Kasota Ponds Wetlands: Summary of MWMO Monitoring Activities 2008–2017

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Front Cover: Water quality sampling at Kasota Pond West. (Credit: MWMO)

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Mississippi Watershed Management Organization

Abstract

The Mississippi Watershed Management Organization has been monitoring the water quality of three wetlands, collectively called the Kasota Ponds, since 2008. The wetlands are located near the border of the cities of Lauderdale and St. Paul. Monitoring has included sampling each wetland once per month throughout the year as well as collecting biological data once every five years beginning in 2011. Bathymetric data for each wetland were collected during the winter of 2017. The purpose of this report is to compile and summarize the data that have been collected from the Kasota Ponds wetlands thus far and to recommend future monitoring and/or restoration activities that could help improve the wetlands as a source of urban wildlife habitat.

Table of Contents

List of Figures

List of Tables

Glossary

Activity Trap: Also known as “bottle traps”, this device is deployed in the field to collect specific types of macroinvertebrates, such as swimmer macroinvertebrates.

Bathymetry: the measurement of depth of a waterbody. Bathymetry mapping can be used to understand the variations in depth within a body of water.

Chironomid: Informally known as “lake flies”, chironomids are an important indicator species (some species are tolerant to pollution). Chironomid larvae and pupae are important food for fish and other aquatic organisms. Adult flying midges are eaten by fish, some birds, bats, and predatory insects.

Chloride: Chloride is a component of road salt for melting ice and snow on impervious surfaces. It dissolves easily in water and is difficult to remove. Detection of chloride can be used as a water quality indicator, and high levels can have negative consequences on the environment.

Corixidae: A family of aquatic insects, commonly known as “water boatmen” that live in streams, lakes, and ponds and are important food for fish. Corixidae can be used as a water quality indicator as some species are very tolerant to pollution.

Dissolved Oxygen (DO): the amount of oxygen dissolved in a waterbody that is available for aquatic organisms for respiration. It is an indicator of the health of a waterbody and its ability to sustain an aquatic ecosystem.

Grab Sample: a single water sample submitted for analysis.

Impaired: a waterway that is considered too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes in the United States.

Index of Biological Integrity (IBI): a regionally based index used to measure the integrity of waterbodies and to determine the level of their biotic impairment. The IBI relies on multiple parameters (termed "metrics") based on macroinvertebrate or aquatic plant community structure and function, to evaluate a complex biotic system.

Intolerant Taxa: group of one or more populations of an organism that are sensitive to certain environmental conditions. Identification of intolerant taxa can be used as a water quality indicator, as these types of organisms cannot live in waters that contain higher levels of pollution, and if they are present, it can indicate a healthy waterbody.

Macroinvertebrate: invertebrate (an animal without an internal skeletal structure) fauna that can be captured by a 500 µm net or sieve.

Nonvascular: plants that do not use a system of vessels to retain or deliver water to other parts of the plant. These plants belong to the division Bryophyta, such as mosses and liverworts.

Odonata: an order of insects that comprise of dragonflies and damselflies.

Persistent Litter: one of the vegetation metrics, which measures the cover of certain plants whose annual leaves and stems decompose very slowly. If high cover of these types of plants is present, it can indicate slower nutrient cycling and lower diversity of biota. A low cover of these plants can show high nutrient cycling which can indicate a healthier wetland.

pH: a logarithmic scale used to measure the acidity or basicity of a solution.

Riprap: loose stone used to form a foundation that protects soil from erosion and/or improve the stability of soil slopes

Salinity: concentration of dissolved salts in a waterbody.

Secchi tube: a plastic cylinder 100 cm in length with a small black and white disk attached to a string that is used to measure water clarity.

Specific Conductivity: an indirect measure of the presence of dissolved solids such chloride, nitrate, sulfate, etc., and can be used as an indicator of water pollution. Adjusted for temperature at 25°C.

Subwatershed: smaller region within a watershed that drains into a waterbody.

Tolerant Taxa: group of one or more populations of an organism that are not as sensitive to certain environmental conditions. Identification of tolerant taxa can be used as a water quality indicator, as these types of organisms can survive in waters that contain higher levels of pollution.

Total Maximum Daily Load (TMDL): a calculation of the maximum amount of a pollutant that a waterbody can receive daily and still safely meet water quality standards.

Total Suspended Solids (TSS): dry-weight of the suspended particles in a water sample. High levels of TSS can negatively impact aquatic life.

Vascular: plants that use a system of vessels to move and retain water. The number of vascular plant genera is used as a metric for wetland health assessments.

Watershed: an area of land where surface water (from rain or snow melt) runoff and groundwater drain into a waterbody. Watershed boundaries are defined by elevation.

Wetland: part of the landscape that is saturated by surface or groundwater, where water is present at or near the surface of soil for a duration of time sufficient to support vegetation typically adapted to saturated soil conditions.

Kasota Ponds Report

Executive Summary

This report presents the monitoring activities of the Mississippi Watershed Management Organization (MWMO) from 2008 to 2017 at the Kasota Ponds wetlands and summarizes the results of those activities. Current and past reports of other monitoring work are available on the MWMO website at mwmo.org/monitoring.

The Kasota Ponds wetland complex consists of three open-water wetlands located near the border between the cities of Lauderdale and St. Paul and along Highway 280 near various industrial-use businesses. The area was originally part of a larger wetland complex. Since then, some of the area has been filled and built upon. Each of the three existing Kasota Ponds wetlands have been dredged to increase their capacity and currently serve an important role as recipients of stormwater runoff from nearby impervious surfaces, including the highway. They are also important patches of habitat for waterfowl, frogs, turtles and insects in an otherwise highly urbanized area.

In 2008, the MWMO began to collect monthly water quality data from the wetlands in order to assess their baseline conditions. Water quality in the wetlands is influenced by precipitation (timing, amount, and intensity) as well as land use practices in the watershed. Receiving runoff from various impervious surfaces including Highway 280, the wetlands were listed on the Federal Clean Water Act's Section 303(d) list of impaired waters in 2014 for chloride and were part of the Minnesota Pollution Control Agency's Twin Cities Metropolitan Area (TCMA) Chloride Total Maximum Daily Load Study and TCMA Chloride Management Plan.

In addition to water quality data collection, the MWMO has conducted biological surveys at each of the wetlands in order to better understand their value as habitat and to be able to inform future management decisions. Macroinvertebrate and vegetation surveys occurred in 2011 and 2016 and will continue on a five-year schedule. MWMO staff also collected bathymetric data for the first time at each of the three wetlands in the winter of 2017. Such data will continue to be collected on a regular basis in order to track any changes in wetland capacity.

Following the summary of data collection methods and results in this report, the MWMO offers some ideas for future work, both monitoring and restoration-wise, to continue to track the health of the Kasota Ponds wetlands and potentially improve their ability to provide both habitat and stormwater management.

Introduction

Wetlands play a vital role in the health of a watershed and provide many benefits to humans and wildlife. Their important functions include stormwater capture and flood attenuation, filtering and improving water quality for downstream waterbodies, groundwater recharge, wildlife habitat, and commercial, aesthetic and recreational uses.

The Kasota Ponds are three wetlands within the Mississippi Watershed Management Organization watershed. They are located in western Saint Paul, just west of Highway 280 at Kasota Avenue, and have been individually named Kasota Pond North (KPN), Kasota Pond West (KPW), and Kasota Pond East (KPE), aka Mallard Marsh (Figure 1). The MWMO monitors the Kasota Ponds wetlands in order to assess their baseline condition due to the importance of the wetlands for wildlife habitat and stormwater management. This report was produced to outline the 10 years of data, results, and recommendations based on monitoring efforts thus far.

During the 10 years of monitoring at the Kasota Ponds, the MWMO conducted monthly water quality sample collection from each of the wetlands, surveyed macroinvertebrates and vegetation in 2011 and 2016, and completed bathymetric mapping of each wetland. Monitoring methodology is presented from these three focus areas of the MWMO's monitoring at the Kasota Ponds. Results are then shared by individual wetland.

Going forward, the MWMO plans to continue monitoring the health and status of these wetlands by conducting monthly water quality sampling and biological surveys every five years. Those future studies will be used in conjunction with the current dataset and recommendations detailed in this report to determine the effectiveness of any restoration and improvement efforts and whether further monitoring of the ponds is necessary.

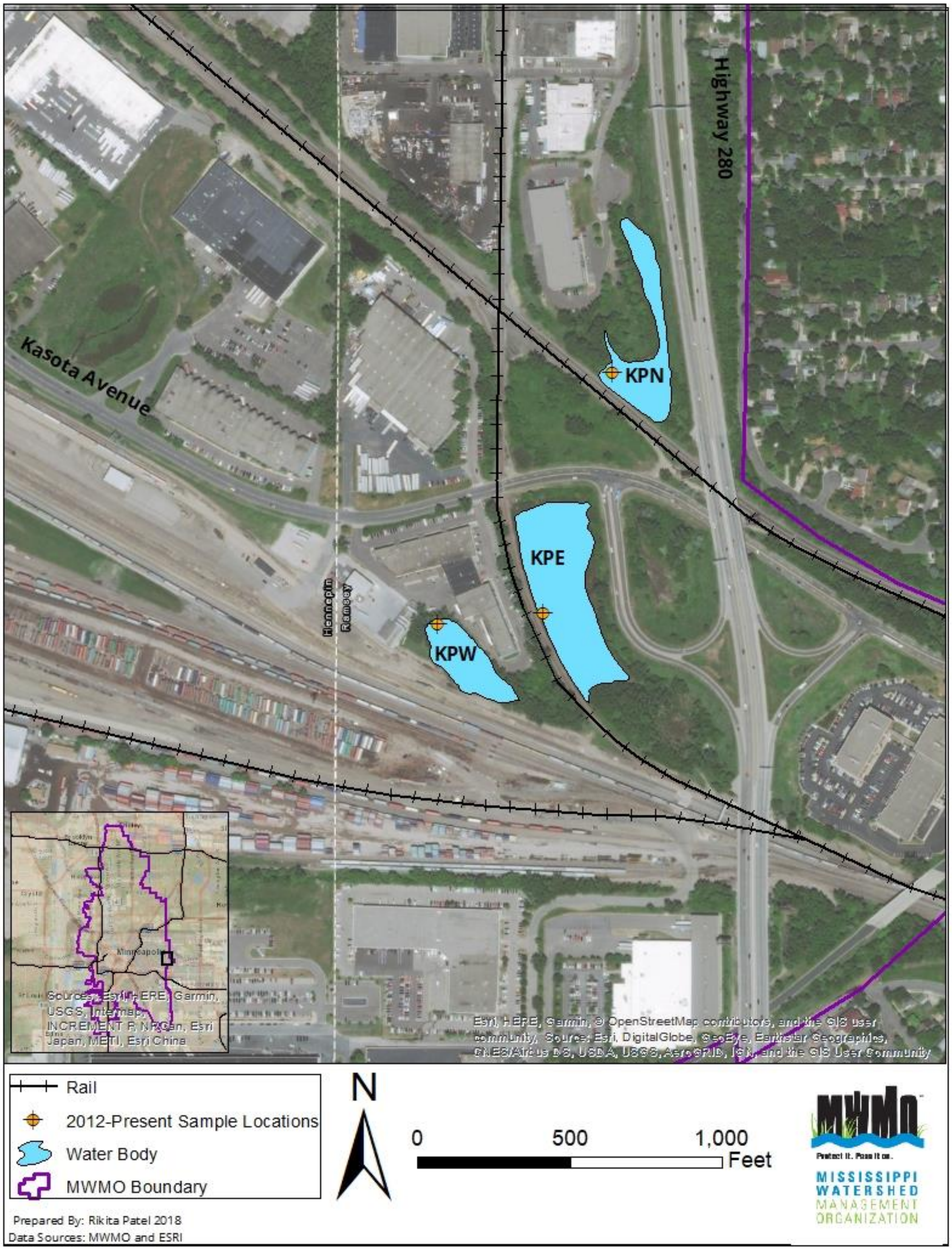

Figure 1. The Kasota Ponds Wetlands.

Background

Minnesota used to be covered by many wetlands, but over the past couple of centuries, almost half of those wetlands have been drained (BWSR, 2016). The area in which the Kasota Ponds wetlands are located was once home to a large 300-acre wetland complex, which covered parts of present-day Minneapolis and St. Paul (Figure 2). The wetland complex was disturbed and drained over time to make way for city development and industry, and little of it remains today (MWMO, 2011).

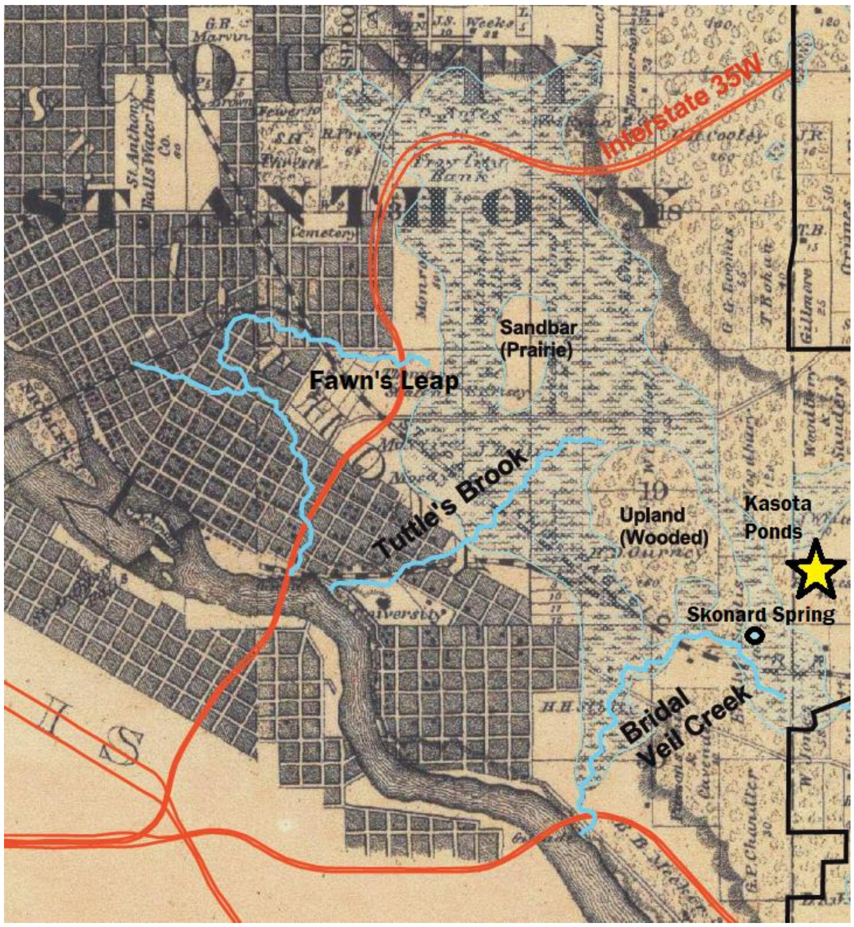

Figure 2. 1857 plat map with water features. Locations are approximate. Original source: *Historic Waters of the Mississippi Watershed Management Organization* report with some additions by MWMO staff.

This wetland complex drained to the Mississippi River by three different streams: Tuttle's Brook, Fawn's Leap stream, and Bridal Veil Creek. These streams do not appear today as they once did. Tuttle's Brook is now a dry creekbed that cuts through University of Minnesota's East Bank. Fawn's Leap has disappeared, as the portion of the wetland complex that fed this stream was drained as the cities developed. Bridal Veil Creek is still somewhat active, and now flows through stormwater tunnels to the Mississippi. Another feature near the Bridal Veil Creek area is a natural spring called Skonard Spring, which likely still flows today and interacts with the Kasota Ponds wetlands (MWMO, 2011). The Kasota Ponds wetlands are located within the Bridal Veil Creek Subwatershed (Figure 1).

Today, the Kasota Ponds wetlands are surrounded by industrial and commercial buildings, roads, railroad, a Superfund site, and other types of impervious surfaces and are mainly accessible by nearby parking lots. The wetlands were most dramatically changed by the construction of Highway 280 in the 1950s. During this time, much of these wetland areas were either dredged for water storage or filled for development. Thirty years later, in the late 1980s, nearby Bridal Veil Creek was clogged due to construction activities in St. Paul and subsequent investigations of contaminants were performed throughout the watershed, including of the Kasota Ponds (MWMO, 2006). A few years later in the early 1990s, high levels of hazardous compounds, such as hydrocarbons and pentachlorophenol that come from petroleum and pesticides, were discovered in the area (MWMO, 2006). Contaminant removal remains an issue in the Bridal Veil Creek subwatershed. Additional details regarding the history of the Bridal Veil Creek subwatershed can be found within The Bridal Veil Creek Subwatershed Desk Study (MWMO, 2006), a collaborative effort between the St. Anthony Park Community Council and the MWMO.

Currently, one of the primary functions of the Kasota Ponds wetlands is to store stormwater runoff from a small portion of the watershed during storm events. Some physical characteristics of these wetlands, such as approximate size and depth, are described in Table 1 below. The wetlands provide habitat for a number of different species including aquatic plants, macroinvertebrates, amphibians, and birds. In 2008, the MWMO began monitoring the water quality of the three Kasota Ponds wetlands: Kasota Pond North (KPN), Kasota Pond East (KPE), and Kasota Pond West (KPW), in an effort to establish baseline data for a number of water quality parameters within the wetlands. In 2011, the MWMO expanded its monitoring to include an assessment of the biological health of the wetlands. Monitoring for macroinvertebrates and vegetation is performed on a five-year schedule.

The MWMO also collected water level data to look at how the waterbodies might fluctuate over time. The water level data collected monthly between 2013 – 2017 show little water level fluctuation, even seasonally, which may indicate groundwater interactions, water leaving the system via overflow outlets, or both.(See Appendix C). Future field exploration of the wetlands will be performed to better understand their hydrologic connectivity.

Table 1. Waterbody characteristics from Minnesota Pollution Control Agency's Twin Cities Metropolitan Area Chloride Total Maximum Daily Load Study from 2016. Percent of impervious surface calculated using the National Land Cover Database from 2011. Watershed area values are based on surface elevation analysis and are preliminary. Mean depth and volume calculated by MWMO staff.

Waterbody	**Watershed area (ac)**	**% Impervious**	**Water-body area (ac)**	**Mean Depth (ft)**	**Volume (ac-ft)**	**Water Use Classification**	**Pollutant impairment**
Kasota Pond North	10	45%	1.4	2.4	3.36	2D Aquatic Life and Recreation	Chloride
Kasota Pond West	6	69%	0.9	6.8	6.12	2D Aquatic Life and Recreation	Chloride
Kasota Pond East	16	43%	2.9	2.8	8.12	2D Aquatic Life and Recreation	Chloride

Monitoring Methodology

Water Quality

The MWMO collected water quality grab samples from the Kasota Ponds from 2008 to 2017. During 2008-2011, grab samples were collected once a month from April-September at multiple locations at each of the Kasota Ponds for a total of seven sites sampled. During this time, Kasota Pond East (KPE) had three sampling locations, while Kasota Pond North (KPN) and Kasota Pond West (KPW) had two sampling sites each (Figure 4). Analysis of data from samples collected during this time determined that there were no statistical differences between sample locations within the same wetland. In 2012, the MWMO began collecting monthly grab samples year-round from one location at each of the three Kasota Ponds (Figure 1).

Figure 3. Collecting a water quality grab sample from Kasota Pond North.

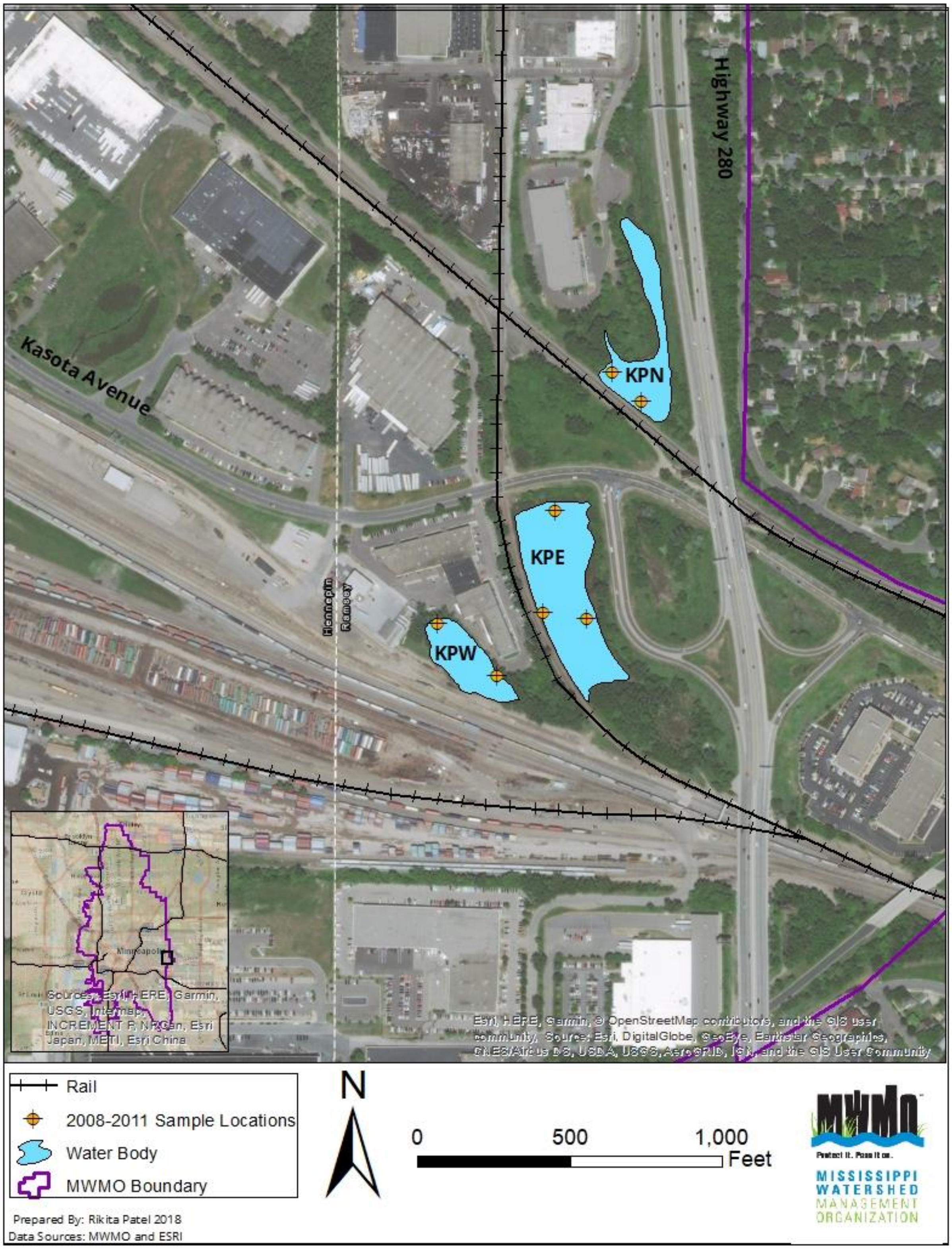

Figure 4. Locations of water quality sampling locations from 2008 to 2011.

Sample Collection, Handling, and Analysis

All water quality samples were collected in approximately three feet of water by plunging an open, laboratory-cleansed (non-sterile) plastic bottle one foot below the water surface upside down, turning it upward to fill, and bringing it out of the water. During times of the year where open water was not available due to ice cover, an ice auger was used to drill a hole and a capped, 3-inch diameter PVC tube was used to collect samples. A handheld multimeter sonde was also deployed approximately one foot below the water surface at the time of sample collection to measure dissolved oxygen, conductivity, salinity, water temperature, and pH (Figure 6). A transparency measurement was taken using a 100 cm Secchi tube (Figure 5).

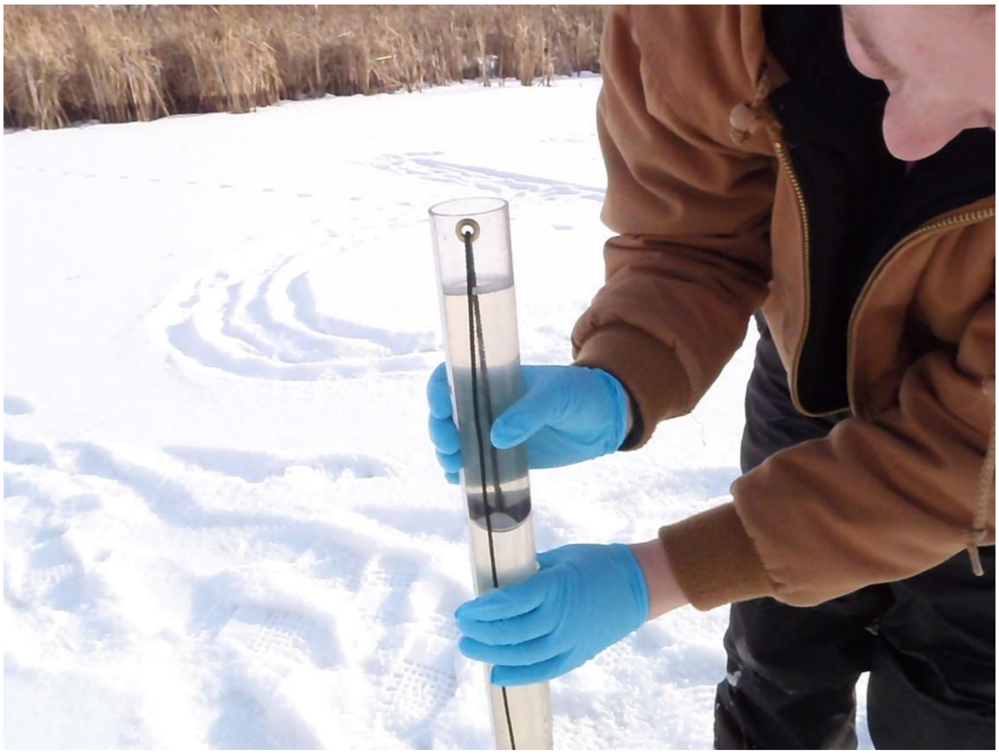

Figure 5. MWMO monitoring staff collecting water transparency data with a Secchi tube.

Samples were analyzed at the Metropolitan Council Environmental Services Laboratory. The laboratory followed strict protocols for quality assurance and quality control. Information regarding laboratory protocol is available from MWMO staff. Refer to Appendix A, Table 1 for a list of the analysis methods and information regarding certification. Blank samples of deionized water were regularly submitted to the laboratory to verify that sample containers were clean and samples were not contaminated during travel. In addition, 10 percent of all samples were collected in duplicate to verify that sampling and laboratory procedures did not affect the data.

Figure 6. Taking measurements using a handheld multimeter sonde.

Water Quality Data Analysis

Currently, the MPCA does not use numeric standards to assess water quality in wetlands. However, the collection of wetland water quality data is important in establishing baseline conditions and is therefore a way to identify and track future potential changes in water quality.

The Kasota Ponds wetlands were listed as impaired for chloride with respect to the state surface water quality chronic standard of 230 mg/L in 2014 and were included in the TCMA Chloride Total Maximum Daily Load Study (MPCA, 2016).

In order to provide additional context for water quality results in the absence of numeric standards, data have been compared to wetland chemistry data collected by the MPCA in a report investigating the status of Minnesota wetlands. For the Mixed Wood Plains ecoregion (MWP) of Minnesota (in which the MWMO is located), the report designates “Stressor Level Categories” of Low, Medium, and High with respect to four water chemistry parameters. These categories and their associated values are displayed in Table 2 below (Genet, 2015). Stressor level values were determined based on reference wetland conditions within a particular ecoregion — in this case, MWP. A low stressor value (green) for a parameter would indicate that the concentration of that particular constituent is at a level having little to no stressful effect on the biota, whereas a concentration falling within the high (red) stressor value range is more likely to negatively affect wetland biota.

Table 2. MPCA wetland stressor designation ranges for parameters of interest (Genet, 2015).

Water Quality Parameter (mg/L)	Low Stressor Value	Medium Stressor Value	High Stressor Value
Chloride (Cl-)	<1.4	>1.4, <7.9	>7.9
Kjeldahl Nitrogen (TKN)	<1.49	>1.49, <3.10	>3.10
Total Phosphorus (TP)	<0.148	>0.148, <0.384	>0.384
Nitrate+Nitrite (NO3+NO2)	No detect	NA	Detect

Biological Surveys

Due to the complicated and variable water chemistry of wetlands, biological surveys can often be more indicative of the overall health of a wetland than its water quality characteristics. Plants and insects that live in wetlands respond in predictable ways to stressors such as poor water quality, changes in hydrology, etc. In this way, wetland biota are reliable indicators of the condition of a wetland.

MWMO monitoring staff surveyed macroinvertebrates and aquatic plants at each of the Kasota Ponds in 2011 and 2016 following methods described in the Macroinvertebrate and Aquatic Plant Community Sampling Protocols for Depressional Wetland Monitoring (MPCA, 2002a; MPCA, 2002b) with an adjustment to the 2016 macroinvertebrate survey methods per MPCA 2014 recommendations (Figure 7). Survey data were used to compute various plant and macroinvertebrate metrics which were then used to calculate total Index of Biological Integrity (IBI) scores. The IBI is utilized as a tool to help provide an accurate measure of the condition of wetland biological communities.

In 2011 and 2016, KPW, KPE, and KPN were each assigned Index of Biological Integrity (IBI) scores for macroinvertebrates and aquatic plants following methods described in Indexes of Biological Integrity for Large Depressional Wetlands in Minnesota (Gernes and Helgen, 2002).

Figure 7. MWMO staff performing macroinvertebrate sampling.

Aquatic Plant Survey Methodology

Aquatic plants were surveyed using the relevé sampling method, following the MPCA's Standard Operating Procedure for Aquatic Plant Community Sampling for Depressional Wetland Monitoring Sites (MPCA, 2002). Relevé surveying involves the selection of a 100 square meter plot that contains a representative portion of the entire wetland's vegetation, including emergent and submerged vegetation, when applicable. Surveyors then identify all of the species within the plot and estimate the percentage of the plot covered by each species. Aquatic plant surveys were conducted in July of both 2011 and 2016, and an IBI score was calculated by MWMO staff for each wetland, following methods described in Indexes of Biological Integrity for Large Depressional Wetlands in Minnesota (Gernes and Helgen, 2002). IBI scores are divided into ranges indicating Poor, Moderate and Excellent wetland health. Table 3 shows the Aquatic Plant IBI score ranges for each of those categories.

Table 3. Aquatic plant IBI score ranges for wetland condition categories for 2011 and 2016 surveys (MPCA 2002).

Wetland Condition Category	IBI Score Range
Excellent	26 - 35
Moderate	16 - 25
Poor	7 - 15

Wetland Macroinvertebrate Sample Collection, Handling and Preservation

Macroinvertebrate samples were collected in June/July 2011 and June 2016 in accordance with the MPCA's Macroinvertebrate Community Sampling Protocol for Depressional Wetland Monitoring Sites (MPCA, 2014). At each of the three wetlands, two samples were collected from the water column and vegetation above the substrate using dipnets. As mentioned previously, unlike the 2011 macroinvertebrate sampling, activity traps were not used in 2016. The MPCA reviewed activity trap use in wetland macroinvertebrate sampling and determined that it required significant staff time relative to its contribution to the IBI score calculation and also had the potential to cause fatalities of non-targeted species such as tadpoles and minnows (Bouchard, Chirhart, and Genet, 2011).

Wetland Macroinvertebrate Sample Processing and Data Analysis

After sampling, macroinvertebrates were preserved in 95% ethyl alcohol, and were later identified to their respective genus or family by staff at Fortin Consulting. An IBI score was calculated for each of the three ponds using methods described in Hennepin County's Wetland Health Evaluation Program (WHEP) protocols which are based on the MPCA's Indexes of Biological Integrity for Large Depressional Wetlands in Minnesota (Gernes and Helgen, 2002). In 2011, the only adjustment made to the IBI calculation was the elimination of one of the 10 metrics. The chironomid diversity metric was not calculated because macroinvertebrates were not identified to the species level. This may have affected other metrics as well, including the total invertebrate metric, and therefore the calculated overall IBI scores for each wetland may be slightly different than they would be had all metrics been included.

In 2016, due to the omission of activity traps which target specific groups of macroinvertebrates, the number of metrics used to calculate macroinvertebrate IBI scores decreased from nine metrics to five metrics.The difference in potential macroinvertebrate IBI scores between 2011 and 2016, as well as the associated wetland condition categories are shown in Table 4. Comparing numeric IBI scores between years is not recommended due to the shift in possible ranges. However, the wetland health condition categories have been adjusted to account for that shift, so general wetland condition comparisons may still be made.

Table 4. Macroinvertebrate IBI score ranges for 2011 and 2016 with associated wetland condition categories (MPCA 2002 and MPCA 2014).

	2011	**2016**
Wetland Condition Category	**IBI Score Range**	**IBI Score Range**
Excellent	31 - 45	19 - 25
Moderate	18 - 30	12 - 18
Poor	0 - 17	5 - 11

Bathymetric Mapping

Figure 8. MWMO staff measure depth at drilled holes in pond.

In February 2017, MWMO staff collected water depth data from each of the Kasota Ponds with the goal of creating bathymetric maps and determining the water storage capacity of the wetlands. The current plan is to continue to collect this data every three to five years in order to be able to observe the rate at which the ponds may be filling with sediment.

Due to the thick emergent vegetation surrounding some of the ponds and their relatively small sizes, data collection occurred during winter through the ice using an ice auger to drill a grid of holes at which depth measurements were taken.

Bathymetry Methodology

Prior to data collection, maps were created with different-sized grids overlaid to get an idea of how many holes would need to be drilled. Based upon the sizes of the wetlands, a grid with 20 feet between points was selected.

On the day of data collection, grid points were measured and marked out over the ice. A gas-powered ice auger was then used to drill through the ice at each of the grid points. Staff used a GPS to mark the location of each measurement point and depth was measured using a plumb line as well as an electronic sonar device.

Individual Wetland Results

Kasota Pond North (KPN)

Figure 9. View of Kasota Pond North.

The northernmost of the Kasota Ponds, KPN is located west of Highway 280 and south of the intersection of North Hunting Valley Road and West Doswell Avenue (Figure 1). The perimeter of the pond is densely vegetated with non-native cattails, buckthorn, and burdock, particularly in the summer months. The pond bottom is thick with aquatic plants, silt, organic matter and clay. From 2008-2011, two sites were sampled for water quality within the wetland. One was located on the southwest side of the pond further away from Highway 280 and the other was located on the southern side of the pond near the railroad tracks. After data analysis in 2012 determined that multiple samples per pond were statistically unnecessary, only the southwest location was sampled in the pond from 2012 -2017 (Figure 9).

Water Quality Summary

Water quality results from KPN were assessed with regard to the MPCA's high, medium, and low wetland stressor categories for certain parameters. The range for each of the categories is shown in Table 2 in the Water Quality Methodology section of this report. Table 5 shows how annual median concentrations of chloride, Kjeldahl nitrogen (TKN), total phosphorus, and nitrate+nitrite fall into the stressor categories. Median values are based on 8-12 samples per year. During years where multiple sites were sampled in the wetland, sample results were averaged so that annual median values were based on equal sample numbers. Red highlighted values indicate high stressor level concentrations, yellow represents medium stressor level values and green indicates low stressor levels. Water quality samples were analyzed for several other constituents. Only some of those will be addressed in this report but additional data may be found on the MPCA's EQuIS database or by request to MWMO monitoring staff.

Table 5. Median annual KPN concentrations with MPCA stressor level designations.

Year	Chloride_mg/L	Kjeldahl Nitrogen_mg/L	Total Phosphorus_mg/L	Nitrate+Nitrite
2008	455.5	2.6	0.085	No Detect
2009	470.3	2.267	0.08	No Detect
2010	156	0.895	0.05	No Detect
2011	403	0.945	0.06	No Detect
2012	367.75	1.225	0.075	No Detect
2013	433.4	2.4	0.13	No Detect
2014	341.8	1.3	0.09	No Detect
2015	285.75	1.4	0.12	No Detect
2016	227.7	1.8	0.175	No Detect
2017	234.9	0.88	0.07	No Detect

As seen in Table 5, chloride levels in KPN have remained above the high stressor level for the 10 years that water quality monitoring has occurred at KPN with the highest median average occurring in 2009 at 470.3 mg/L and the lowest in 2010 at 156 mg/L. TKN and total phosphorus median annual concentrations have occasionally risen within the medium stressor level category but for the most part, have been under the low stressor level designation. Nitrate+nitrite median concentrations are all below the method detection limit and therefore also fall within the low stressor level category.

Chloride

Chloride pollution is an issue in the KPN wetland. As previously mentioned, KPN was one of the four wetlands included in Minnesota's 2014 impaired waters list for chloride and therefore was part of the Twin Cities Metro Area TMDL study (MPCA, 2016). The Minnesota surface water quality standard for chloride is 230 mg/L, much higher than the high wetland stressor level designation (Table 2). As one might expect, median monthly chloride concentrations show that the highest chloride levels occur during the winter and spring months, thus corresponding with melt events where salt applied to the roadways and other surfaces would wash off into the wetlands (Figure 10). However, the surface water standard is also often exceeded in the summer and fall months in KPN.

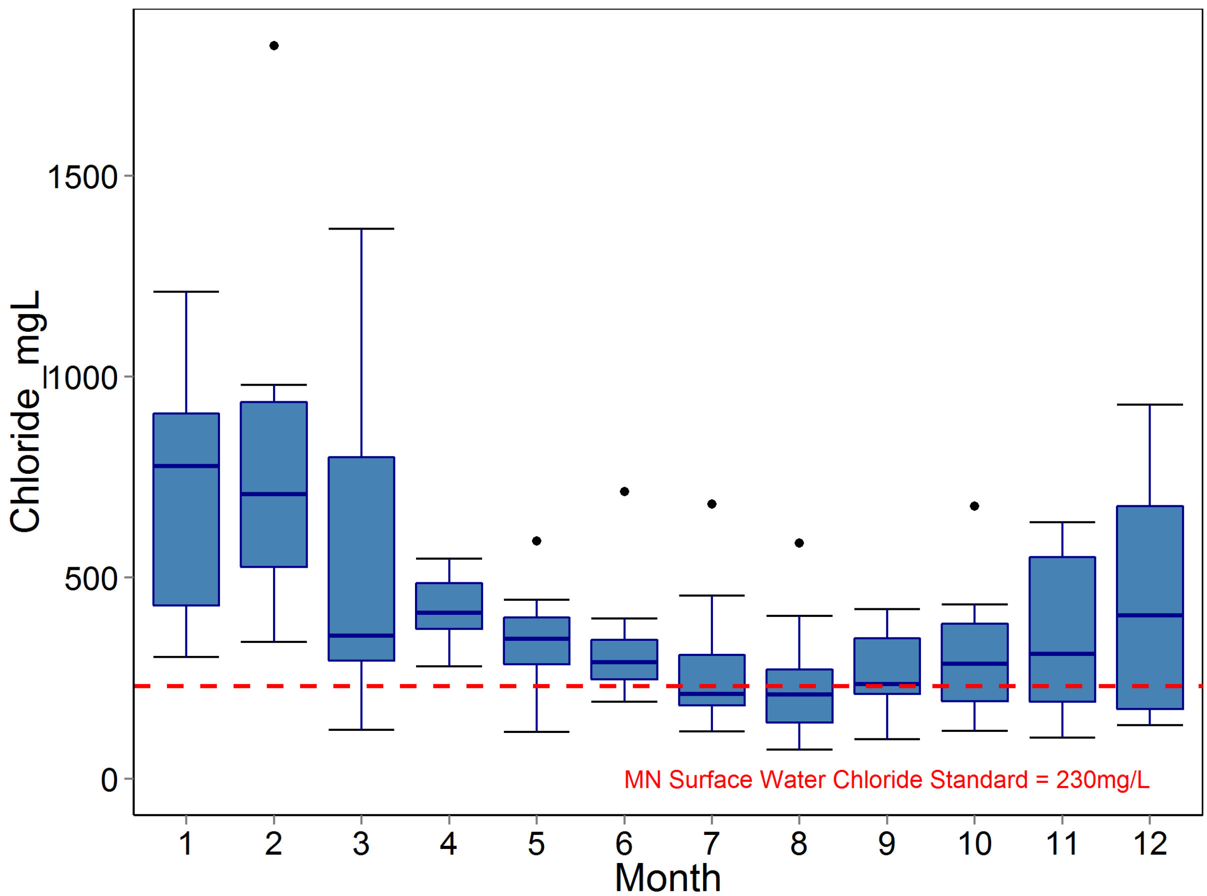

Figure 10. Median monthly chloride concentrations at Kasota Pond North. For an explanation of bloxplots, see Appendix B.

Total Phosphorus

Total phosphorus (TP) concentration is a concern in freshwater bodies because it is often positively correlated with algae growth and negatively correlated with water transparency/clarity. In other words, as TP concentrations increase, algae levels tend to go up and water clarity subsequently decreases. High algae levels can decrease the dissolved oxygen available for wetland biota. As shown in Table 5, the annual median TP concentration in KPN rarely exceeded the medium stressor level value and did not exceed the high stressor level. However, TP concentrations often vary on a seasonal basis. Figure 11 shows that median monthly TP concentrations at KPN were highest in the winter and summer months. During those seasons, concentrations did occasionally move into the medium and sometimes high stressor categories. Due to its association with sediment particles, TP concentrations may increase in winter and early spring as a result of the higher sediment runoff with melt events. Summer TP increases are likely associated with increased plant biomass in runoff during the peak growing season.

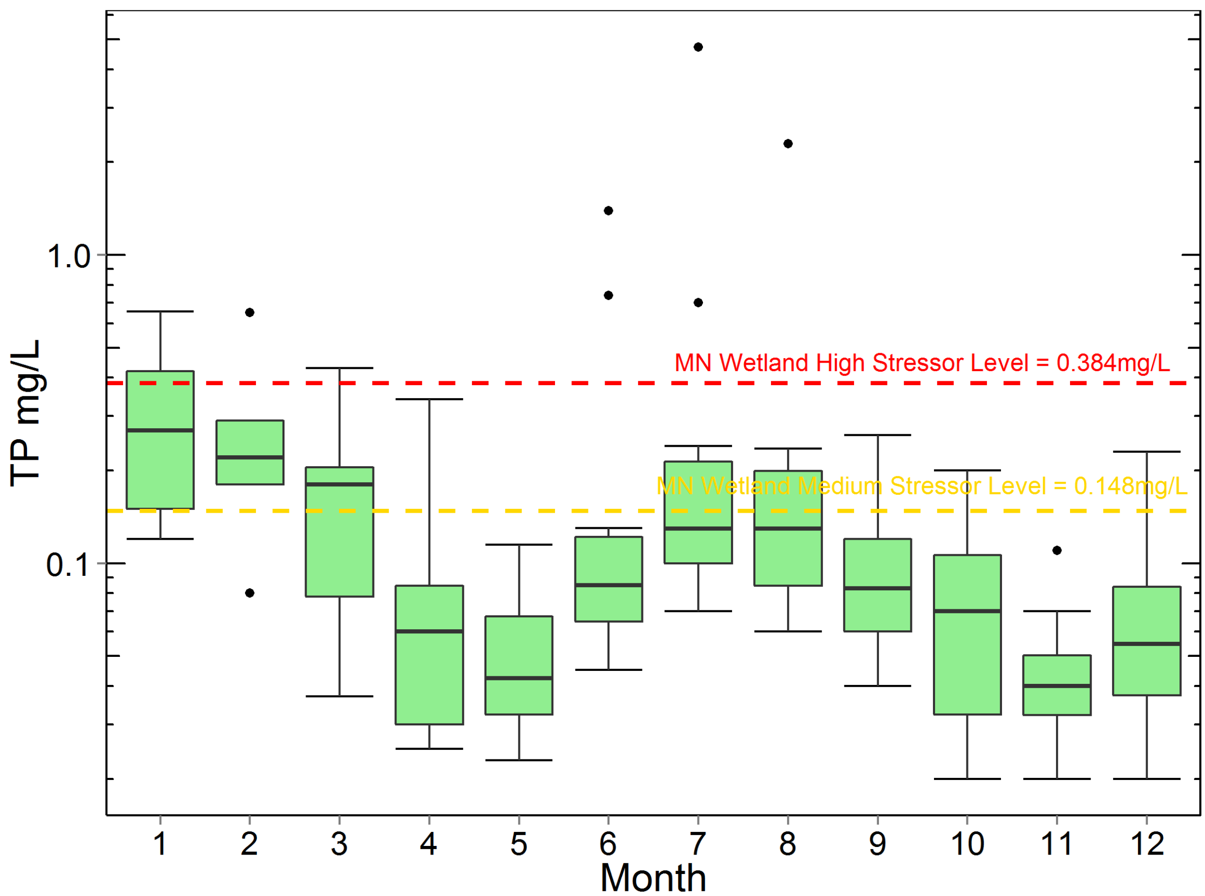

Figure 11. Median monthly total phosphorus concentrations in Kasota Pond North based on data collected between 2008 and 2017. Wetland stressor level categories are represented as lines. Y axis is shown in log scale for visualization purposes. For an explanation of bloxplots, see Appendix B.

Biological Data Summary

Aquatic Plants

Aquatic plant surveys in 2011 and 2016 at KPN resulted in very similar IBI scores. A few more plant genera were found in the wetland during the 2016 survey, resulting in a score of 9 as compared with the score of 7 in 2011 (Table 6). However, both of these scores fall within the MPCA's "poor" condition range for aquatic plant IBIs (Table 3).

Table 6. Aquatic plants IBI scores for KPN – 2011and 2016.

	2011		**2016**	
Aquatic Plant Metrics	**Metric Value**	**IBI Score[1]**	**Metric Value**	**IBI Score[1]**
Vascular Genera	2	1	5	1
Nonvascular Genera	0	1	0	1
Grass-like Genera	0	1	0	1
Carex Cover	0	1	0	1
Utricularia present	no	1	No	1
Aquatic Guild Genera	2	1	4	3
Persistent Litter	63%	1	63%	1
Total IBI Score		7		9

[1] Possible Score of 1, 3, or 5

Macroinvertebrates

As discussed in the methodology section for macroinvertebrate surveys, the methods used changed between the 2011 and 2016 surveys. In the 2011 survey, activity traps were deployed to target certain invertebrates, particularly Corixidae. These traps were not used in 2016 per MPCA recommendations and therefore the scoring was done differently, using Hennepin County's WHEP revised scoring sheets and condition ranges. Due to these changes in method, it is not appropriate to compare individual metrics or actual IBI scores between years (Table 7). However, using the adjusted ranges for assessment of wetland condition, the macroinvertebrate IBI surveys indicate "poor" conditions for both 2011 and 2016 (Table 3).

Table 7. Macroinvertebrate IBI scores for KPN – 2011 and 2016.

	2011		2016	
Invertebrate Metrics	**Total Taxa**	**IBI Score[3]**	**Total Taxa**	**IBI Score**
Total number of invertebrate taxa	16	1	7	3
Odonata Taxa[1]	1	1	1	1
Leech Taxa	1	1	1	1
Snail Taxa	1	1	1	1
ETSD[2] (# genera of mayflies, caddisflies, fingernail clams, dragonflies)	3	1	2	3
Number of intolerant taxa	3	3	NA	NA
Tolerant taxa proportion of sample count[a]	42.5%	3	NA	NA
Dominant three taxa as proportion of sample count[a]	83.2%	1	NA	NA
Corixidae proportion of beetles and bugs in AT[b]	91.8%	1	NA	NA
Total Macroinvertebrate IBI Score		13		9

[a] Dip net samples only
[b] Activity trap (AT) samples only
[1] Dragonfly/Damselfly
[2] Number of genera of Mayflies, Caddisflies, Fingernail clams, Dragonflies
[3] Possible Score of 1, 3, or 5

Bathymetry Monitoring Summary

Water depth was measured through the ice at 32 locations in the KPN wetland. The maximum, minimum, and average depths from the bathymetric survey are shown in Table 8 below. A bathymetric map was generated by interpolating the data points to create depth contours for the entire pond (Figure 12).

Table 8. Summary data for KPN bathymetric survey.

Pond	**Maximum (ft)**	**Minimum (ft)**	**Average (ft)**
Kasota Pond North	3.2	0.3	2.4

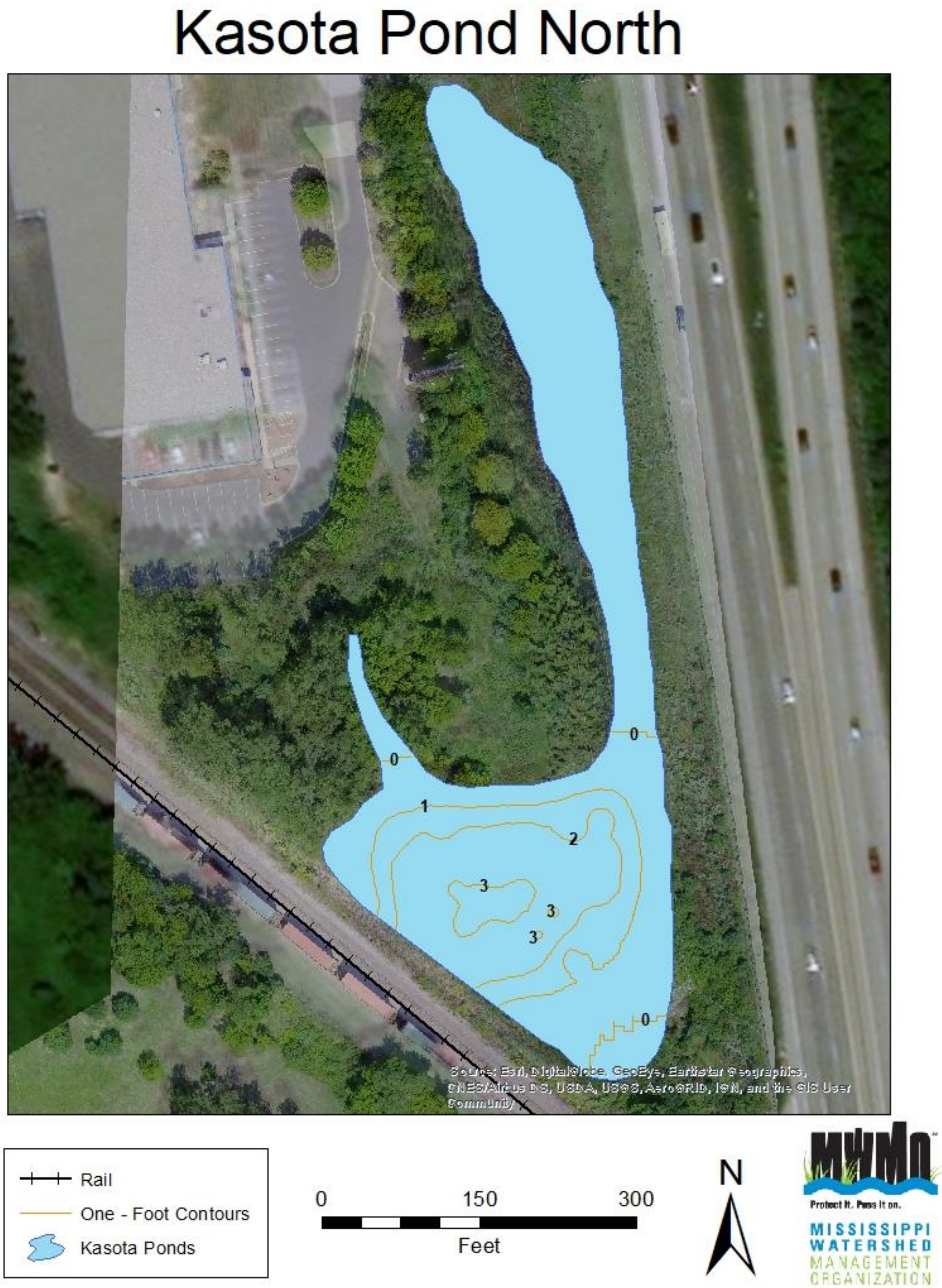

Figure 12. Kasota Pond North bathymetric map.

Kasota Pond East (KPE)

KPE, also known as Mallard Marsh, is the largest of the Kasota Ponds and is located southwest of the intersection of Highway 280 and Kasota Avenue (Figure 1). Most of the pond is surrounded by a grassy buffer, except for the west side of the pond- where railroad tracks pass alongside the pond bank with approximately three feet of riprap between the tracks and the wetland. KPE is home to many animals; turtles, geese, and ducks have been regularly observed in and around the pond. The bottom of the wetland is composed of organic matter, silt, and clay. This wetland is dense with cattails and aquatic plants during the summer months. From 2008-2011, three sites were sampled regularly within the pond. Each of these three sites are located in approximately the middle of the north, west, and east sides of the pond. From 2012-2017, KPE was sampled only at the west sampling location (Figure 13).

Figure 13. MWMO staff collecting a water quality sample at KPE.

Water Quality Summary

Table 9. Median annual concentrations at Kasota Pond East with MPCA stressor level designations.

Year	Chloride_mg/L	Kjeldahl Nitrogen_mg/L	Total Phosphorus_mg/L	Nitrate+Nitrite
2008	549	3.94	0.120	No Detect
2009	437	2.57	0.107	No Detect
2010	354	1.37	0.077	No Detect
2011	493	1.21	0.058	No Detect
2012	425	1.70	0.070	No Detect
2013	433	1.20	0.070	No Detect
2014	380	0.78	0.050	No Detect
2015	332	0.87	0.050	No Detect
2016	442	0.75	0.035	No Detect
2017	469	0.96	0.044	No Detect

Table 9 shows annual median concentrations of chloride, TKN, total phosphorus, and nitrate+nitrite with the corresponding MPCA Wetland Stressor Level (Table 2). Annual median chloride concentrations exceeded the high stressor level in all 10 years in which data were collected. TKN median concentrations were occasionally within the medium and high stressor level ranges. Total phosphorus and nitrate+nitrite annual medians remained within the low stressor level range during the 2008-2017 sampling period.

Chloride

As in KPN, chloride concentrations in KPE are very high. Not only did the annual median chloride concentration remain within the high stressor level range, but the much higher Minnesota surface water standard of 230 mg/L was also exceeded in all years (Figure 14). Similarly to KPN, chloride concentrations have been observed to vary seasonally within KPE with higher chloride concentrations in the winter and spring months.

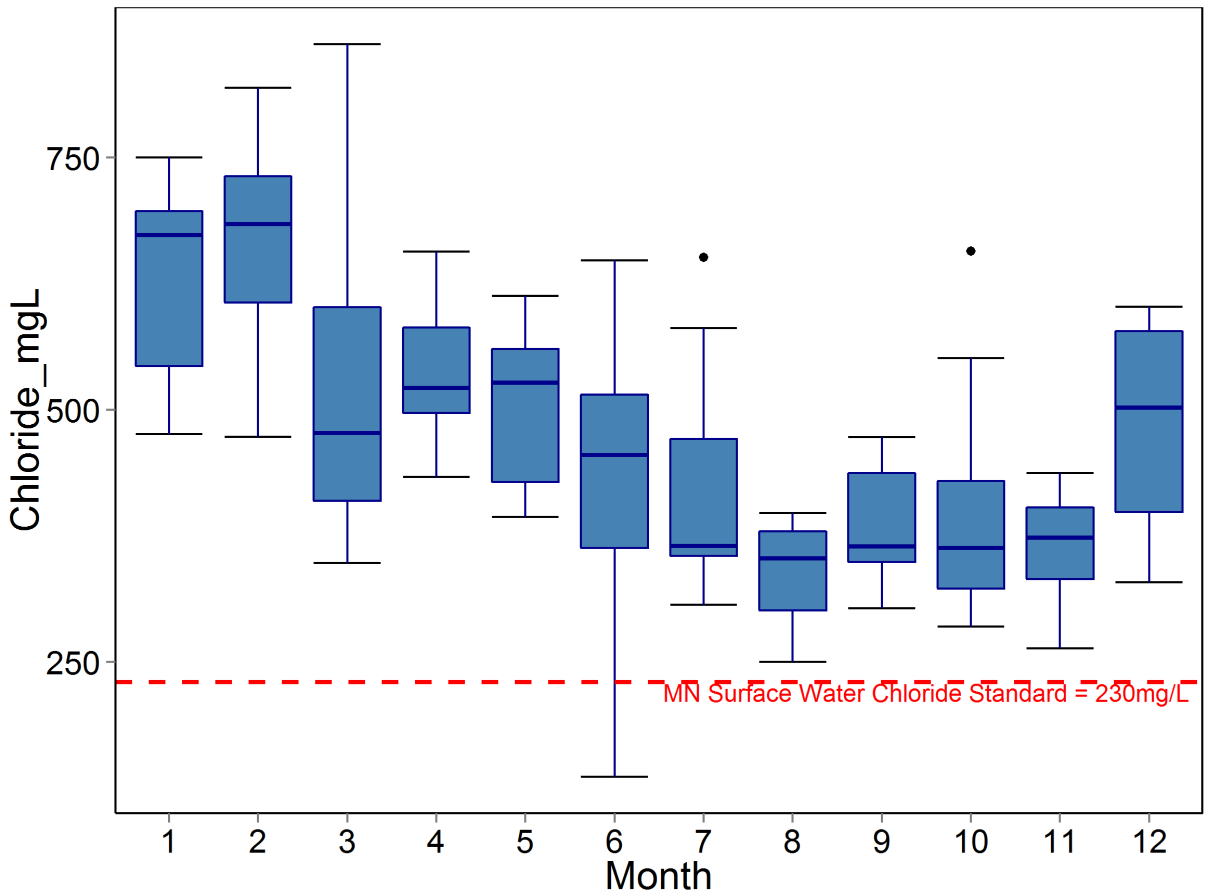

Figure 14. Monthly median chloride level at Kasota Pond East.

Total Phosphorus

As shown in Table 9, the annual median TP concentration in KPE remained within the low stressor level. However, TP concentrations often vary on a seasonal basis. Figure 15 shows that median monthly TP concentrations at KPE were highest in the winter/early spring and increased again during summer months. The March median TP concentration rose into the medium stressor level category, while all other monthly medians remained in the low stressor category. Due to its association with sediment particles, TP concentrations may increase in winter and early spring as a result of the higher sediment runoff with melt events. Summer TP increases are likely associated with increased plant biomass in runoff during the peak growing season.

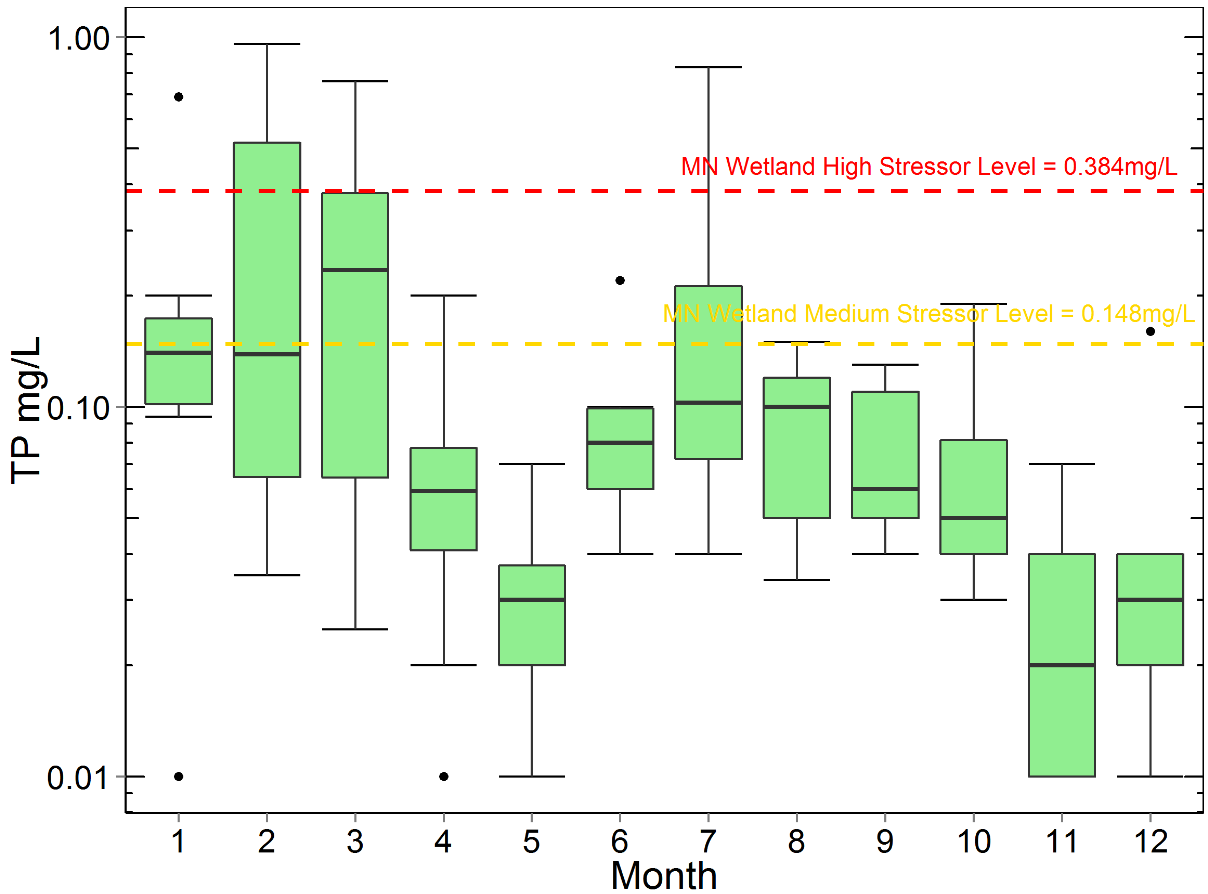

Figure 15. Boxplot of median monthly TP values at KPE for data from 2008-2017 with wetland stressor level categories as lines. Y axis is shown in log scale for visualization purposes.

Biological Monitoring Summary

Aquatic Plants

KPE received the same overall aquatic plant IBI score in both 2011 and 2016 (Table 10). During the 2016 survey, more genera were found in KPE but the overall score stayed the same. IBI scores of 9 fall within the “poor” category of wetland condition assessment (Table 3).

Table 10. Aquatic plants IBI scores for KPE – 2011 and 2016.

	2011		**2016**	
Aquatic Plant Metrics	**Metric Value**	**IBI Score[1]**	**Metric Value**	**IBI Score[1]**
Vascular Genera	5	1	7	1
Nonvascular Genera	0	1	0	1
Grass-like Genera	0	1	0	1
Carex Cover	0	1	0	1
Utricularia present	no	1	no	1
Aquatic Guild Genera	4	3	5	3
Persistent Litter	63%	1	63%	1
Total IBI Score		9		9

[1] Possible Score of 1, 3, or 5

Macroinvertebrates

Individual macroinvertebrate metric scores and total IBI scores for 2011 and 2016 are presented in Table 11. Due to the difference in methods between the 2011 and 2016 surveys, it is not appropriate to compare the numeric IBI scores between the two years. However, the wetland conditions ranges were adjusted based on the new methods and for both years, the IBI scores correspond to a “moderate ” wetland condition in 2011 and a “poor” wetland condition in 2016 (Table 4).

Table 11. Macroinvertebrate IBI scores for KPE – 2011 and 2016.

	2011		2016	
Invertebrate Metrics	**Total Taxa**	**IBI Score[3]**	**Total Taxa**	**IBI Score[3]**
Total number of invertebrate taxa	22	1	9	3
Odonata Taxa[1]	2	1	2	1
Leech Taxa	3	3	1	1
Snail Taxa	2	1	1	1
ETSD[2] (# genera of mayflies, caddisflies, fingernail clams, dragonflies)	5	3	2	3
Number of intolerant taxa	3	3		
Tolerant taxa proportion of sample count[a]	70.8%	1		
Dominant three taxa as proportion of sample count[a]	77.8%	1		
Corixidae proportion of beetles and bugs in AT[b]	16.4%	5		
Total IBI Score		19		9

[a] Dip net samples only
[b] Activity trap (AT) samples only
[1] Dragonfly/Damselfly
[2] Number of genera of Mayflies, Caddisflies, Fingernail clams, Dragonflies
[3] Possible Score of 1, 3, or 5

Bathymetry Monitoring Summary

Water depth was measured through the ice at 114 locations in the KPE wetland. The maximum, minimum, and average depths from the bathymetric survey are shown in Table 12 below. A bathymetric map was generated by interpolating the data points to create depth contours for the entire pond (Figure 16).

Table 12. Kasota Pond East bathymetry survey results.

Pond	Maximum (ft)	Minimum (ft)	Average (ft)
Kasota Pond East	5.5	1.3	2.8

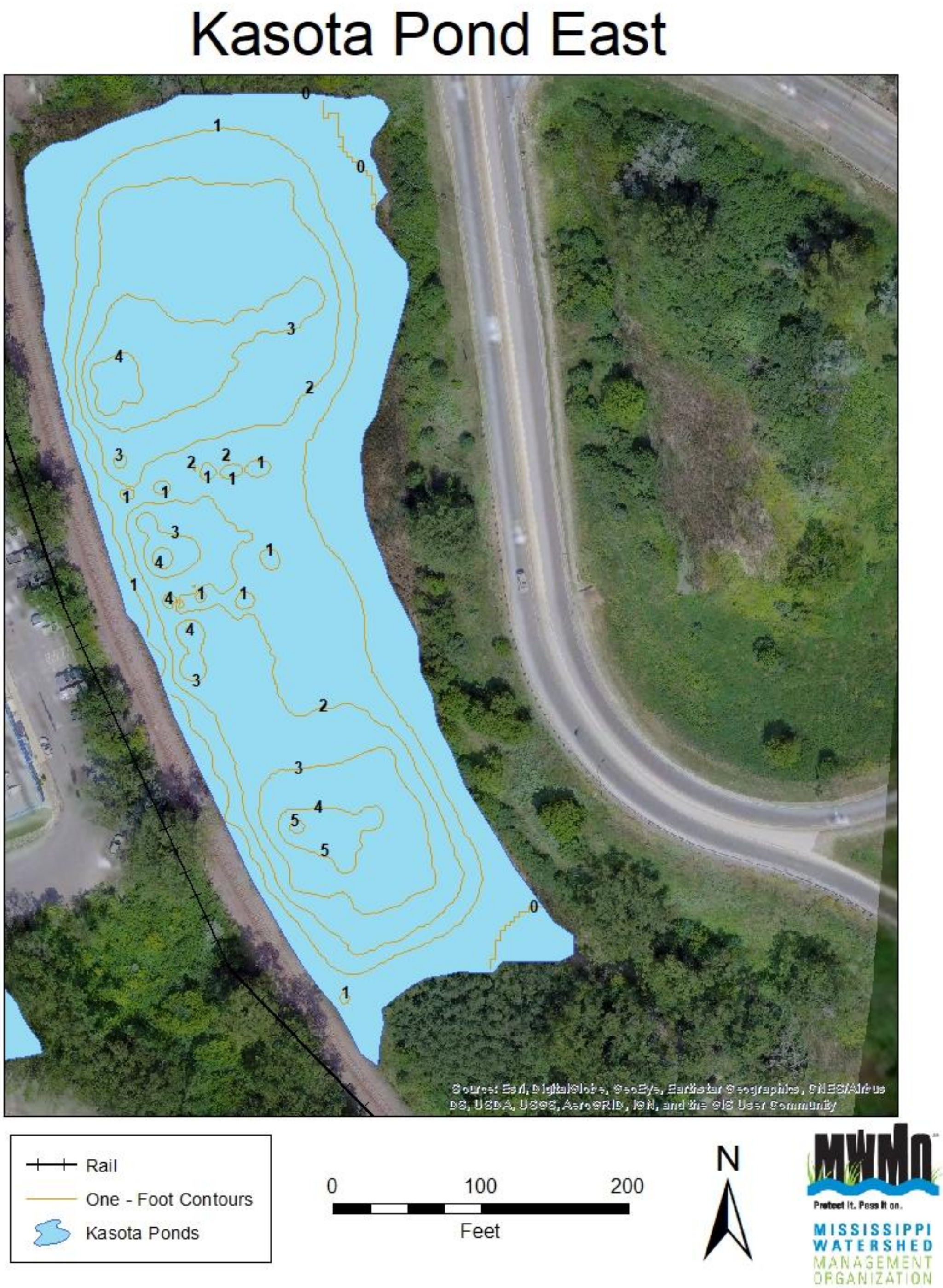

Figure 16. Bathymetry map of Kasota Pond East with one-foot contours.

Kasota Pond West (KPW)

Kasota Pond West is the smallest of the Kasota Ponds and located just west of Kasota Pond East (Figure 1). KPW receives runoff from a nearby parking lot and railyard. In the summer months, it is often host to dense algal blooms while other aquatic vegetation is seldom present. The pond has a sandy bottom with a few inlet pipes feeding into it. From 2008-2011, the MWMO sampled two sites within KPW on the north and east sides (Figure 4). From 2012-2017, samples were only taken at the north location (Figure 18).

Figure 17. Canada geese in Kasota Pond West.

Water Quality Summary

Figure 18. MWMO staff collects water quality sample in Kasota Pond West.

Table 13. Kasota Pond West median annual concentrations with MPCA stressor level designations.

Year	Chloride_mg/L	Kjeldahl Nitrogen_mg/L	Total Phosphorus_mg/L	Nitrate+Nitrite
2008	551	3.3	0.055	No Detect
2009	359	3.35	0.06	No Detect
2010	310.5	1.35	0.045	Detect
2011	381.5	1.5	0.04	Detect
2012	294.5	1.3	0.04	No Detect
2013	409.5	2.2	0.09	No Detect
2014	365.4	1.4	0.08	No Detect
2015	360.25	1.75	0.13	No Detect
2016	362.45	1.4	0.085	No Detect
2017	394.6	1.2	0.08	No Detect

Annual median chloride values at KPW exceeded the MPCA wetland high stressor level during all years monitored (Table 13). Total Kjeldahl nitrogen annual median concentrations exceeded the high or medium stressor level in approximately half of the years monitored between 2008 and 2017. Total phosphorus median concentrations remained within the low stressor designation and Nitrate+nitrite median values were in the low stressor level with the exception of 2010 and 2011.

Chloride

As with KPN and KPE, KPW has very high levels of chloride year-round. Not only do the annual median chloride concentrations greatly exceed the MPCA high stressor level, but in all years medians also exceeded the much higher MPCA surface water chloride standard of 230 mg/L. Chloride levels do vary on a seasonal basis, with elevated concentrations during winter and spring months compared with the rest of the year (Figure 19). This is likely due to an influx of chloride from snowmelt events.

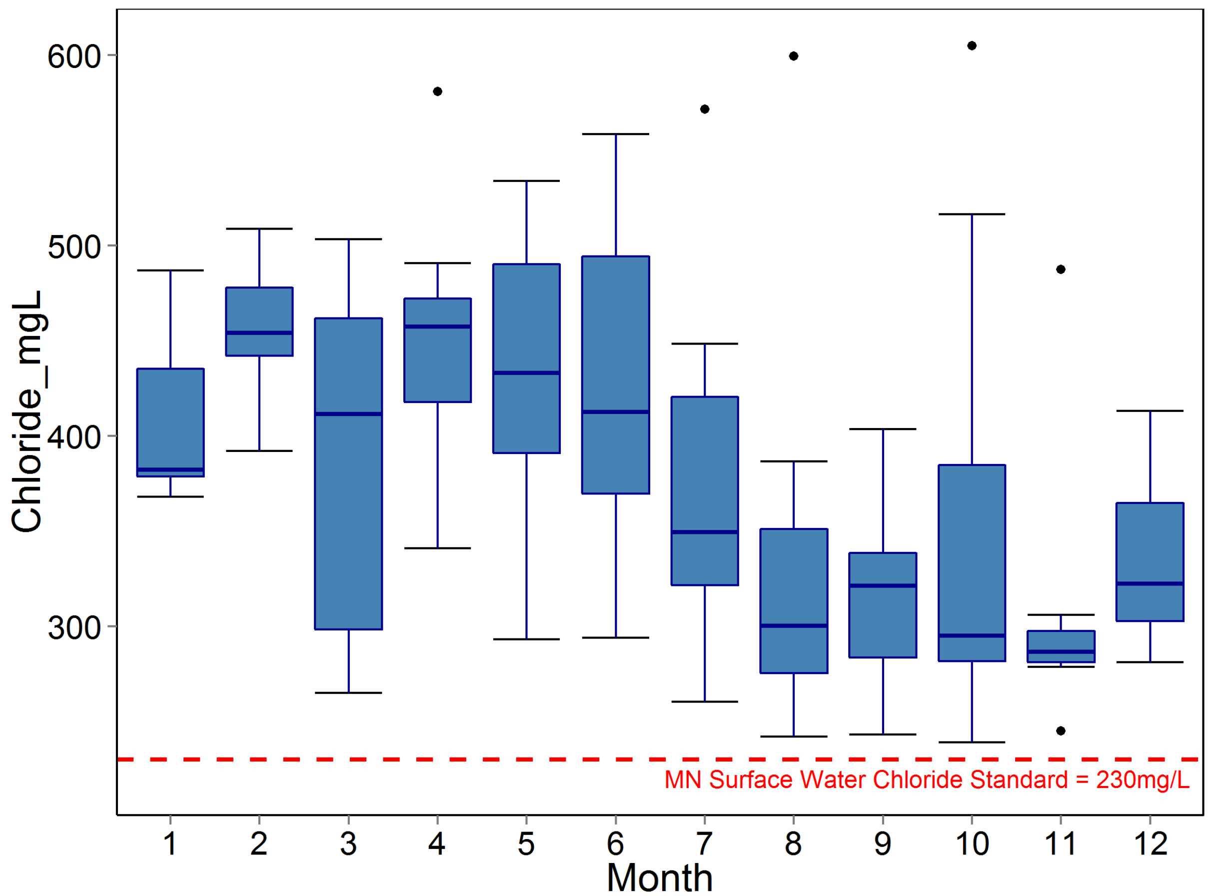

Figure 19. Kasota Pond West monthly median chloride values. MN surface water chloride standard shown as red dashed line.

Total Phosphorus

Total phosphorus (TP) concentration is often positively associated with elevated algae levels. KPW annual median TP concentrations are within the low stressor level but TP concentrations do fluctuate somewhat on a seasonal basis. As seen in Figure 20, KPW TP concentrations tend to increase slightly in late summer/early fall during the peak growing season.

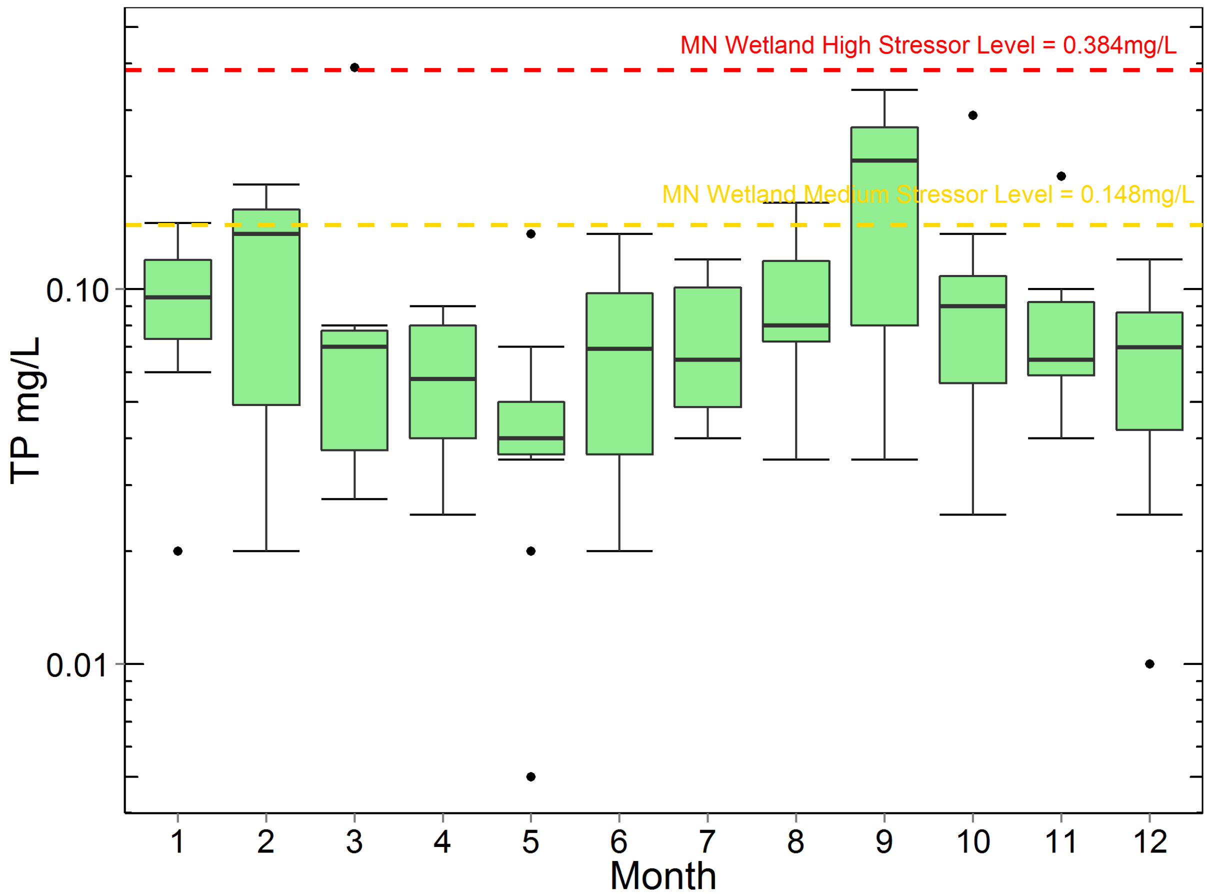

Figure 20. Boxplot of median monthly TP values at KPW for data from 2008-2017 with wetland stressor level categories as lines. Y axis is shown in log scale for visualization purposes.

Biological Monitoring Summary

Aquatic Plants

No aquatic plants were found in KPW in 2011 and 2016 and therefore received an IBI score of 0 for both surveys.

Macroinvertebrates

Individual macroinvertebrate metric scores and total IBI scores for 2011 and 2016 are presented in Table 14. Because of the difference in methods between 2011 and 2016, it is not appropriate to compare the numbric IBI scores between the two years. Wetlands conditions ranges were adjusted based on the methods and for both years, the IBI scores at KPW correspond to a “poor” wetland condition (Table 4).

Table 14. Macroinvertebrate IBI scores for KPW – 2011 and 2016.

	2011		2016	
Invertebrate Metrics	**Total Taxa**	**IBI Score[3]**	**Total Taxa**	**IBI Score**
Total number of invertebrate taxa	15	1	8	3
Odonata Taxa[1]	0	1	2	1
Leech Taxa	3	3	1	1
Snail Taxa	2	1	1	1
ETSD[2] (# genera of mayflies, caddisflies, fingernail clams, dragonflies)	0	1	1	1
Number of intolerant taxa	0	1	0	
Tolerant taxa proportion of sample count[a]	54.2%	3	NA	
Dominant three taxa as proportion of sample count[a]	89.3%	1	NA	
Corixidae proportion of beetles and bugs in AT[b]	28.6%	5	NA	
Total IBI Score		17		7

[a] Dip net samples only
[b] Activity trap (AT) samples only
[1] Dragonfly/Damselfly
[2] Number of genera of Mayflies, Caddisflies, Fingernail clams, Dragonflies
[3] Possible Score of 1, 3, or 5

Bathymetry Monitoring Results

Water depth was measured at 52 locations through the ice at the KPW wetland. Summary data from this survey are shown in Table 15 below. Contour depth lines were created by interpolating the depth survey data. A bathymetric map with these contours is shown in Figure 21.

Table 15. KPW bathymetry survey results.

Pond	Maximum (ft)	Minimum (ft)	Average (ft)
Kasota Pond West	9.5	3.1	6.8

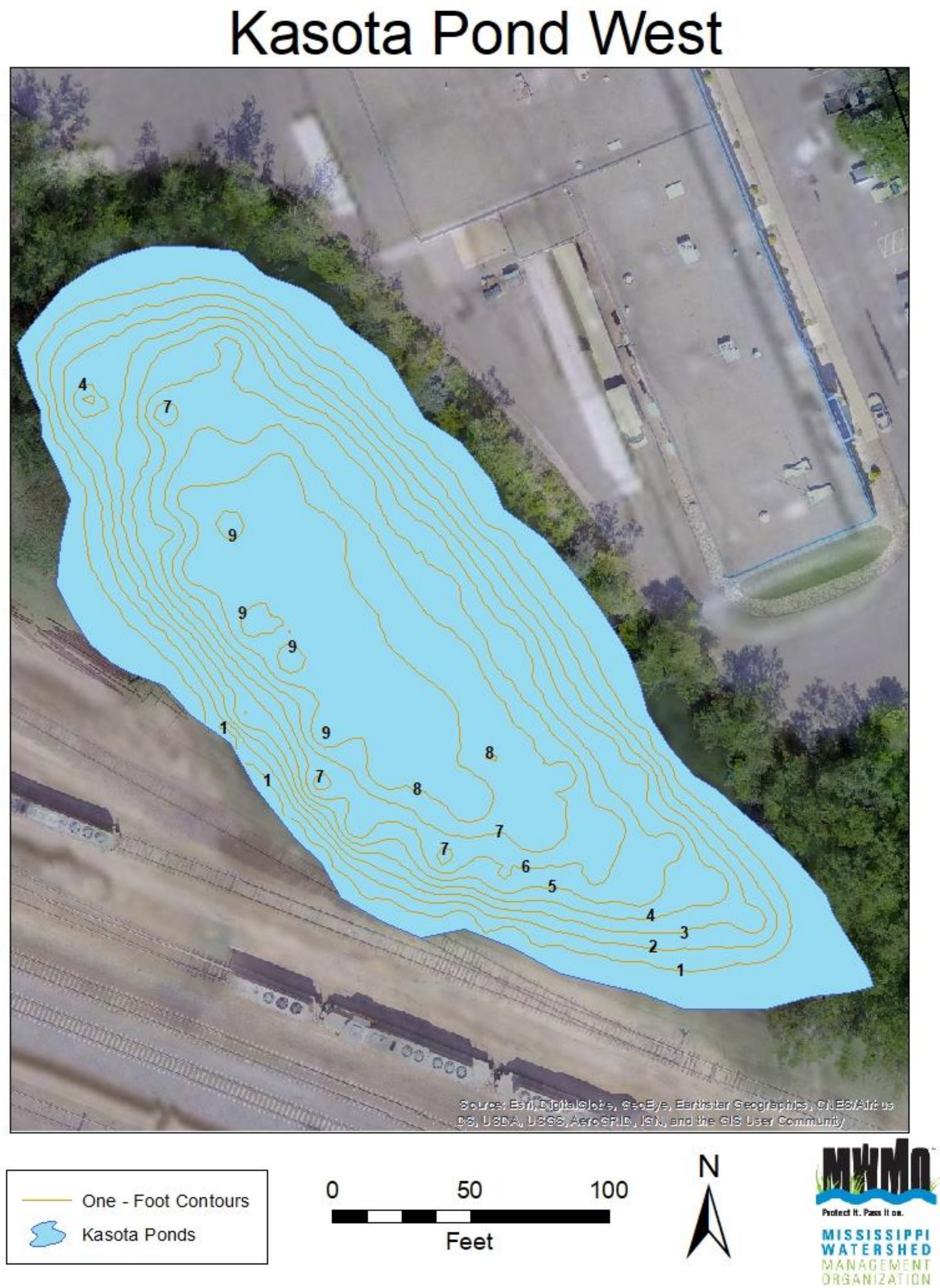

Figure 21. Kasota Pond West bathymetry map with one-foot contours.

Summary

Water Quality

Median annual chloride concentrations far exceeded the MPCA high stressor level for chloride concentrations during 2008-2017 at all three Kasota Ponds wetlands. In most of those years, the annual chloride median concentrations also exceeded the MPCA surface water standard of 230 mg/L at the wetlands. Several other parameters were sampled and analyzed for at the Kasota Ponds with certain of them entering the medium MPCA stressor level range during some years. Many of the parameters monitored do not have corresponding wetland MPCA stressor levels nor surface water quality standards with which to provide a comparison but are still important to monitor because of their potential effect on living biota in the wetland. All Kasota Ponds' water quality data can be downloaded from the MPCA's EQUIS website: https://cf.pca.state.mn.us/water/watershedweb/wdip/search_more.cfm.

Aquatic Plants

According to both the 2011 and 2016 surveys, all of the ponds were in poor condition with regard to aquatic plant communities (Figure 22 and Figure 23). The IBI scores for both KPW and KPE did not change, and the IBI score for KPN improved slightly from 2011 to 2016 (Table 16). In both 2011 and 2016, KPE and KPN were dominated by cattails and lacked diversity, while KPW contained no aquatic plants.

Table 16. Aquatic plants IBI scores comparison.

	2011 aquatic plants IBI score	2016 aquatic plants IBI score
KPW	0	0
KPE	9	9
KPN	7	9

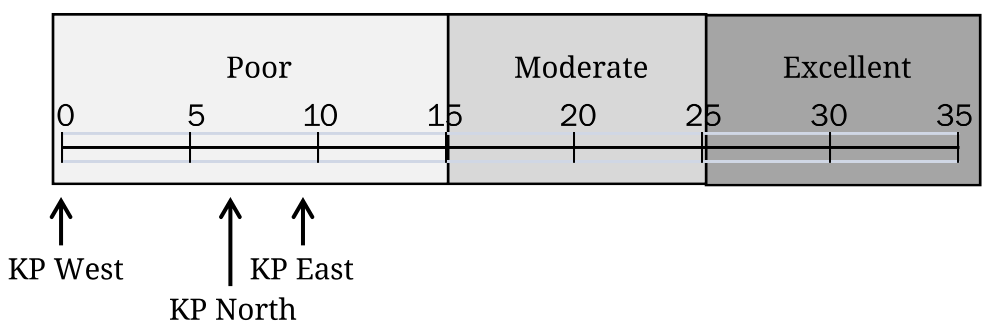

Figure 22. 2011 Aquatic plant IBI scores showing health relative to other wetlands in the state as set by the MPCA.

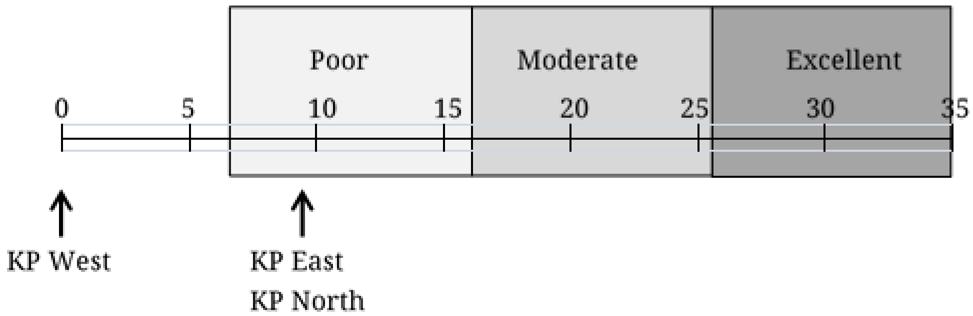

Figure 23. 2016 Aquatic plant IBI scores showing health relative to other wetlands in the state as set by the MPCA.

Macroinvertebrates

The 2011 macroinvertebrate IBI scores of Kasota Ponds indicated the wetlands were in poor to moderate health (Figure 24) and the 2016 IBI scores showed that all the ponds were in poor health (Figure 25). However, it is important to consider the fact that activity traps were not used in 2016. Activity traps target a specific group of macroinvertebrates and, due to their omission, the metrics contributing to the IBI calculation and the overall score range have changed since 2011. Therefore, while biodiversity and overall wetland health may have decreased since 2011, it is unlikely that the change is as drastic as the data comparison would suggest. Macroinvertebrate community composition can be affected by various factors such as weather patterns during a particular year and, ideally, assumptions regarding trends in wetland macroinvertebrate community condition would not be made until more data are collected.

Table 17. Macroinvertebrate IBI scores comparison.

	2011 macroinvertebrate IBI score	2016 macroinvertebrate IBI score
KPW	17	7
KPE	19	9
KPN	13	9

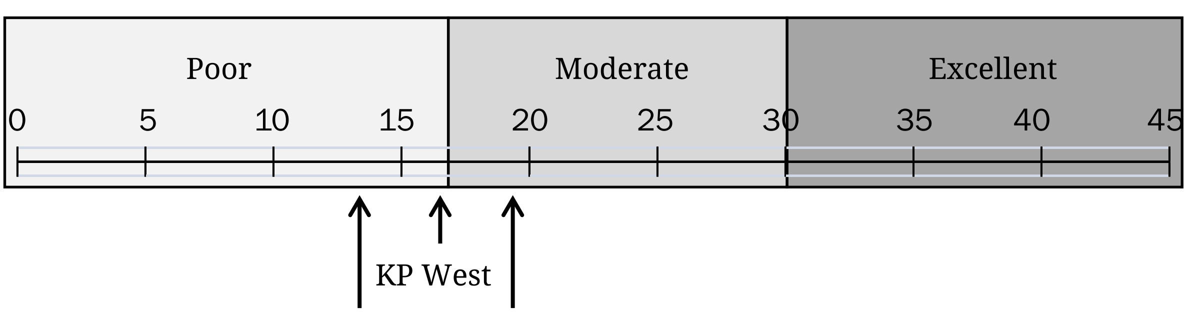

Figure 24. 2011 macroinvertebrate IBI scores showing health relative to other wetlands in MN as set by the MPCA.

Figure 25. 2016 macroinvertebrate IBI scores showing health relative to other wetlands in MN as set by the MPCA.

Looking Forward

Figure 26. An aerial view of Kasota Pond North and Kasota Pond East in March 2019.

The MWMO appreciates the complexities of wetlands and all they have to offer, and even though the Kasota Ponds wetlands are relatively small, they make an impact on the health of the watershed and working to restore and protect them are high priorities. Now that baseline data have been collected and analyzed, one of the next steps to improve the MWMO's understanding of these wetlands is to study how water interacts within the system and the watershed. This will be achieved through delineating each wetland, as well as monitoring the groundwater to determine groundwater interaction with the wetlands. Delineation work will use the latest available Lidar data and ground-truthing locations of catch basins, and inlet and oulets of stormwater infrastructure to identify the pathways of the surface water runoff to and from the wetlands.

The MWMO plans to conduct another round of biological surveys and water quality sampling in 2021 to build on the data collected thus far. This ongoing monitoring will allow the MWMO to continue to track the health of aquatic plant and macroinvertebrate communities and to assess the effectiveness of any habitat improvement efforts that may occur at the wetlands.

Figure 27. An aerial view of Kasota Pond West in March 2019.

MWMO will continue to work with community groups in their cleanup efforts around the wetlands, as well as assist where possible with the planning, organizing and implementation of shoreline and habitat improvements in and around the wetlands.

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Appendix A

Table A.1. Laboratory methods and certification for each analyte.

Analyte	Lab	Method	Certified
Total Metals (Copper, Nickel, Lead, Zinc, Cadmium, Chromium, Mercury)	Metropolitan Council	EPA 200.8 with ATP, Rev. 5.4 (Mercury) EPA 245.7	Yes
Total Phosphorus plus Total Kjeldahl Nitrogen	Metropolitan Council	EPA 365.4 & EPA 351.2 Rev 2.0	Yes
Dissolved Phosphorus	Metropolitan Council	EPA 365.4	Yes
Orthophosphorus	Metropolitan Council	SM 4500-P E	Yes
Total Ammonia Nitrogen	Metropolitan Council	EPA 350.1 Rev 2.0	Yes
Nitrate & Nitrite Nitrogen	Metropolitan Council	4500 NO3 H-00	Yes
Total & Volatile Suspended Solids	Metropolitan Council	SM 2540 D and E - 1997	Yes
Total Dissolved Solids	Metropolitan Council	SM 2540 C	No
Total Hardness	Metropolitan Council	SM 2340 C-97	Yes
Total Chlorides	Metropolitan Council	SM 4500-CI E-97	Yes

Appendix B

Boxplot Explanation

Some of the water quality data in this report are displayed using box and whisker plots (boxplots). Boxplots are a valuable way to determine trends and show variability within a year. The MWMO used boxplots in this report to show monthly concentrations of chloride and total phosphorus at each wetland.

A boxplot uses all of the data points to compute basic summary statistics. Figure B.1 shows an example boxplot. For each plot, the box represents the middle 50 percent of the data from the 25th to the 75th percentile. The vertical lines extending off of the boxes (the 'whiskers') represent the 5th to the 25th percentile (for the lower whisker) and 75th to 95th percentile (for the upper whisker). The horizontal line that cuts across the box represents the median value, or 50th percentile. Any data point falling outside of the 5th to 95th percentile is marked by an open circle and is considered an outlier.

Generally, more compact boxes with short 'whiskers' and few outliers indicate low variability in bacteria concentrations. To better visualize the data, boxplots have been plotted on a logarithmic scale. A log scale reduces wide range data to a more manageable size in a graph.

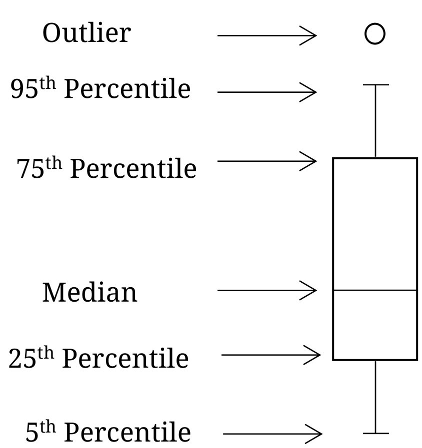

Figure B.1. An example box and whisker plot.

Appendix C

Pond Elevation Data

Table C.1. Kasota Ponds maximum, minimum, and average water elevations from 2013 - 2017.

Pond	Maximum Elevation (ft)	Minimum Elevation (ft)	Average Elevation (ft)
Kasota Pond North	877.72	875.86	876.59
Kasota Pond East	873.66	872.68	873.12
Kasota Pond West	864.77	862.86	864.08

Using depth measurements from the bathymetry study, recorded staff gauge readings, and known elevation markers in the area, MWMO staff were able to calculate the elevation of the ponds. The elevation data show that the northernmost pond (KPN) is at the highest elevation, followed by the eastern pond (KPE) and then the western pond (KPW) (Table C.1 and Figure C.1).

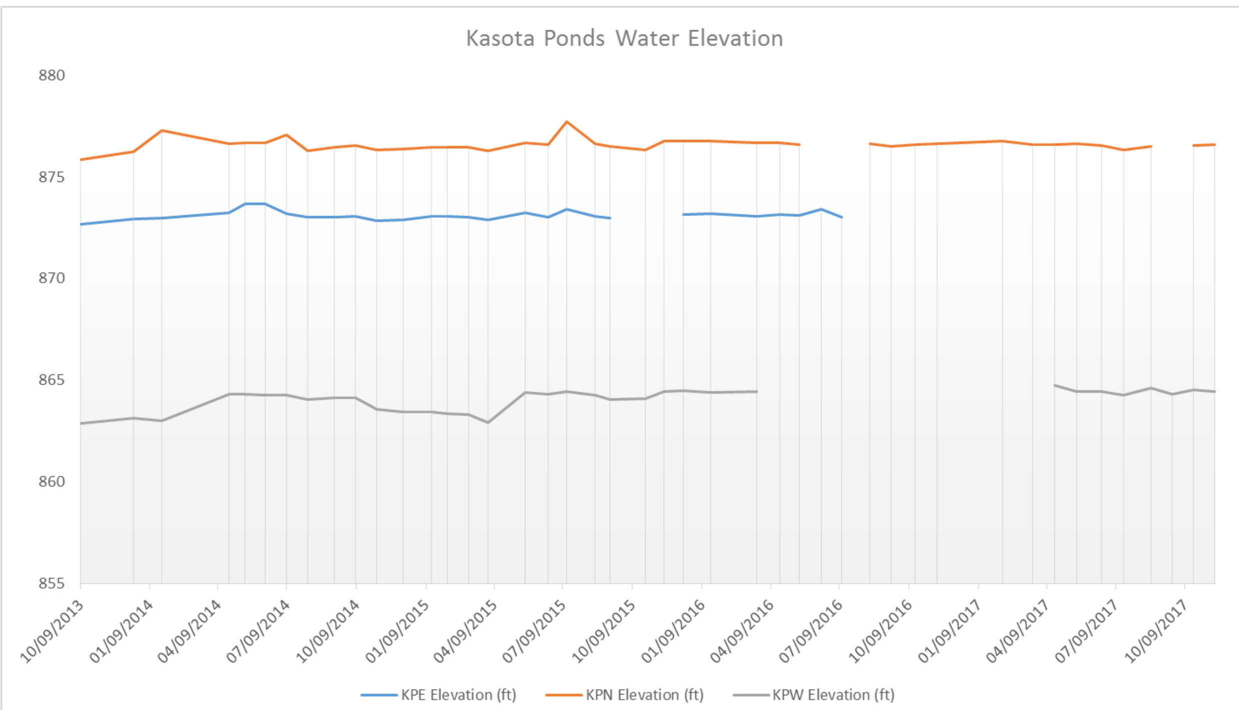

Figure C.1. Recorded water elevation of the Kasota Ponds from 2013 to 2017.