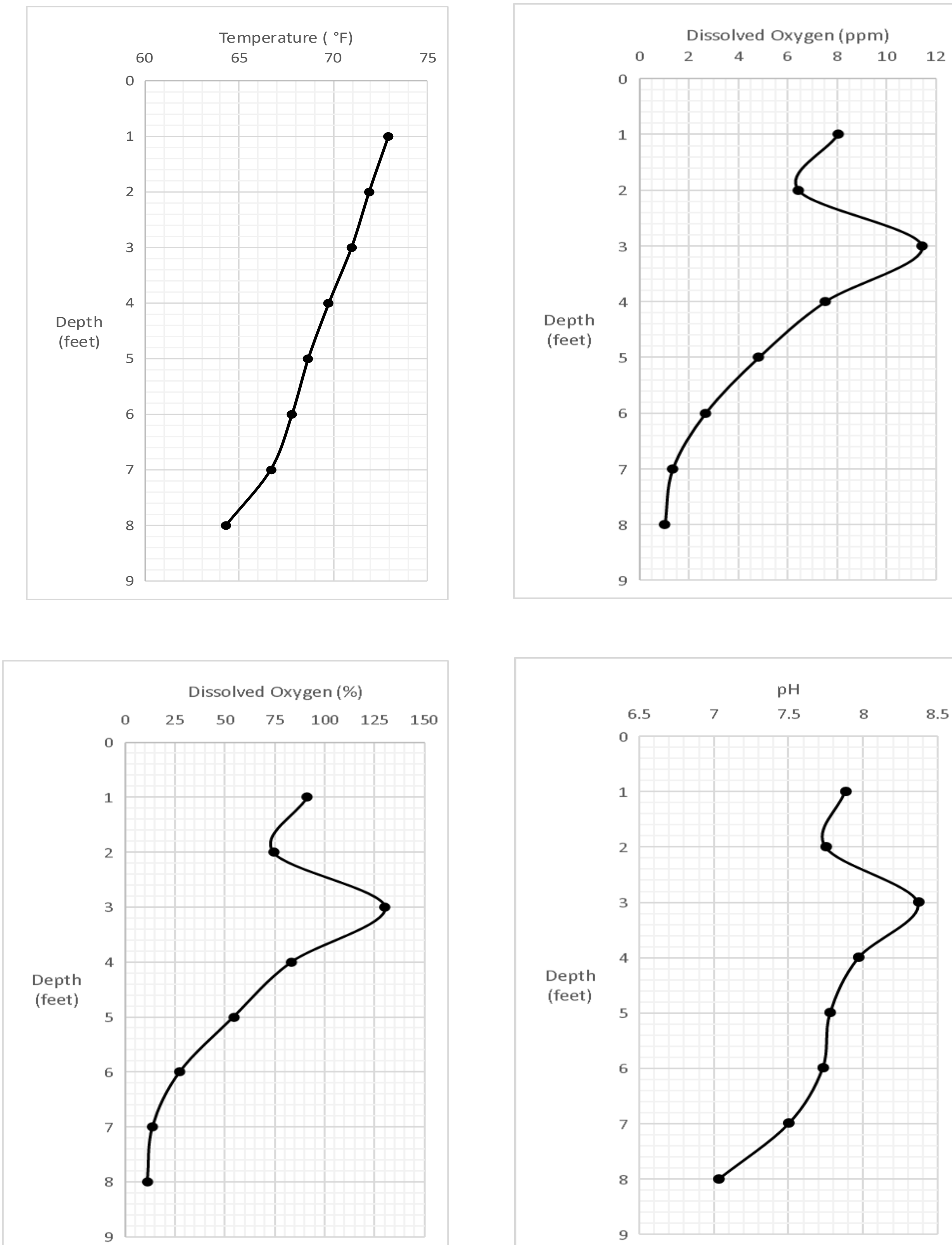
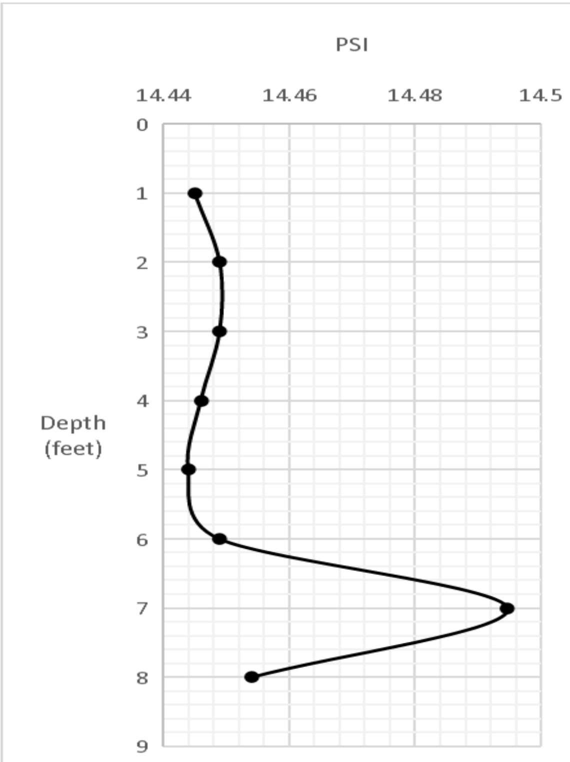


Figure 5 (cont.)



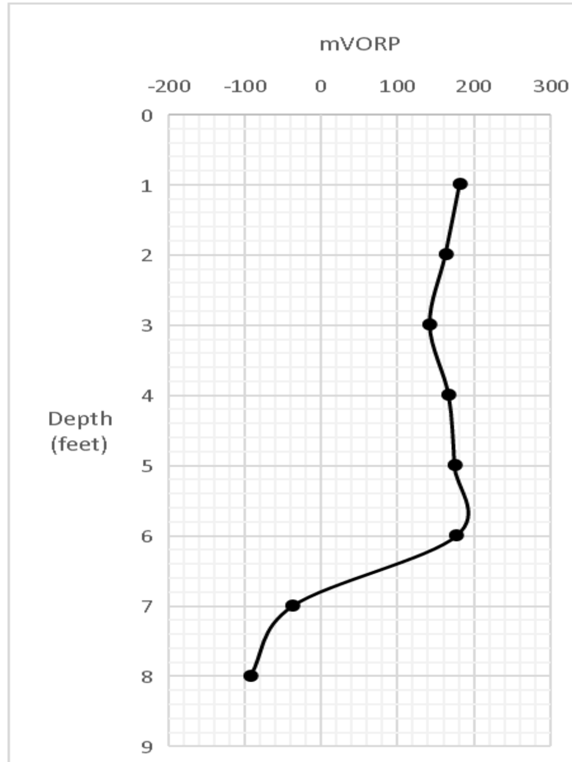
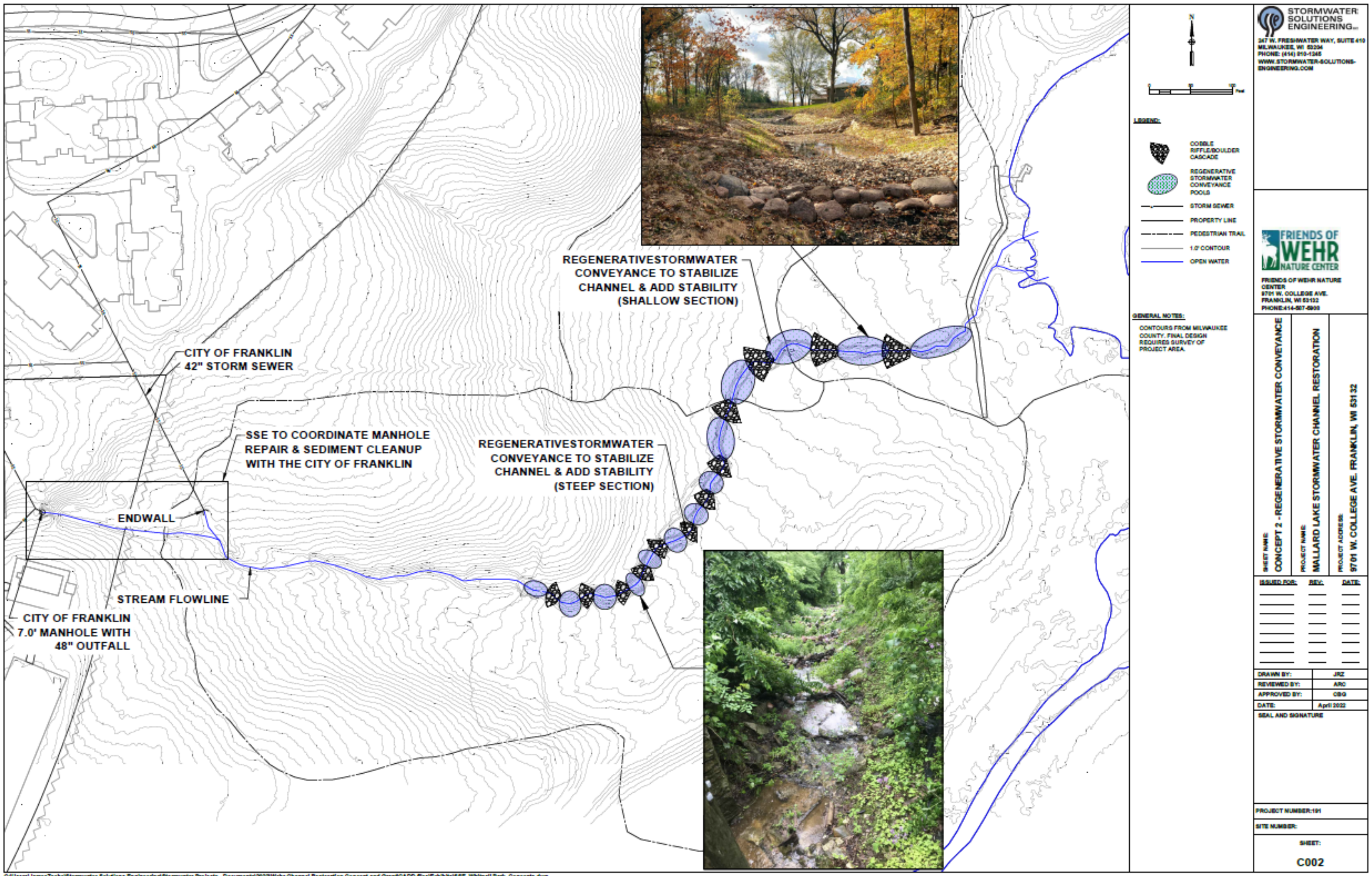


Figure 6
Regenerative Stormwater Conveyance Design Plan for Tributary to Mallard Lake



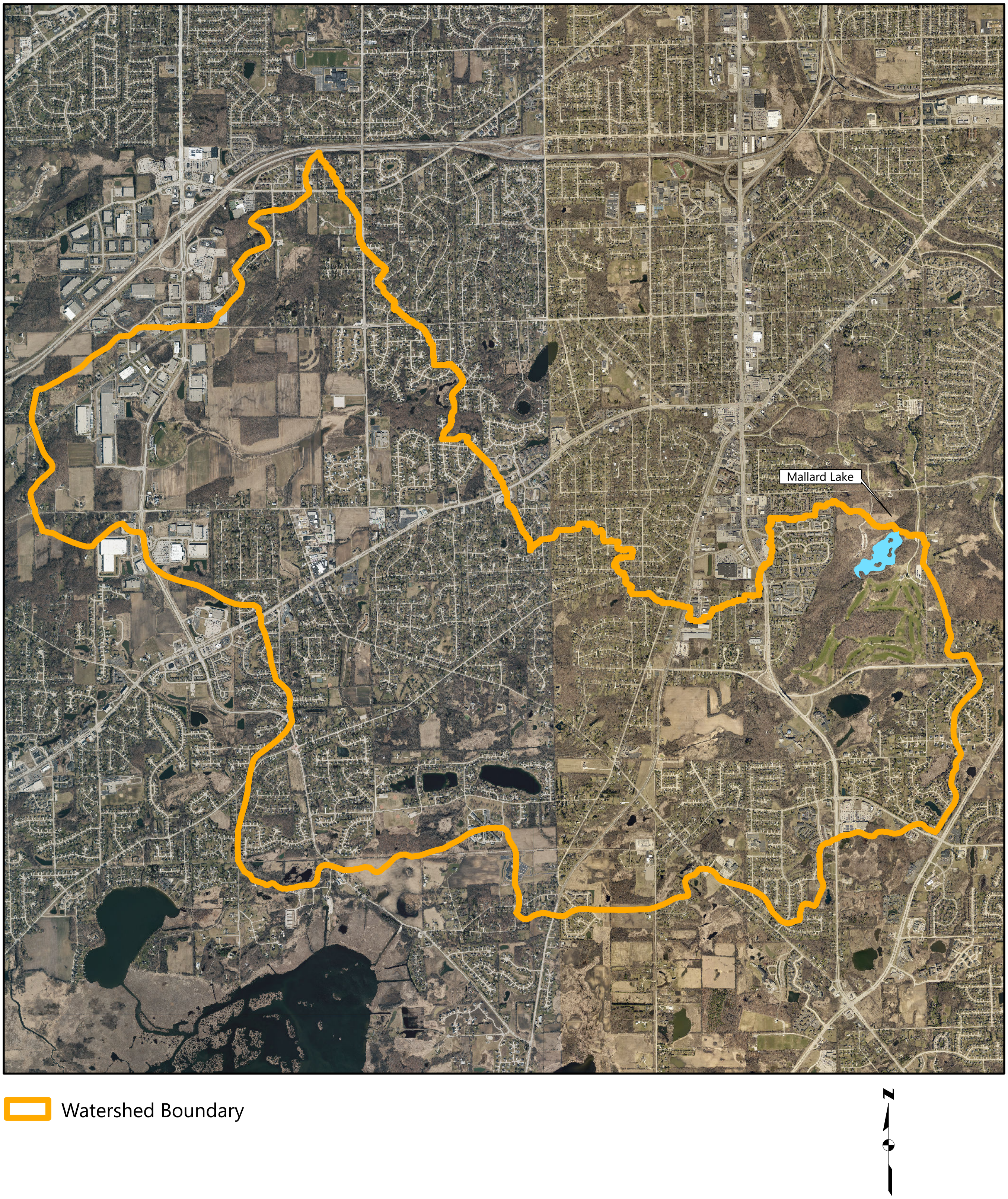
Source: Wehr Nature Center and Stormwater Solutions Engineering

SEWRPC Staff Memorandum

MALLARD LAKE SURVEY, MILWAUKEE COUNTY, WISCONSIN

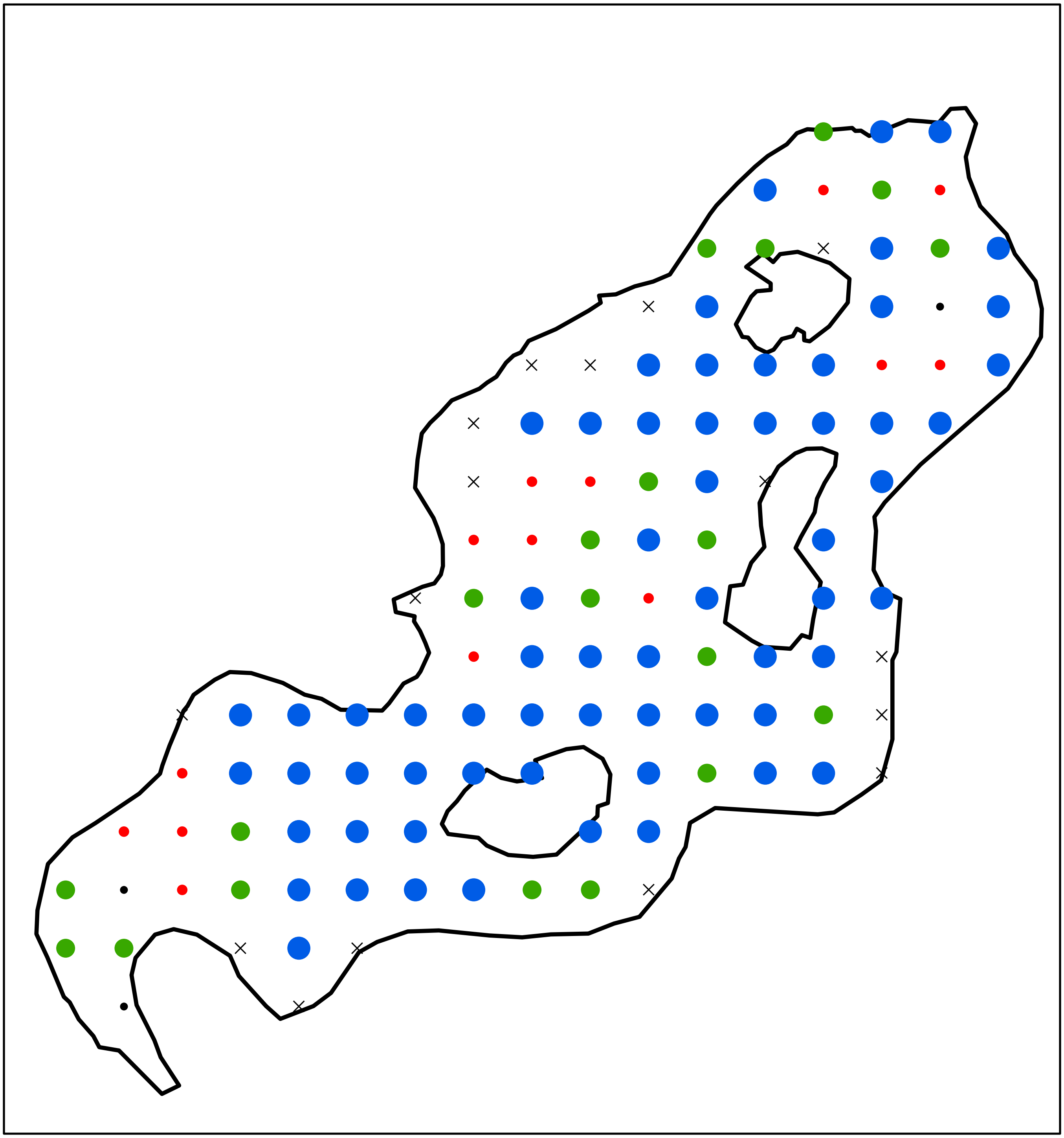
MAPS

Map 1
Mallard Lake Watershed



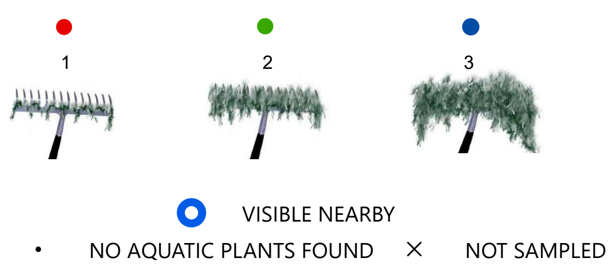
Source: SEWRPC

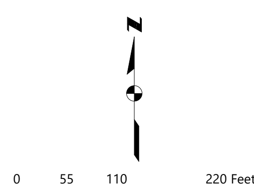
Map 2
Total Rake Fullness on Mallard Lake: Summer 2025



Note: Survey was conducted on Mallard Lake on July 21st, 2025.

RAKE FULLNESS RATING

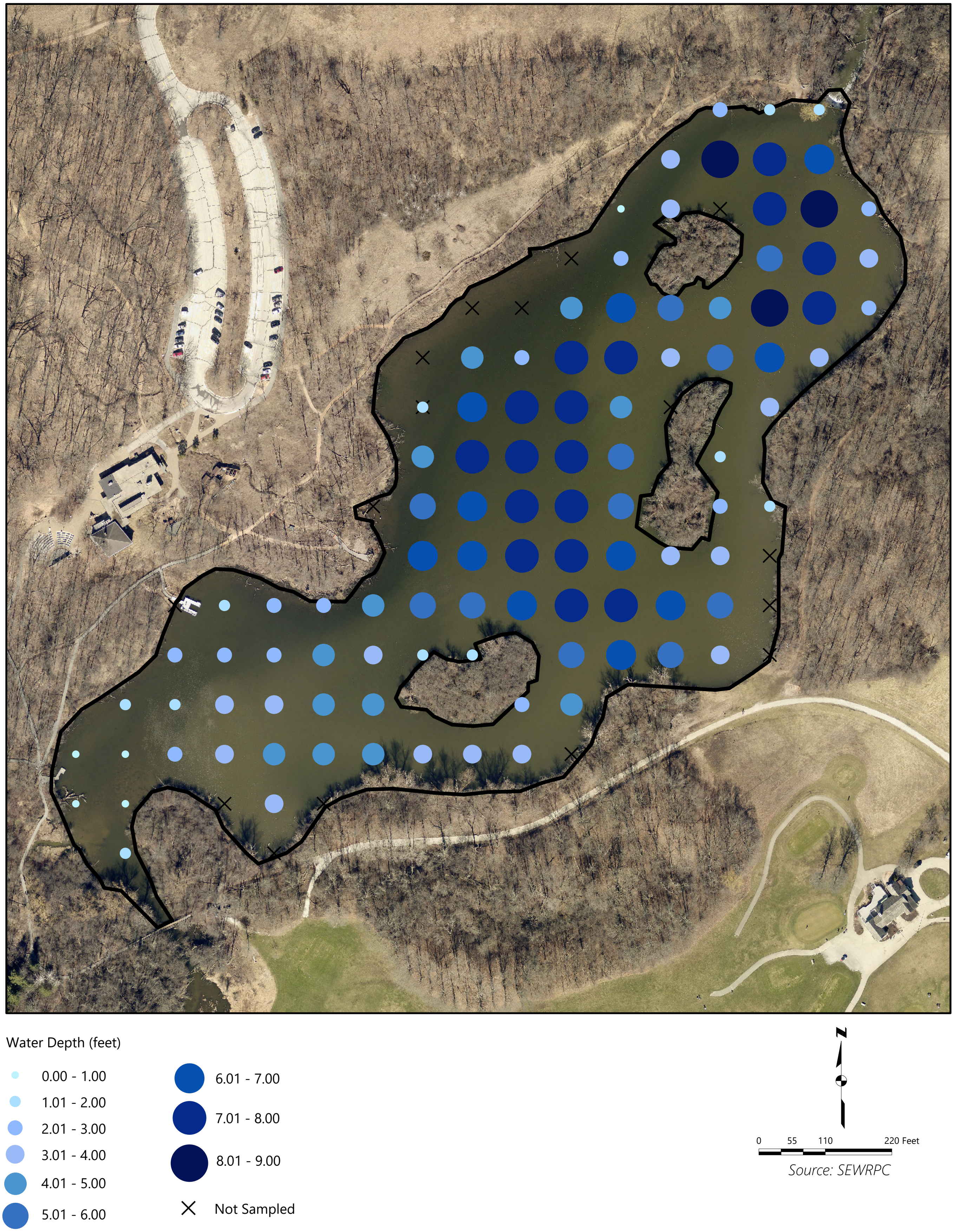




Source: SEWRPC

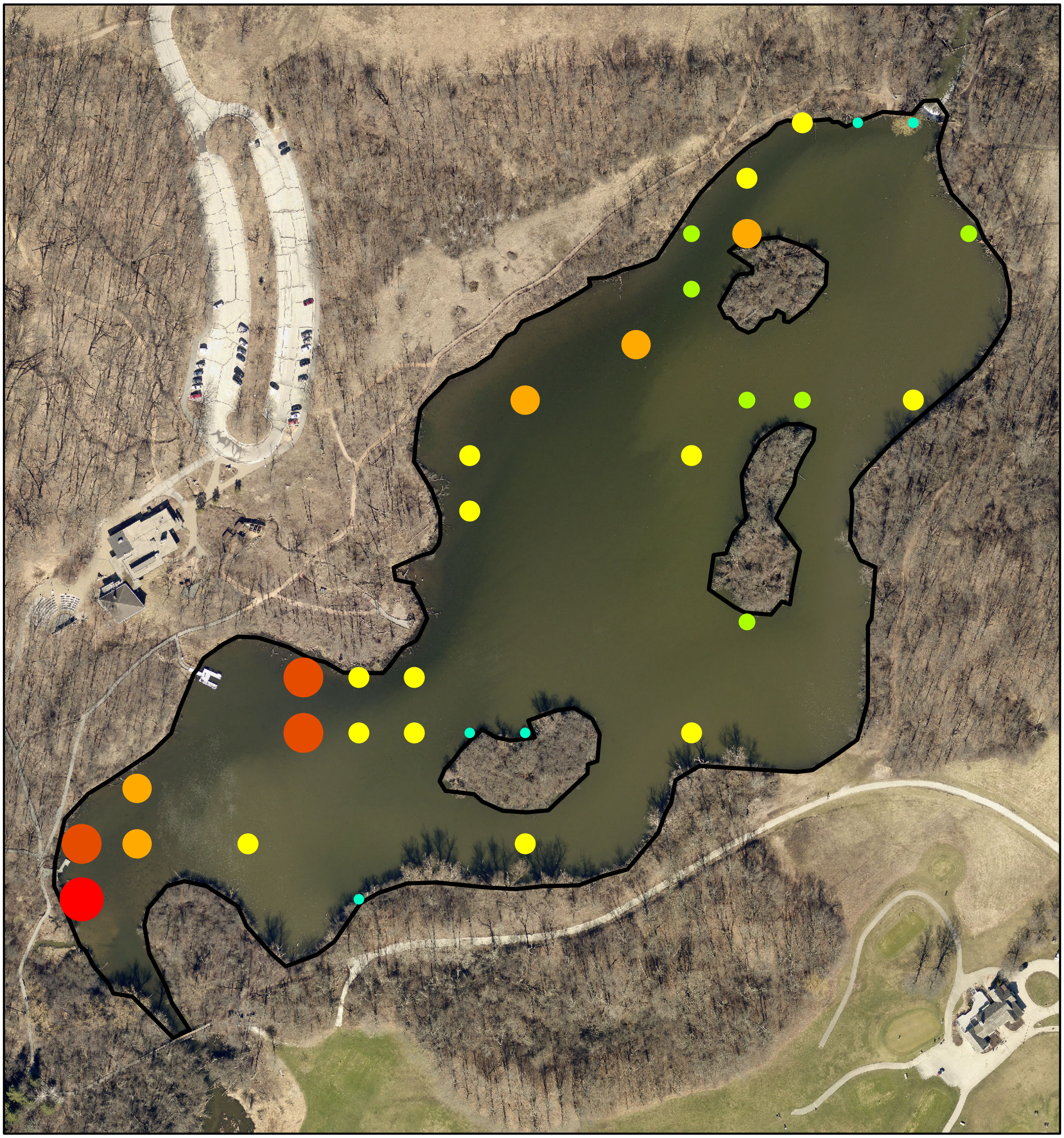
Source: WDNR and SEWRPC

Map 3
Water Depth in Mallard Lake: Summer 2025



Source: SEWRPC

Map 4
Sediment Depths in Mallard Lake: Summer 2025



Sediment Depth (feet)

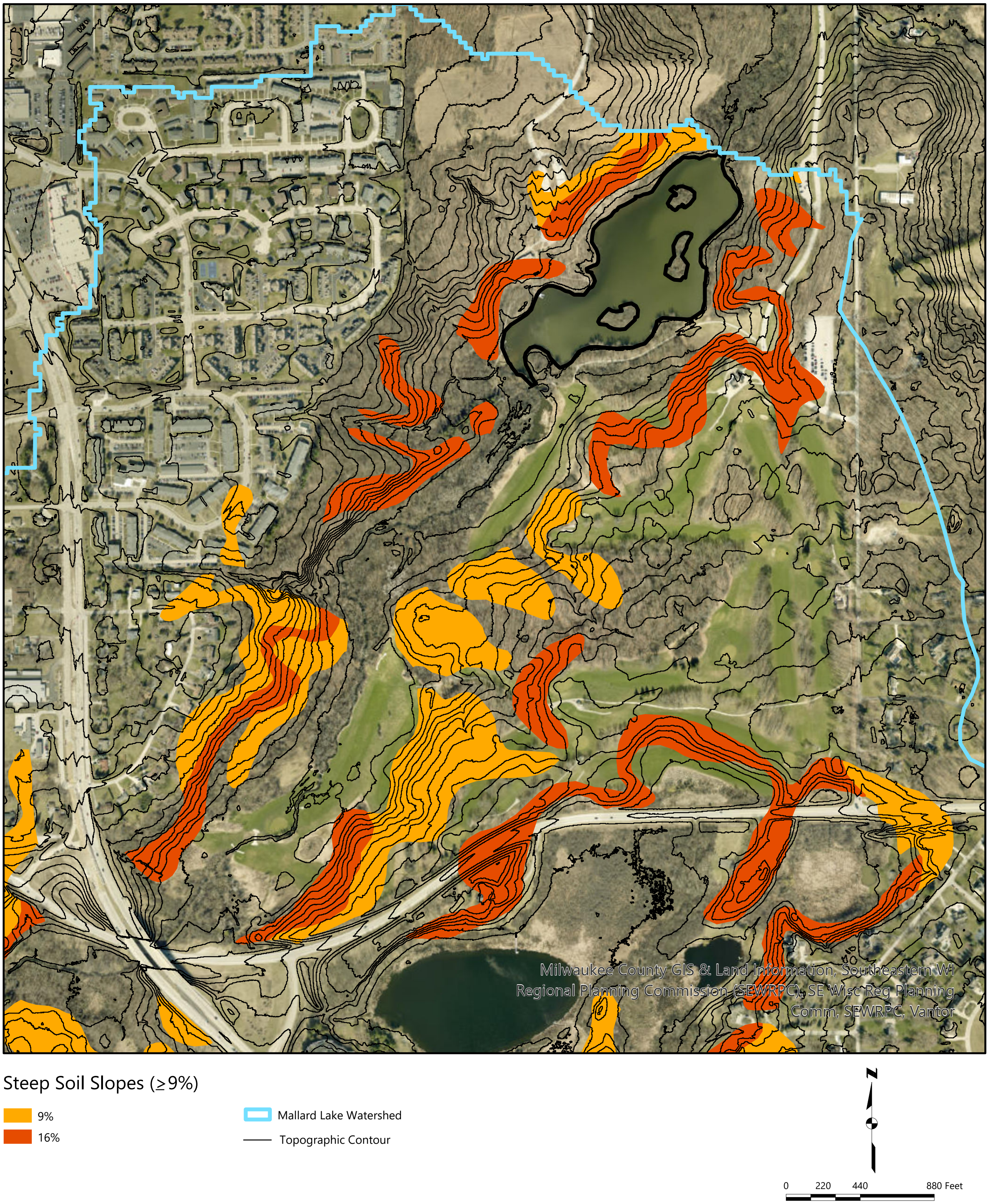
- 0.01 - 0.49
- 0.50 - 0.99
- 1.00 - 1.99
- 2.00 - 2.99
- 3.00 - 3.99
- 4.00 - 4.99

N

0 55 110 220 Feet

Source: SEWRPC

Map 5
Steep Slopes Within Less Than a Mile Proximity to Mallard Lake



Source: SEWRPC