Final Report

for

Comprehensive Lake Management Planning Grant
Project #LPL162317

Forestville Millpond

June 2018

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Executive Summary

Created in 1877, the Forestville Millpond has endured a variety of uses and has been established as a fixture in the Door County Community and historic accounts illustrate a once healthy, multi-use waterbody. Decades of both anecdotal and scientific observation have begun to document a steady decline of the overall health of the Millpond and has continually been a topic of concern among the public and local officials.

The most recent comprehensive study was performed in 1996, with data collection of historic and current conditions. A renewed concern of worsening conditions in the Millpond prompted a public meeting in 2016 and subsequently led to the application for a Comprehensive Lake Management Planning Grant to perform necessary research and analysis of current conditions. This work was done throughout 2017 and this report provides the current conditions of the Forestville Millpond.

The watersheds that contribute to the Millpond are the upper reaches of the Ahnapee River and Silver Creek and their associated tributaries. The contributing area totals approximately 17,900 acres that is made up of 50% agricultural activities. An analysis of the land use, as well as computer modeling of sediment and nutrient loads, highlights the primary driver of pollutant loading as agricultural sources.

Results of the bathymetric study show that the Millpond is extremely shallow. A surface area of 94 acres was surveyed and the maximum depth was determined to be approximately 6 feet with the average depth being 2.9 feet and 92% of the waterbody falling under 3 feet of depth. Additionally, sediment cores revealed one to two feet of accumulated muck at the bottom of the Millpond. This represents a very shallow system with an abundance of unconsolidated sediments that are easily stirred up and contribute to poor water clarity conditions.

Sediment cores also revealed high concentrations of Total Phosphorus in the accumulated sediments, illustrating many years of nutrient and sediment loading. Cores also demonstrated elevated levels of oil and grease, and some sample showed traces of heavy metals, but not at thresholds to warrant concern. Overall, sediments in the Millpond represented a silt loam deposition and nutrient levels showed impairment, but not to the point of being problematic for disposal off site.

Water chemistry was performed upstream and within the Millpond. 25% of the upstream samples taken throughout the summer exceeded the established stream threshold for Total Phosphorus concentrations, while two out of the three samples taken in the Millpond exceeded the acceptable threshold for waterbodies such as the Millpond. Temperature within the Ahnapee River and the Millpond did not rise above tolerable levels, but Dissolved Oxygen levels dropped below established thresholds several times throughout the sampling season. The measured concentrations of Total Phosphorus and Chlorophyll, as well as established water clarity measurements place the Forestville Millpond in the category of a Eutrophic waterbody.

The aquatic plant survey revealed a very sparse population of any type of aquatic vegetation, with the most abundant species being nonnative Eurasian Water Milfoil. Other species identified indicated that suitable habitat does exist for quality aquatic habitats, but other factors show that changes need to be made to create a sustainable home for a biodiverse population.

The updated information also included revisiting the fish population. The previous comprehensive study was performed in 2008 and the 2016 update revealed nearly identical results. The most abundant species in the Millpond is carp, with the most abundant gamefish being a considerably far-behind second is largemouth bass. The makeup of the fish population is characteristic of a eutrophic waterbody with elevated nutrient inputs, low dissolved oxygen levels and plant populations that reflect those conditions.

The overarching goal of this report is to update the current conditions of the Forestville Millpond while reviewing potential management options to address the perceived concerns. Public input was sought to consider this. This is a good start, as it gives insight into the opinions of the general population. A public survey revealed that the majority of landowners within the Millpond watershed would like to address water quality, clarity and quantity. A large segment of respondents would like to see more fish and fewer aquatic plant and algae. Overwhelmingly, the participants in the survey do not agree with continuing to do nothing, and do not agree with removal of the dam.

Future steps in the Millpond watershed will involve gathering information from the public, government officials, resource professionals, and local and state agencies to form a set of consensus-based goals. These will be used to move forward with a set of management options to address the issues of the Millpond, as well as dictate future management.

1. History of the Forestville Millpond

The structure that is now known as the Forestville Dam was constructed in 1877 on what was then known as the Wolf River, whose name was later changed to the Ahnapee River. Demand grew from the need for a grist mill in southern Door County, and the construction of the 1,000 foot dam of heavy timbers, rock and earth was arranged by John Fetzer and C.W. Youngs. The mill opened in January of 1878 and the business flourished over several years, eventually leading to the need to expand the dam in the early 1880's to accommodate greater milling capacity.

Figure 1-1. John Poh

In December of 1883, a twenty-foot portion of the dam washed away and was replaced in the spring. Repairs to the dam coincided with the addition of a wood-fueled, steam power house to run the mill during time of low water and allow for continued production. John Poh (see Figure 1-1) had worked at the mill since he was fifteen years old and was named the head miller in 1886. He purchased the mill in 1897 and continued to make improvements and enjoyed tremendous success until the production of wheat began to give way to dairy farming. Milling continued into the early 1900s (See Figure 1-2).

In March of 1920, water in the millpond had reached record levels that lead to both of the wooden dam gates to be washed out. John Poh had devoted 54 years of his life to the mill and had kept it running until then; he passed away in 1925.

Figure 1-2. Forestville Dam in 1918

Through efforts of the Works Progress Administration, a new concrete dam was constructed in 1934 (see Figure 1-3). This dam was dedicated as the Poh Community Dam and Lake in 1935. In 1949, the dam and the surrounding property were sold to the Town of Forestville by John Poh Jr. May of 1960 brought heavy rains and a breach of the earth-and-rock-filled portion of the dike. This failure drained the impoundment and flooded downstream areas. In 1963, the town gave the park and dam structure to the Door County Board to develop a county park. The name Poh Community Dam was lost at this time and going forward, the dam became known as the Forestville Dam.

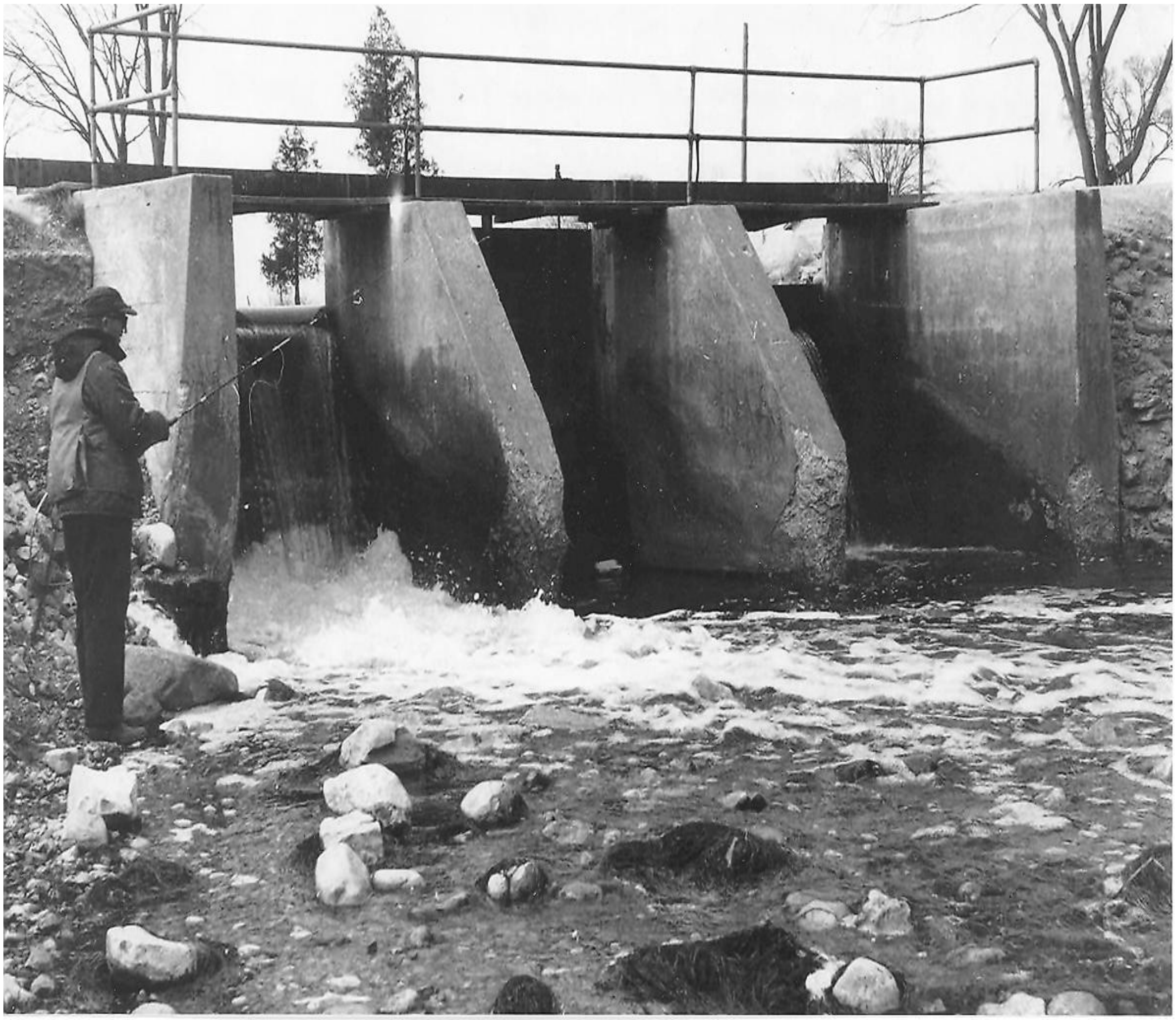

Figure 1-3. Forestville Dam in 1934

In 1968, a meeting between the Soil Conservation Service and the Forestville Fish and Game Club was held to discuss poor water quality. Examination of water sample results indicated very high concentrations of phosphorus and one of the dissolved oxygen samples dropping below 3 parts per million. Inspection of photos taken the previous year showed indications of milfoil and algae.

In 1982, the Forestville Dam entered its current configuration with a replacement of the spillway structure and a reconfiguration of the outflow through the bottom (see Figure 1-4 – Figure 1-6). This project coordinated with an effort to dredge near the dam structure to improve the swimmable areas in the park.

Figure 1-4. Forestville Dam in 2011

Figure 1-5. Dam Overflow Spillways

Figure 1-6. Dam Outflows to Ahnapee River

In a follow up to the reconstruction of the dam, the Wisconsin Department of Natural Resources proposed and undertook a project to draw down the pond and chemically treat the millpond in 1984; a rotenone treatment led to the removal of undesirable fish and a restocking effort with northern pike, and large and small-mouth bass. Several restocking efforts were attempted between 1985 and 1993 with several large fish kills documented. The fish kills were attributed to low dissolved oxygen concentrations resulting from excessive nutrients fueling large algae blooms; stocking efforts were discontinued.

In 1994, the Door County Soil and Water Conservation Department, in cooperation with the Door County Parks Department, secured a Wisconsin Lake Management Planning Grant to study the millpond throughout 1994 and 1995. A final report was developed and submitted in 1996, with results indicating excessive nutrient loading contributing to a eutrophic condition. The 1996 report also put forward several management options to consider, with advantages and disadvantages outlined for each. There was no activity generated to follow up on the 1996 report and conditions in the watershed and the Millpond continued.

Extensive water testing throughout 2012 and 2013 by the University of Wisconsin-Oshkosh, through a Wisconsin Coastal Management grant, culminated into a 2014 report of monitoring of non-point pollutants within the Ahnapee River watershed, including the Forestville Millpond. The conclusions of the 2014 report supported previous data collected on the millpond with average phosphorus concentrations in exceedance of established thresholds.

In 2016, the topic of health of the Millpond was revisited in a special meeting of the Door County Airport and Parks Committee. This meeting was open to the public and presented a history of the Millpond and Forestville Dam, as well as a review of the findings of the 1996 study. It was important to highlight that nothing had been done to advance the management options laid out in that study, and conditions had appeared to worsen. This meeting was well attended and was in fact, standing-room only at the Forestville Town Hall. After presentation of the current information and lengthy discussion, it was suggested that 1996 data was outdated and known conditions of The Forestville Millpond should be updated. Further consultation with resource professionals and state agency personnel led to the same conclusion and a Comprehensive Lake Management Planning Grant application was submitted to conduct the necessary research to update the 1996 plan.

2. Land Use

The watershed that contributes to the Forestville Millpond is approximately 17,900 acres of predominantly rural landscape. The total acreage is comprised of 50% agricultural use, 43% woodlands and natural areas and 7% developed and urban areas (see Chart 2-1).

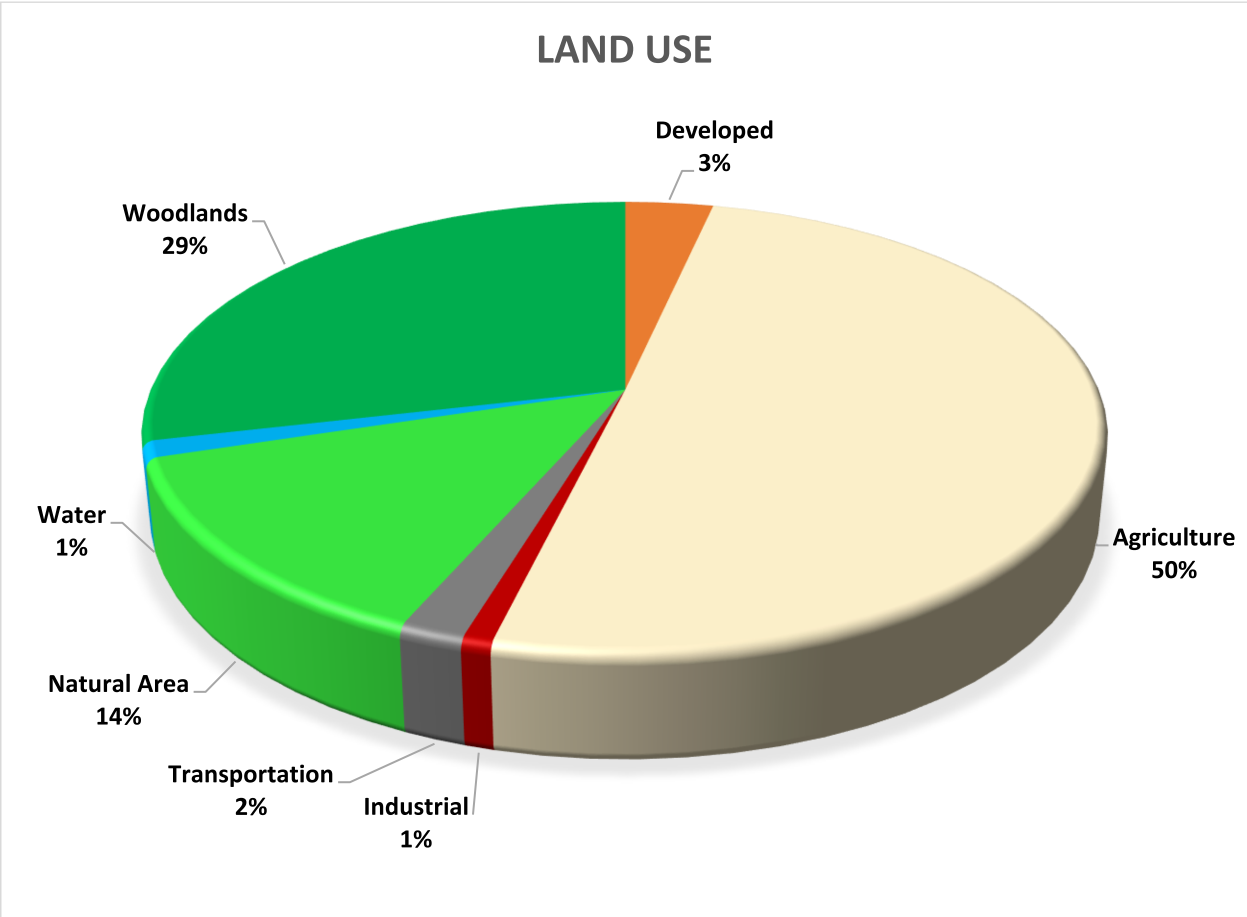

Chart 2-1. Summary of Land Use

For the most part, wetlands and forested areas are located adjacent to the Ahnapee River corridor and its tributaries. The majority of developed areas exist along the Highway 42/57 corridors and adjacent to the Millpond (see Figure 2-1).

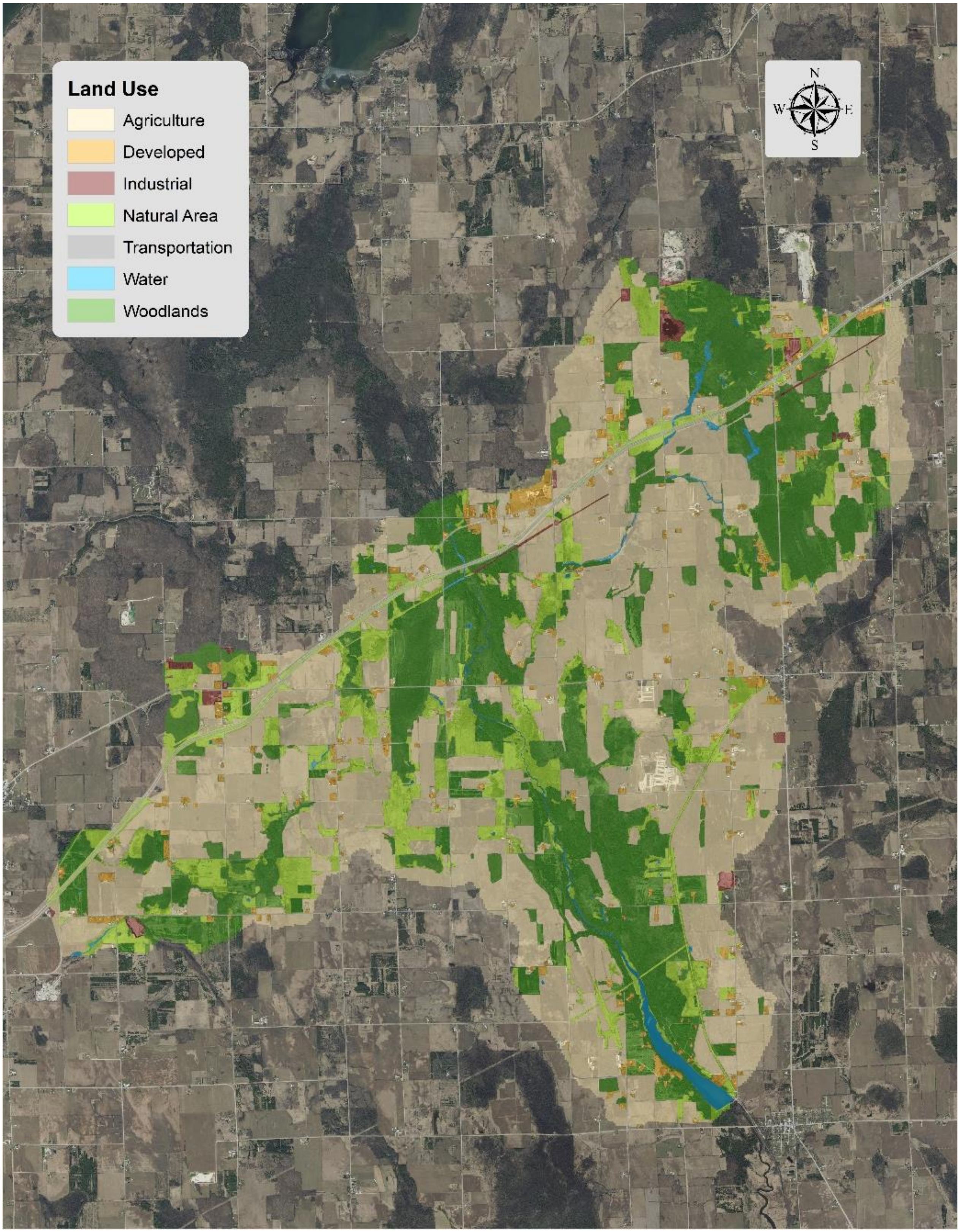

Figure 2-1. Map of Millpond Watershed Land Use

Agriculture

Agriculture within the watershed is made up of cropland, pastures and farmsteads/farm buildings. There is approximately 8,700 acres of cropland and pastures, including long-term specialty crops such as orchards. There are currently approximately 7,700 acres included in a Nutrient Management Plan (see Figure 2-2). This represents 88% of the cropland within the watershed. Cropland is predominantly a mix of dairy rotations and cash cropping, with most fields in corn, soybeans, small grains or alfalfa.

The number of livestock facilities has decreased from twenty eight sites practicing animal husbandry in 1996 to ten in 2018 (see Figure 2-3). There is one Concentrated Animal Feeding Operation comprised of two sites within the watershed boundaries.

Woodlands

Woodlands throughout the watershed are comprised of both natural systems, as well as tree plantations. There is approximately 5,100 acres of woodlands. Much of the Ahnapee River corridor is made of two predominant types of woodlands; much of the upland types are northern mesic forests composed of maples, hemlock, white pine, beech and yellow birch and lowland forests are made up of swamps dominated by black spruce, tamarack and cedar.

Natural Areas

Acreage that has been placed in the Natural Areas category consists of open space, wetlands, parks, trails and recreational areas. This landscape type constitutes approximately 2,430 acres of the total watershed. Many of these areas are adjacent to stream corridors, as well as agricultural fields.

Developed

Developed areas are comprised of residential areas, commercial, retail, schools and administrative buildings. This equates to approximately 620 acres in the watershed and is spread throughout. The most current information locating sanitary systems for residential development shows 350 active systems and 33 deactivated systems within the watershed (see Figure 2-4). The County-wide Sanitary Survey was completed in 2015; all sanitary systems in the Millpond Watershed have been inspected and brought up to existing code.

Transportation

State and County highways, town roads and village streets make up the transportation category. The transportation network is dispersed throughout the watershed and covers approximately 330 acres.

Industrial

Industrial areas are made up of a variety of land use types, including communication and utility elements, waste processing, manufacturing, electrical substations/transmission and extractive activities. Approximately 150 acres of the watershed consists of industrial type land use.

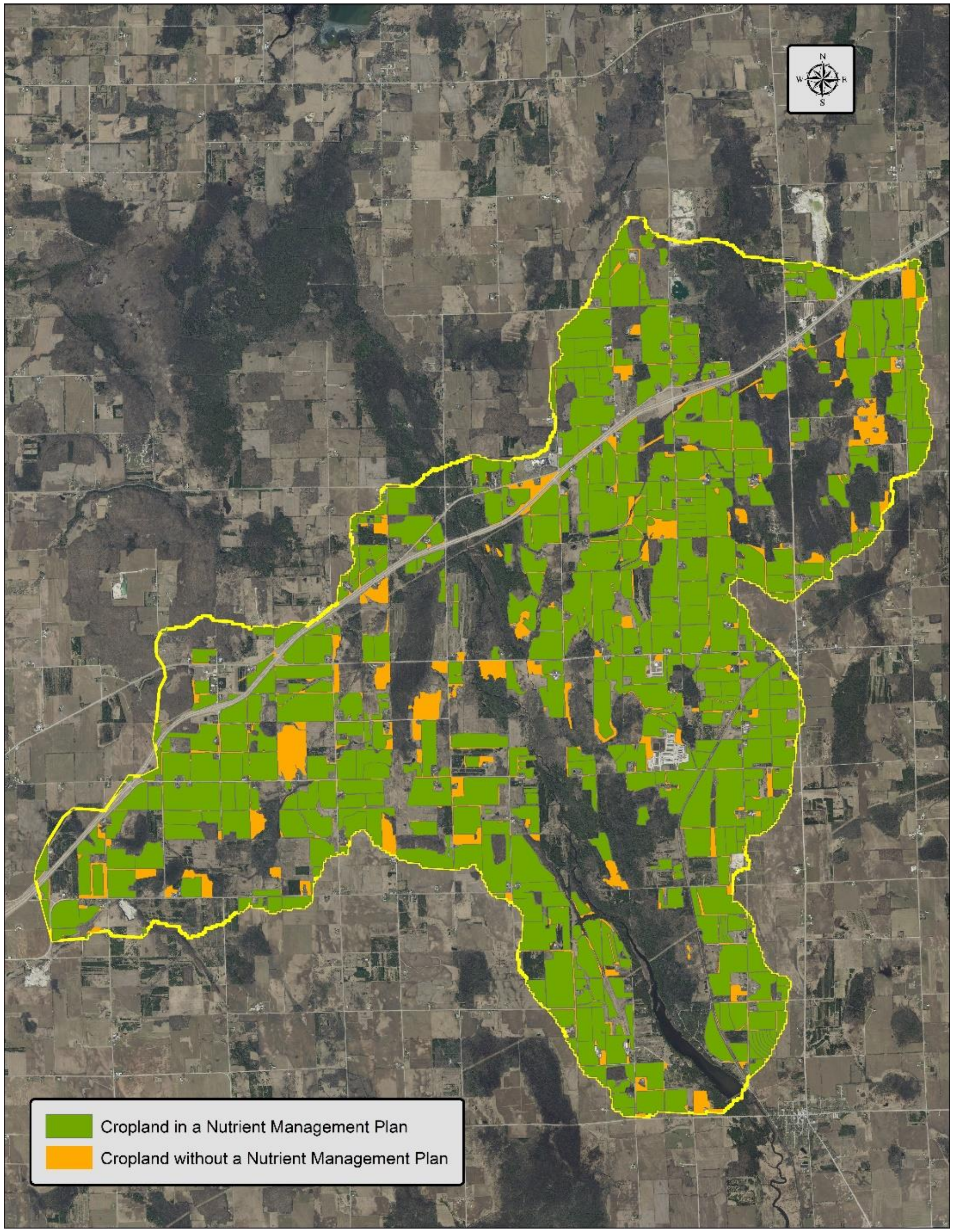

Figure 2-2. Cropland and Nutrient Management Coverage

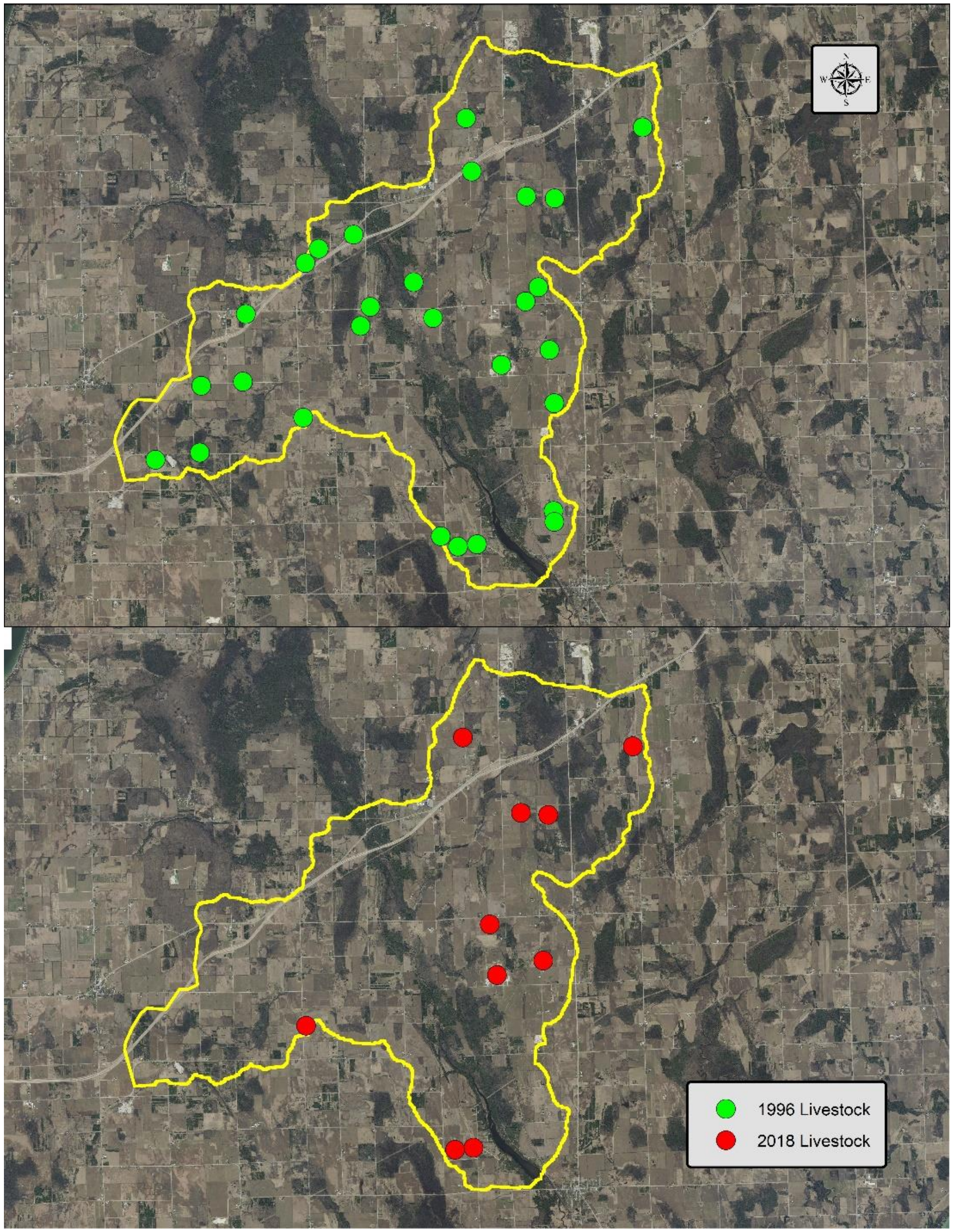

Figure 2-3. Livestock Operations in 1996 and 2018

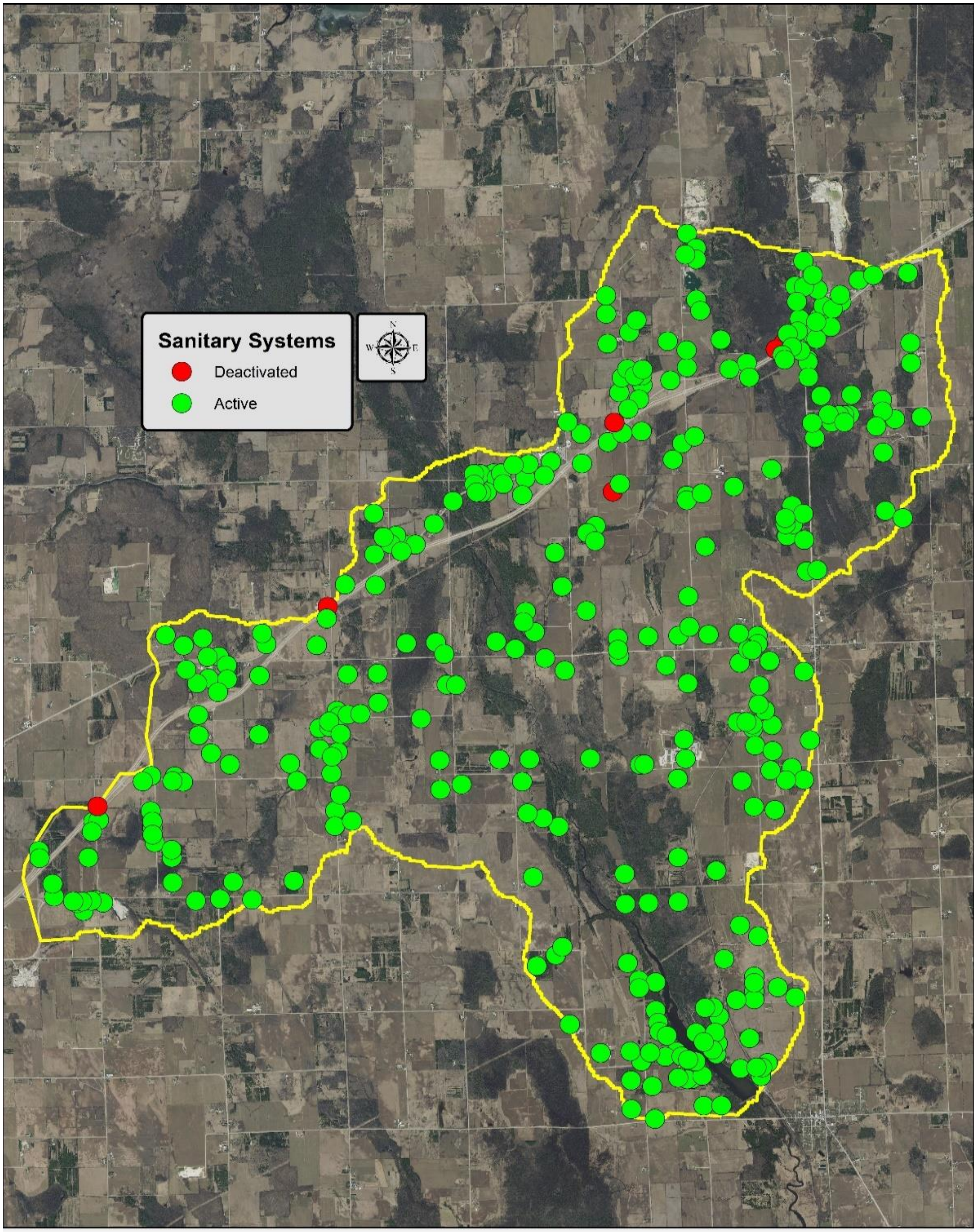

Figure 2-4. Sanitary Systems

3. Model Results

A significant portion of the evaluation of the Millpond is to develop an estimate of nutrient and sediment loading throughout the watershed. To develop this estimate, the SWCD used the model titled Spreadsheet Tool for Estimating Pollutant Load (STEPL), developed for the Environmental Protection Agency to calculate loads from various land uses and the reductions when coupled with best management practices (BMPs).

Inputs for the model were collected through ArcGIS review, as well as field verification of cropland, feedlots and animal numbers. Door County has a very robust GIS data set, making development of necessary data easier. To further refine estimates, the watershed was divided into three smaller subwatersheds: The Upper Ahnapee, Silver Creek and The Millpond (see Figure 3-1).

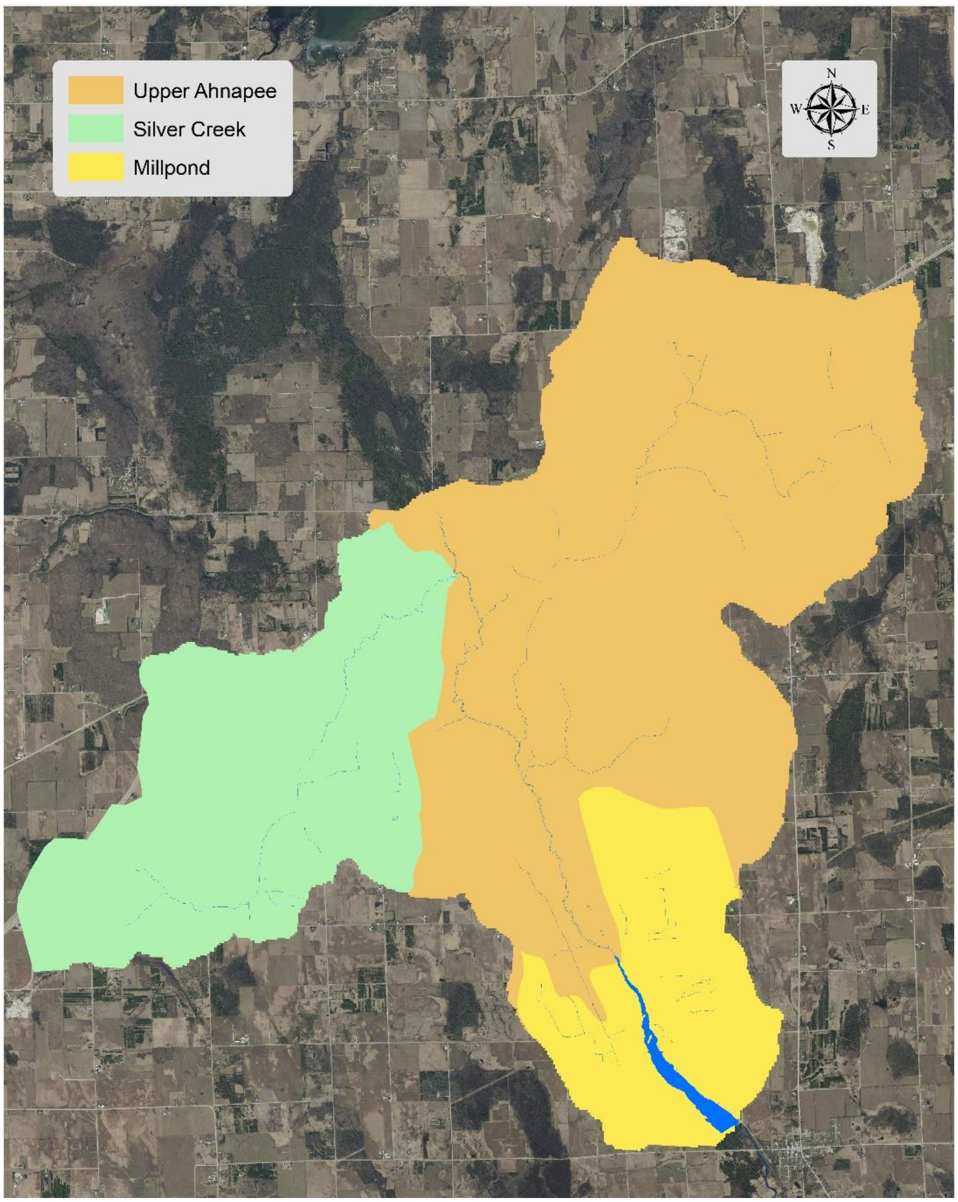

Figure 3-1. Subwatersheds Draining to the Forestville Millpond

Each subwatershed was inventoried for total acreages of urban areas, cropland, pastureland, forests, natural areas and feedlots. Each of the urban areas was broken into individual acreage for commercial, industrial, institutional, transportation, multi-family and single-family. Each of these land use types has an associated nutrient and sediment load, based on values assigned by the model and calculated via the Universal Soil Loss Equation.

Additionally, agricultural inputs are detailed by the number of agricultural animals in each watershed and the number of months that manure is applied to cropland and pastureland. Likewise, information collected by the Door County Sanitarian Department was entered to calculate nutrient contributions from residential sources. The number of septic systems, average population for each system and the average failure rate were factored into the model inputs.

The following tables (see Table 3-1 – Table 3-4) summarize the sum of the inputs to the STEPL model for the Forestville Millpond.

Subwatershed	Urban	Cropland	Pastureland	Forest	Natural Area	Feedlot	Total
Upper Ahnapee	651	5440	44	3035	1176	2	10348
Silver Creek	328	2244	19	1199	989	0	4779
Millpond	135	1177	63	876	266	1	2518

Table 3-1. STEPL Land Use Acres Input by Subwatershed

Subwatershed	**Beef Cattle**	**Dairy Cattle**	**Horse**
Upper Ahnapee	48	4098	36
Silver Creek	20	20	0
Millpond	10	125	0
Total	78	4243	36

Table 3-2. STEPL Agricultural Input by Subwatershed

Subwatershed	**Number of Septic Systems**	**Average Population per Septic System**	**Average Septic Failure Rate (%)**
Upper Ahnapee	193	2.43	2
Silver Creek	93	2.43	2
Millpond	64	2.43	2
Total	350	--	--

Table 3-3. STEPL Septic System Input by Subwatershed

Subwatershed	**Urban Acres**	**Commercial %**	**Industrial %**	**Institutional %**	**Transportation %**	**Multi-Family %**	**Single-Family %**
Upper Ahnapee	651	7	16	9	28	2	38
Silver Creek	328	3	13	1	40	3	40
Millpond	135	1	10	0	16	0	73

Table 3-4. STEPL Urban Land Use Distribution Input by Subwatershed

The output generated by STEPL provides total load values for the following parameters:

Nitrogen – A value representing the amount of nitrogen delivered by watershed land use. As organic materials decompose, they release ammonia, which is in turn oxidized to form both nitrates and nitrites. The primary sources of organic nitrates include human sewage, livestock manure, fertilizers and erosion of natural deposits. Inorganic nitrogen in surface waters is a primary driver of eutrophication.

Phosphorus – A calculation of phosphorus delivery from watershed sources. Phosphorus is an essential nutrient in plants and animals, and is also a common constituent of agricultural fertilizers, manure, and organic wastes in sewage and industrial effluent.

Biochemical Oxygen Demand – A measurement of the amount of dissolved oxygen needed (demanded) by aerobic organisms to break down organic matter in a waterbody. This measurement can be equated to the organic material present in wastewater and a quantification of inputs from runoff from cropland, urban areas, feedlots and failing septic systems.

Sediment – An estimation of the delivery of soil particles from all land uses. Sediment delivery is primarily associated with cropland and equates to higher values of other parameters that impact surface waters including elevated phosphorus (attaches to soil particles), increased turbidity and suspended solids, warmer temperatures and lower dissolved oxygen concentrations.

Many successful years of conservation have been a benefit to the Millpond watershed. All of the significant livestock operations within the three subwatersheds have addressed runoff and waste management concerns at the feedlot and farmstead. Additionally, 88% of the cropland and pastureland throughout the area is included in a nutrient management plan to address manure application at proper rates, locations and timing. These BMPs were used in the model to best reflect current conditions. Results are broken down by subwatershed before and after BMPs. The results also calculate the estimated load reduction from installed BMPs and illustrate the remaining nutrient and sediment loads to be addressed by future conservation work and BMP installation (see Table 3-5). Loads after BMP consideration can be further analyzed by land use (see Table 3-6).

	Without BMPs				With BMPs			
Subwatershed	Nitrogen (lb/year)	Phosphorus (lb/year)	BOD (lb/year)	Sediment (tons/year)	Nitrogen (lb/year)	Phosphorus (lb/year)	BOD (lb/year)	Sediment (tons/year)
Upper Ahnapee	31821.3	9127.4	60135.8	1113.3	26707.1	6444.7	59991.3	1090.7
Silver Creek	14049.3	4104.2	27327.7	562.2	11989.2	3017.3	27224.4	546.0
Millpond	7058.2	2187.7	13227.5	321.3	5889.5	1585.9	13199.9	317.0
Total	52928.8	15419.3	100691.0	1996.7	44585.8	11047.9	100415.5	1953.7

Table 3-5. STEPL Total Load by Subwatershed

Land Use	Nitrogen (lb/year)	Phosphorus (lb/year)	BOD (lb/year)	Sediment (tons/year)
Urban	5962.74	985.11	20540.85	143.97
Cropland	37602.34	9639.24	76660.39	1769.20
Pastureland	244.96	17.87	993.88	0.75
Forest	516.18	285.80	1247.83	26.64
Natural Areas	41.99	34.64	83.98	13.12
Septic	217.62	85.23	888.60	0.00
Total	44585.82	11047.90	100415.54	1953.69

Table 3-6. STEPL Total Load by Land Use

Summary of Results

The output generated by the STEPL model shows that the majority of nutrient and sediment loading is driven by agriculture, more specifically cropland. On review of land use in the watershed, this is not surprising as 50% of the land use throughout the watershed is agriculture-based.

The comparison of total load before and after the application of BMPs creates a strong argument for the need for additional conservation work on the landscape. Currently, 88% of the cropland is being operated under the guidelines of a nutrient management plan. Targeting the remaining acres to attempt full compliance with nutrient management requirements will help to lower input of nutrients and sediment from field sources. Additionally, continued work to address upland field needs with practices such as constructed waterways, reduced tillage and vegetative buffers will further reduce nutrient and sediment loss from agricultural sources.

Nutrient management assumes that concentrated flow channels in fields are protected in permanent vegetation to reduce soil loss. Door County SWCD staff have observed that this does not always occur, or existing vegetative waterways are poorly maintained. Staff are actively working with landowners and operators to address these concerns. Another important item to note is that the STEPL model address a significant portion of the sediment delivery in the calculations for phosphorus delivery, as phosphorus attaches to soil particles and they share the same delivery mechanism. A comprehensive analysis of all applied BMPS is necessary to accurately portray the true estimates of sediment delivery.

Next steps in the watershed, regardless of management decisions for the Millpond, will be to further analyze data above and below the dam to develop a 9-Key Element plan for the Upper Ahnapee River in Door County and compliment efforts in the lower portions of the watershed in Kewaunee County. Future efforts will also be benefited by breaking down subwatersheds even further into smaller hydrologic units. This refinement will help to target efforts and future resources to prioritized areas that display elevated loading levels. Future iterations of the model process will include the application of additional best management practices at livestock sites and on cropland.

4. Bathymetry

One of the ongoing concerns, and observations, of the Forestville Millpond is the loss of capacity due to accumulated sediments. In addition to concerns of the water depth, accumulated sediments can impact lake clarity, water quality and the overall health of the ecosystem.

Bathymetry is the study of the "bed" or "floor" of a waterbody, this can include everything from rivers and streams to lakes to oceans. A bathymetric study maps the depth of the waterbody relative to the water surface, and is compiled in a topographic map that represents the bottom of the waterbody.

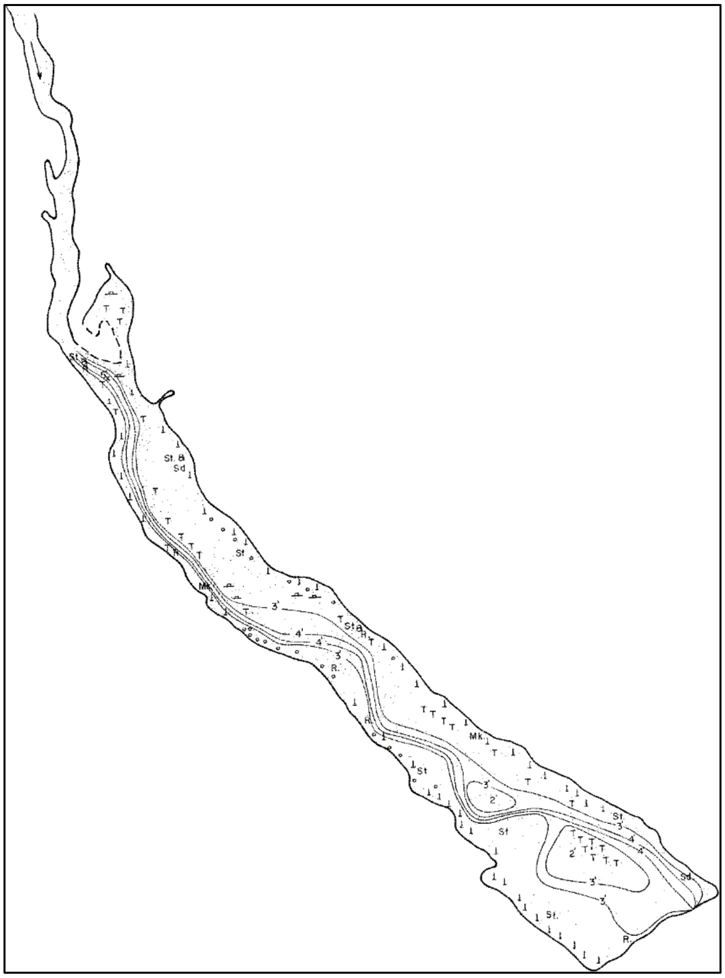

Figure 4-1. 1974 Bathymetric Map – Wisconsin DNR

The last complete bathymetric survey of the Forestville Millpond was conducted in 1974 (see Figure 4-1).

An important element of this project was to make a determination of the amount of accumulated sediment since the 1974 survey.

Data was collected by SWCD staff on July 25, 2017. Survey points were collected on the shoreline to establish the existing benchmark elevation, as well as the surface elevation of the water on that date. Survey points were collected using a Carlson Surveyor+ data collector, outfitted with Novatel GPS-702-GGL antennae. Coordinates were collected in Wisconsin State Plane – Central NAD 83(91) US foot horizontal datum and NAVD88 vertical datum.

A boat was used to traverse the surface of the Millpond, and 566 points were recorded with coordinates and depth taken at each point (see Figure 4-2). Horizontal coordinates were captured and recorded in the Carlson data collector. Depth to the subsurface was collected through sonar readings at each position. Equipment used for sonar readings was an Eagle Supra ID marine sonar locator. Calibration was made using a survey rod with a plate attached to the bottom (see Figure 4-3). Measurements were made and adjustments for the location of the transducer position relative to the boat were factored in. All depth measurements were based on a surface water elevation of 592.4.

A raster map was developed from the collected points, in which elevations were plotted and interpolated in between collected points. This map illustrates an approximation of the bottom of the Millpond (see Figure 4-4).

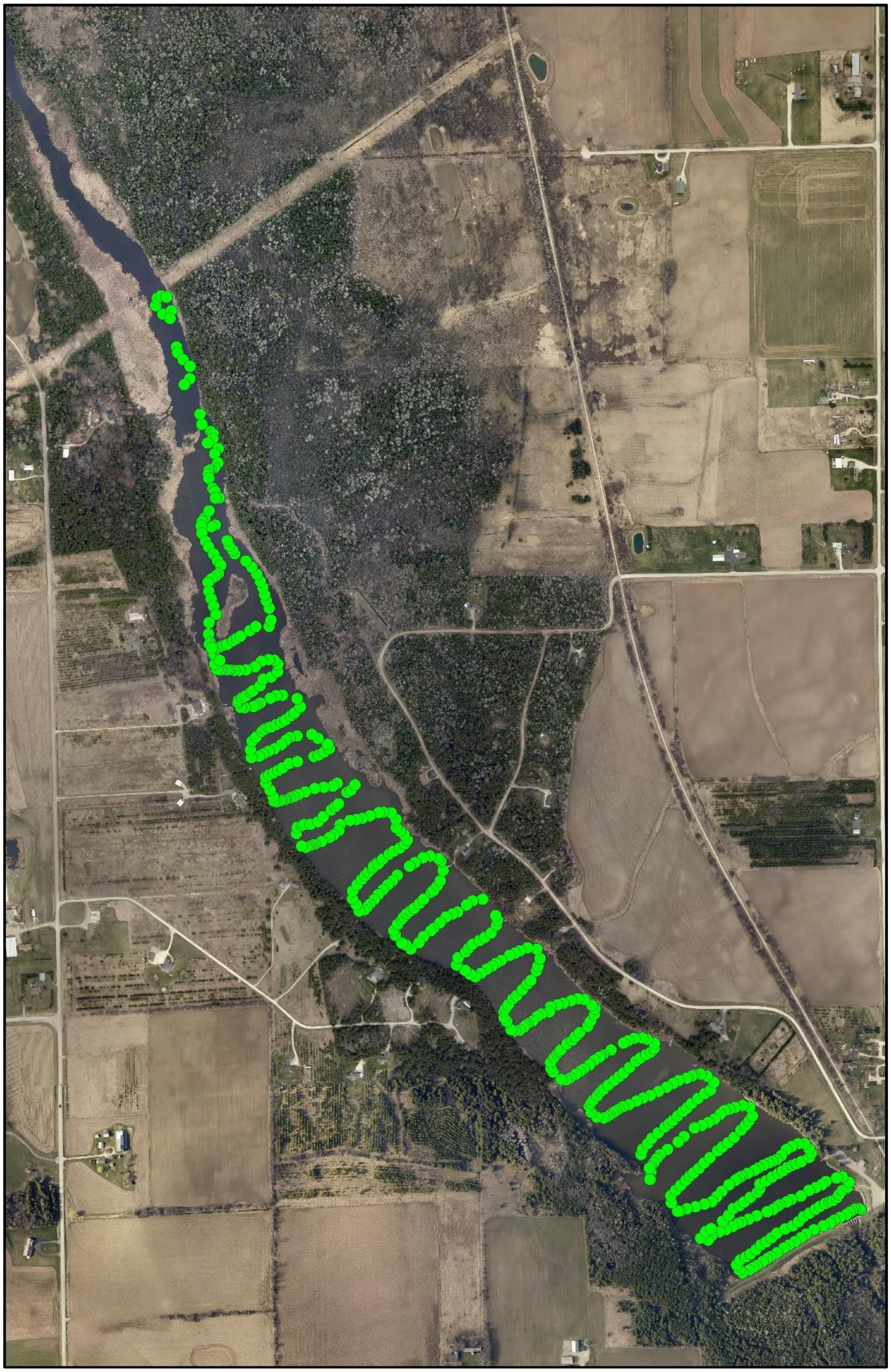

Figure 4-2. July 25, 2017 Transect Points

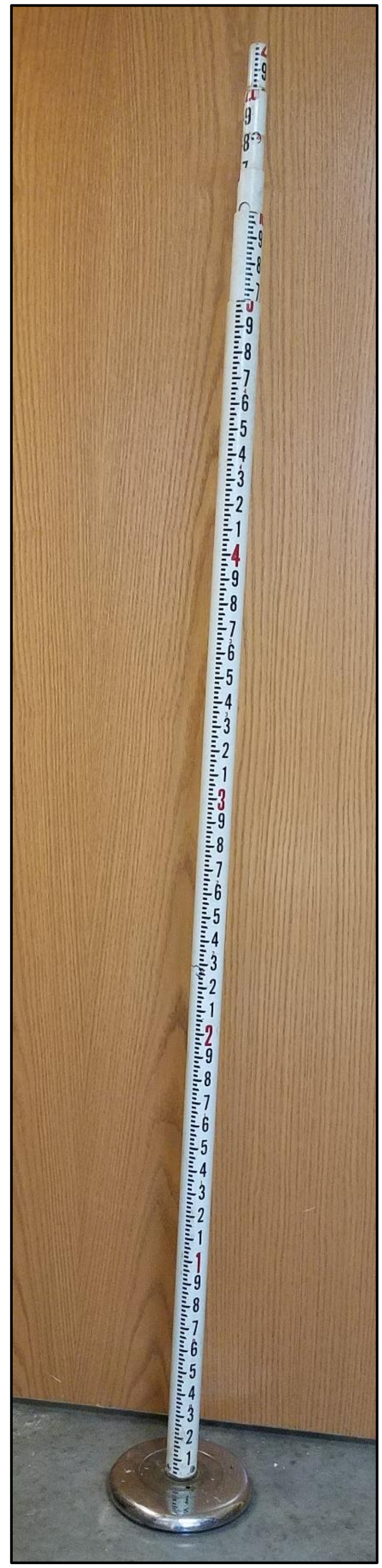

Figure 4-3. Survey Rod with Plate

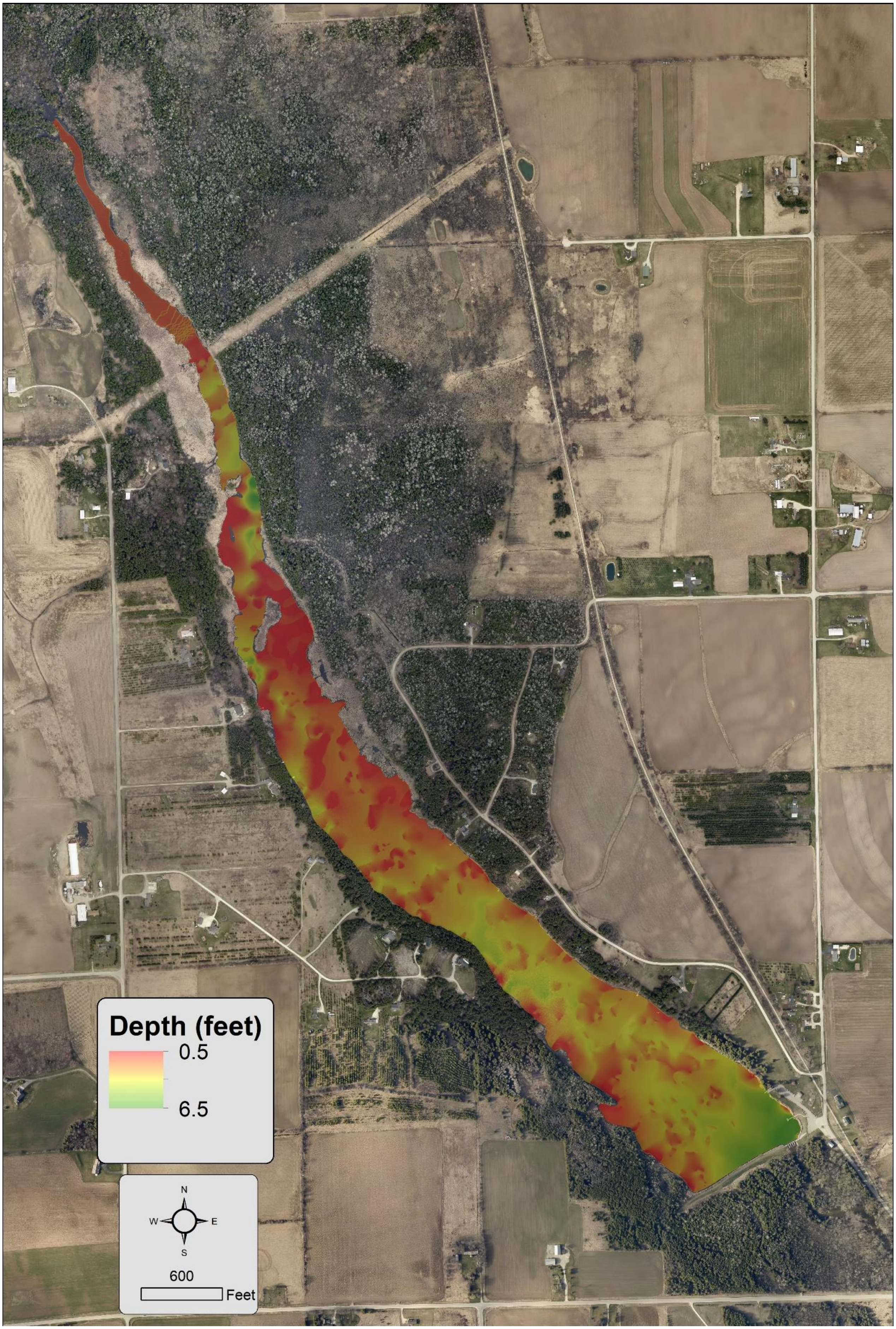

Figure 4-4. Millpond Depth

The key elements of the Millpond subsurface were generated and determined through the above mentioned rasterization process (see Table 4-1). These characteristics are essential for calculations of capacity and how it has changed over time.

Survey Year	2017	1974
Water Surface Area	94 Acres	65 Acres
Under 3 Feet	92%	73%
Maximum Depth	6.1 Feet	5
Minimum Depth	0.6 Feet	--
Average Depth	2.9 Feet	--
Shoreline	4.3 Miles	2.34
Volume	229 Acre-Feet	137 Acre-Feet

Table 4-1. Bathymetry Characteristics

Comparison to the 1974 bathymetric results is difficult; the area surveyed and methodology is different and problematic to reproduce. With that said, it is still useful to look at both sets of data to make a determination of sediment deposition within the millpond over the last few decades.

A review of other millponds and flowages across the state is useful in that it provides context on the ratio of waterbody sizes to volume. While these are all impoundments, comparison should be made with caution; each site has a unique set of characteristics and identical comparisons are not possible. With that said, it is still useful to look at a range of characteristics of impounded waterbodies (see Table 4-2).

Baron Flowage #1	52	12	31	240
Eau Claire River Flowage	56	22	21	461
Apple Falls Flowage	62	40	12	485
Baron Flowage #3	62	10	33	276
Coon Fork Flowage	62	20	25	563
Lower Park Falls Flowage	62	16	3	571
Dells Millpond	66	16	32	409
Teal River Flowage	66	9	56	239
Riverdale Flowage	68	20	30	468
Black Brook Flowage	69	23	28	727
Billy Boy Flowage	71	7	58	204
Rockville Flowage	76	6	9	198
Wyocena Millpond	96	12	31	309

A review of 86 millponds and flowages produced 13 with surface areas that fall between 50 – 100 acres and presents a diverse range of depth and volume. An interesting item to note is the relationship between depth, volume and the percentage of the waterbody with less than three feet of depth; few waterbodies in the review had greater than 50% less than three feet.

Summary of Results

While the direct comparison of historic bathymetric data to current is not possible, it is still helpful to make a general comparison to look at available capacity. In general terms, the numbers seem to suggest continued sedimentation in the Forestville Millpond.

When compared to other waterbodies of similar surface area, the telling statistics are that the Forestville Millpond has a relatively small capacity, and the maximum depth, average depth and percent of the total waterbody appear to be factors that heavily influence the total capacity.

Reduction of sediment inputs, coupled with a series of drawdowns and/or dredging will greatly increase the available capacity of the millpond.

5. Water Chemistry

Upstream Locations

Four sites were identified for sampling the Ahnapee River system upstream from the Millpond (see Figure 5-1). Sampling was done twice a month, from May through October at the following locations: Station #153161 is located at the County H crossing of the Ahnapee River; Station #10047671 is also located at County H, as it crosses an unnamed tributary; Station #10047672 is located on the main branch of the Ahnapee River, upstream of the confluence with an unnamed tributary flowing from the east; and, Station #10047673 is also located on the Ahnapee River, downstream of the confluence with the same tributary. Stations #10047672 and #10047673 are both located on private property.

Water chemistry samples were collected by the University of Wisconsin – Oshkosh, Environmental Research and Innovation Center students and staff, according to accepted protocols. Collected samples were analyzed at the State of Wisconsin Lab of Hygiene. Samples collected at the upstream locations were analyzed for the following:

- Suspended Solids
- Total Phosphorus
- Temperature
- Dissolved Oxygen
- pH

Millpond Location

Water chemistry samples from the Millpond were collected at one location, once a month, from June through August. Station #153160 is located in the southeast end of the Millpond, just upstream of the dam spillways (see Figure 5-2).

Water chemistry samples in the Millpond were also collected by the University of Wisconsin – Oshkosh, Environmental Research and Innovation Center students and staff, according to accepted protocols. Collected samples were analyzed at the State of Wisconsin Lab of Hygiene. Samples collected at the Millpond location were analyzed for the following:

- Suspended Solids
- Total Phosphorus
- Chlorophyll A
- Nitrate + Nitrite
- Total Nitrogen
- Temperature
- Dissolved Oxygen
- pH

The following sections will summarize the results, as well as detail specific parameters used to make conclusions of the health of the Forestville Millpond.

Figure 5-1. Upstream Sample Locations.

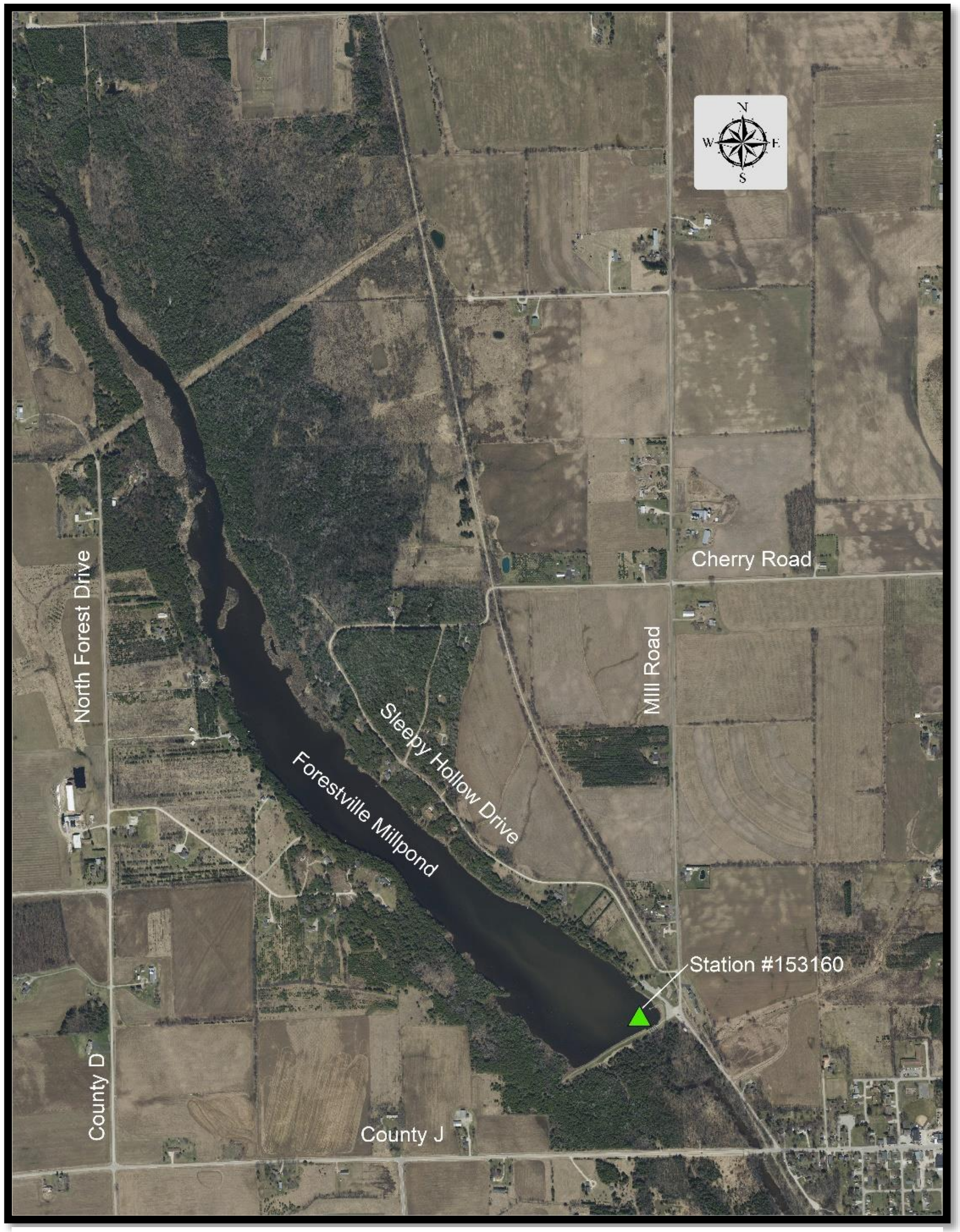

Figure 5-2. Millpond Sample Location.

Results

Station #153161 – Ahnapee River at County H											
Date Sampled	5/15/17	5/30/17	6/12/17	7/17/17	7/31/17	8/22/17	8/30/17	9/16/17	9/30/17	10/15/17	10/28/17
Suspended Solids (mg/L)	No Detect	4.67	7.25	8.0	11.3	12.0	10.2	4.4	2.6	7.0	3.6
Total Phosphorus (mg/L)	0.0204	0.0590	0.107	0.097	0.120	0.108	0.0904	0.023	0.0258	0.0576	0.0423
Temperature (°C)	12.8	17.6	20.7	17.6	19.95	20.02	--	17.64	10.81	11.4	7.45
Air Temperature (°C)	14	14	21	16	22	20	19	29	11	11	4
Dissolved Oxygen (mg/L)	10.3	7.2	5.5	5.4	5.94	2.88	--	10.09	10.17	9.5	3.9
pH	8.4	7.8	8.3	6.6	7.87	7.79	--	6.8	6.43	5.9	7.96

Station #10047671 – Unnamed Tributary											
Date Sampled	5/15/17	5/30/17	6/12/17	7/17/17	7/31/17	8/22/17	8/30/17	9/16/17	9/30/17	10/15/17	10/28/17
Suspended Solids (mg/L)	No Detect	2.50	4.25	2.50	No Detect	4.0	7.2	11.3	12.5	7.75	6.0
Total Phosphorus (mg/L)	0.0368	0.0360	0.0412	0.052	0.0196	0.0258	0.0333	0.165	0.334	0.13	0.0456
Temperature (°C)	14.4	16.0	18.1	16.1	22.57	16.55	--	18.19	14.46	12.2	7.0
Air Temperature (°C)	14	14	21	16	22	20	19	29	11	11	4
Dissolved Oxygen (mg/L)	8.8	9.0	8.7	6.13	3.37	4.14	--	3.79	1.78	8.0	4.1
pH	8.5	8.3	8.3	7.4	7.13	7.92	--	6.17	6.18	6.2	8.02

Station #10047672 – John May 80M											
Date Sampled	5/15/17	5/30/17	6/12/17	7/17/17	7/31/17	8/22/17	8/30/17	9/16/17	9/30/17	10/15/17	10/28/17
Suspended Solids (mg/L)	4.75	3.25	5.50	3.60	3.0	5.6	2.6	2.4	No Detect	14.8	No Detect
Total Phosphorus (mg/L)	0.0286	0.0431	0.0614	0.066	0.0327	0.0392	0.0227	0.018	0.0201	0.261	0.0419
Temperature (°C)	11.4	16.5	20.2	17.7	22.91	18.91	--	20.21	12.4	11.9	6.98
Air Temperature (°C)	14	14	21	16	22	20	19	19	11	11	4
Dissolved Oxygen (mg/L)	8.7	8.8	7.9	5.6	5.82	3.8	--	9.98	10.52	8.2	4.0
pH	8.4	8.6	8.3	7.7	8.28	8.06	--	7.16	8.07	6.9	7.96

Station #10047673 – John May 50M											
Date Sampled	5/15/17	5/30/17	6/12/17	7/17/17	7/31/17	8/22/17	8/30/17	9/16/17	9/30/17	10/15/17	10/28/17
Suspended Solids (mg/L)	No Detect	3.50	6.75	3.00	2.8	7.8	2.8	No Detect	No Detect	9.0	2.0
Total Phosphorus (mg/L)	0.0290	0.0454	0.0652	0.081	0.0369	0.0568	0.0270	0.0181	0.02	0.0793	0.0376
Temperature (°C)	11.6	16.6	20.2	17.4	22.67	18.93	--	20.35	12.09	11.9	6.99
Air Temperature (°C)	14	14	21	16	22	20	19	29	11	11	4
Dissolved Oxygen (mg/L)	8.9	9.2	7.8	5.4	5.5	3.62	--	10.14	10.47	9.4	1.3
pH	8.4	8.7	8.5	7.6	8.16	8.04	--	6.98	6.81	5.9	8.02

Station #153160 – Forestville Millpond Above Dam – 1-foot Depth			
Date Sampled	7/17/17	8/22/17	9/16/17
Suspended Solids (mg/L)	22.0	22.5	5.8
Total Phosphorus (mg/L)	0.136	0.0851	0.0355
Temperature (°C)	25.43	23.95	23.78
Air Temperature (°C)	16	20	29
Dissolved Oxygen (mg/L)	6.23	3.2	10.48
pH	8.11	8.29	6.66
Chlorophyll A - µg/L	59	41.7	5.1
Nitrate + Nitrite - mg/L	0.909	0.815	2.0
Total Nitrogen- mg/L	2.36	2.32	1.31

Station #153160 – Forestville Millpond Above Dam – 3-foot Depth			
Date Sampled	7/17/17	8/22/17	9/16/17
Suspended Solids (mg/L)	--	--	7.6
Total Phosphorus (mg/L)	--	--	0.0348
Temperature (°C)	21.98	23.79	23.58
Air Temperature (°C)	16	20	29
Dissolved Oxygen (mg/L)	4.42	3.29	10.39
pH	7.82	8.39	7.63
Chlorophyll A - µg/L	--	--	6.44
Nitrate + Nitrite - mg/L	--	--	2.04
Total Nitrogen- mg/L	--	--	1.22

Station #153160 – Forestville Millpond Above Dam – 5-foot Depth			
Date Sampled	7/17/17	8/22/17	9/16/17
Suspended Solids (mg/L)	--	--	--
Total Phosphorus (mg/L)	--	--	--
Temperature (°C)	21.66	23.76	23.0
Air Temperature (°C)	16	20	29
Dissolved Oxygen (mg/L)	3.93	3.43	10.82
pH	7.72	8.42	8.05
Chlorophyll A - µg/L	--	--	--
Nitrate + Nitrite - mg/L	--	--	--
Total Nitrogen- mg/L	--	--	--

Total Suspended Solids

Total Suspended Solids (TSS) occur from a number of materials including silt, decaying plant and animal matter, industrial waste and sewage. These can be from a variety of sources including excess soil erosion, wastewater discharge, snowmelt and stormwater runoff.

High TSS concentrations can impact aquatic life in a number of ways, one of the most prevalent being the blocking of sunlight from reaching submerged vegetation, resulting in reduced rates of photosynthesis. As photosynthesis is reduced, plants release less dissolved oxygen into the water. Light that is completely blocked can led to death of aquatic vegetation and subsequent decomposition, using available oxygen. Each of these situations leads to low dissolved oxygen and potential fish kills. Elevated TSS can also lead to decreased water quality and impact the ability of fish to see and catch prey. Suspended sediment can also clog fish gills, reduce growth rates, decrease resistance to disease, and prevent egg and larval development.

There is not a specified threshold to evaluate TSS. As a general guide, permits issued to wastewater treatment plants outline a maximum of 20 mg/L as a monthly average and 30 mg/L as a weekly average. TSS concentrations in the upstream sample sites did not exceed 13 mg/L, and five of the forty-four samples taken throughout the season exceeded 10 mg/L. Of four samples taken within the Millpond, the July and August samples, taken at a depth of one foot, exceeded 20 mg/L.

Total Phosphorus

Phosphorus is an essential nutrient in plants and animals, and is also a common constituent of agricultural fertilizers, manure, and organic wastes in sewage and industrial effluent. Phosphorus exists in water in either a particulate phase or a dissolved phase. Particulate matter includes living and dead plankton, precipitates of phosphorus, phosphorus adsorbed to particulates, and amorphous phosphorus. The dissolved phase includes inorganic phosphorus and organic phosphorus. Total phosphorus (TP) is a measure of all the forms of phosphorus, dissolved or particulate, that are found in a sample.

A disproportionate level of Phosphorus in waterbodies is the major nutrient contributor to excessive aquatic plant growth, including algae blooms. Eutrophication is a natural process that results from accumulation of nutrients in lakes or other water bodies, but it is often accelerated by human activities that increase the rate and the amount of nutrients entering the water body. If excessive amounts of nutrients are added to a water body, algae and aquatic plants can grow in large quantities. When these plants die, they are decomposed by bacteria, which use dissolved oxygen. Dissolved oxygen concentrations can drop too low for fish to breathe, leading to fish kills. Excessive amounts of algae grow into scum on the water surface, decreasing recreational value and clogging water-intake pipes. Rapid decomposition of dense algae scums with associated organisms can give rise to foul odors.

The State of Wisconsin has established the maximum threshold for Phosphorus levels in surface waters throughout the state. As outlined in NR 102.06(3)(b), the maximum threshold criterion for total phosphorus in the Ahnapee River is 75 micrograms per liter (µg/L) or .075 milligrams per liter (mg/L). As outlined in NR 102 (4)(b)3, the maximum threshold criterion for the Forestville Millpond is 40 micrograms per liter (µg/L) or .040 milligrams per liter (mg/L). Algal blooms in surface waters are likely to occur at phosphorus levels greater that 20 micrograms per liter (µg/L) or 0.020 milligrams per liter (mg/L). Nearly all of the samples taken in the upstream locations (#'s 153161, 10047671, 10047672 and 10047673)revealed levels that exceeded 0.020 mg/L and eleven of the forty-four samples exceeded the 0.075 mg/L stream threshold (see Chart 5-1). All of the samples taken in the Millpond (#153160) revealed levels in exceedance of 0.020 mg/L and two of the three samples exceeded the 0.040 mg/L threshold designated for waterbodies similar to The Forestville Millpond (see Chart 5-2).

The Lower Ahnapee River, below the Forestville Dam, has been listed as a 303(d) Impaired Water, due to excessive Total Phosphorus concentrations. The link to this designation and the condition of the Millpond and Upper Ahnapee watersheds is clear upon review of Total Phosphorus concentrations in this study.

Temperature

The measurement of temperature provides an indicator of specific conditions at the time of sampling, as well as potential levels of thermal pollution. Thermal pollution can be described as the human-induced change in the temperature of lakes, rivers and other surface waters to the point that it could adversely affect fish and other aquatic wildlife. Elevated water temperatures can reduce the reproductive success of fish and other aquatic wildlife, can contribute to degradation of habitat and in extreme cases can lead to fish kills.

The acute temperature criteria has been established for each month by water type. The Ahnapee River is considered a small, warm-water fishery. The acceptable temperature threshold for the Ahnapee ranges from 80°F - 85°F throughout the field season; all of the samples were well below the acute temperature criteria (see Chart 5-3). Temperatures in the Millpond fell within 71°F – 77.8°F (see Chart 5-4).

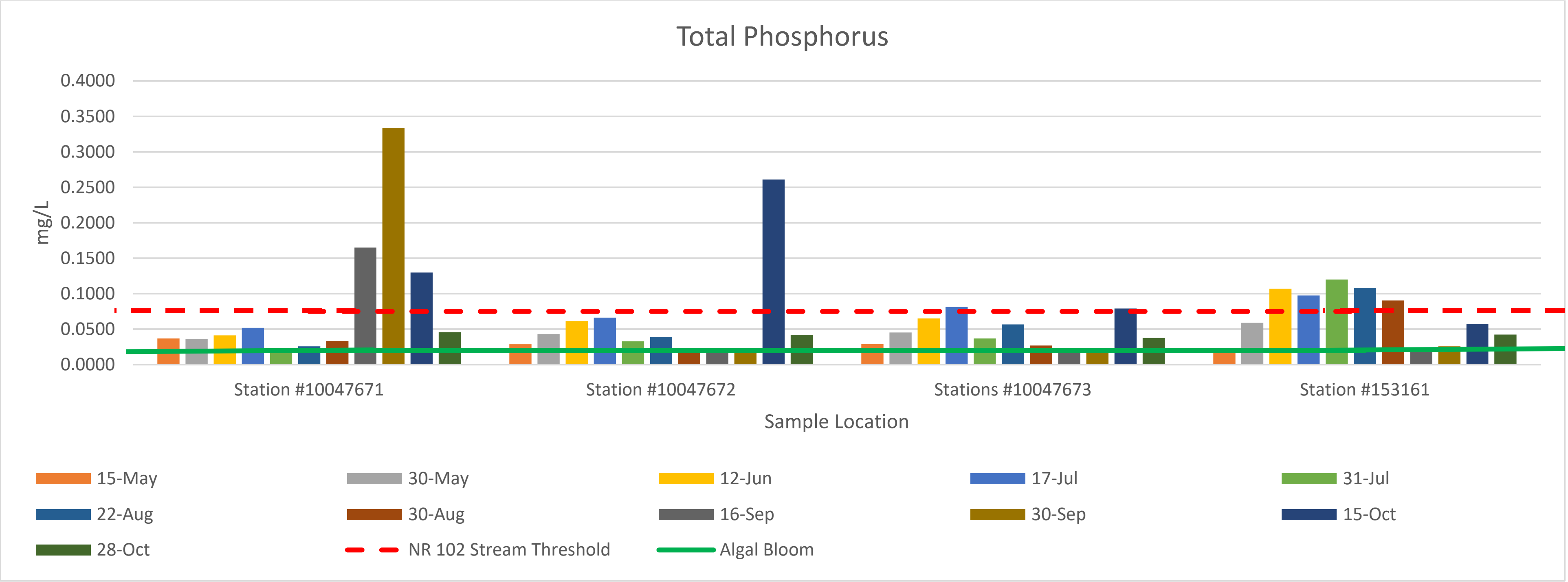

Chart 5-1. Total Phosphorus at Upstream Sites.

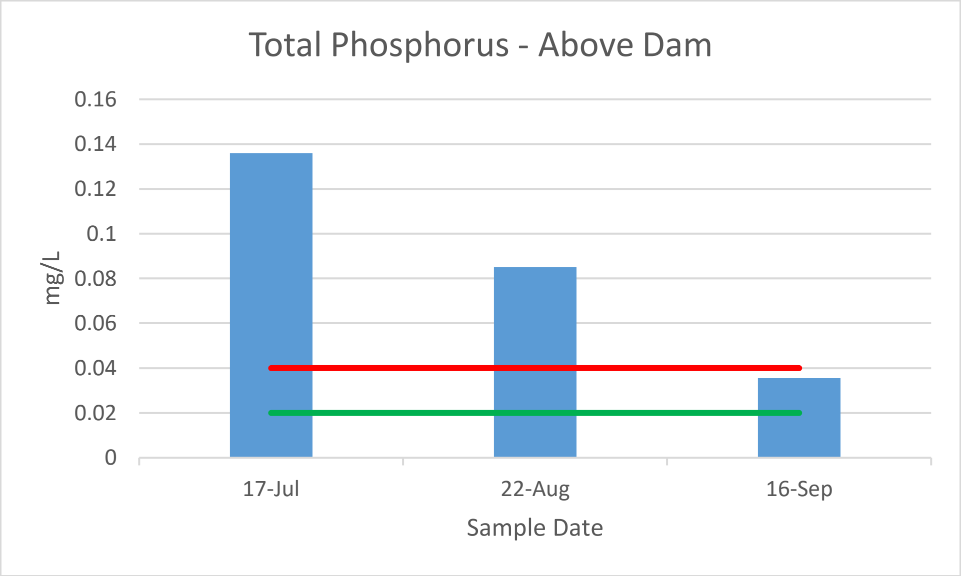

Chart 5-2. Total Phosphorus at Millpond Site.

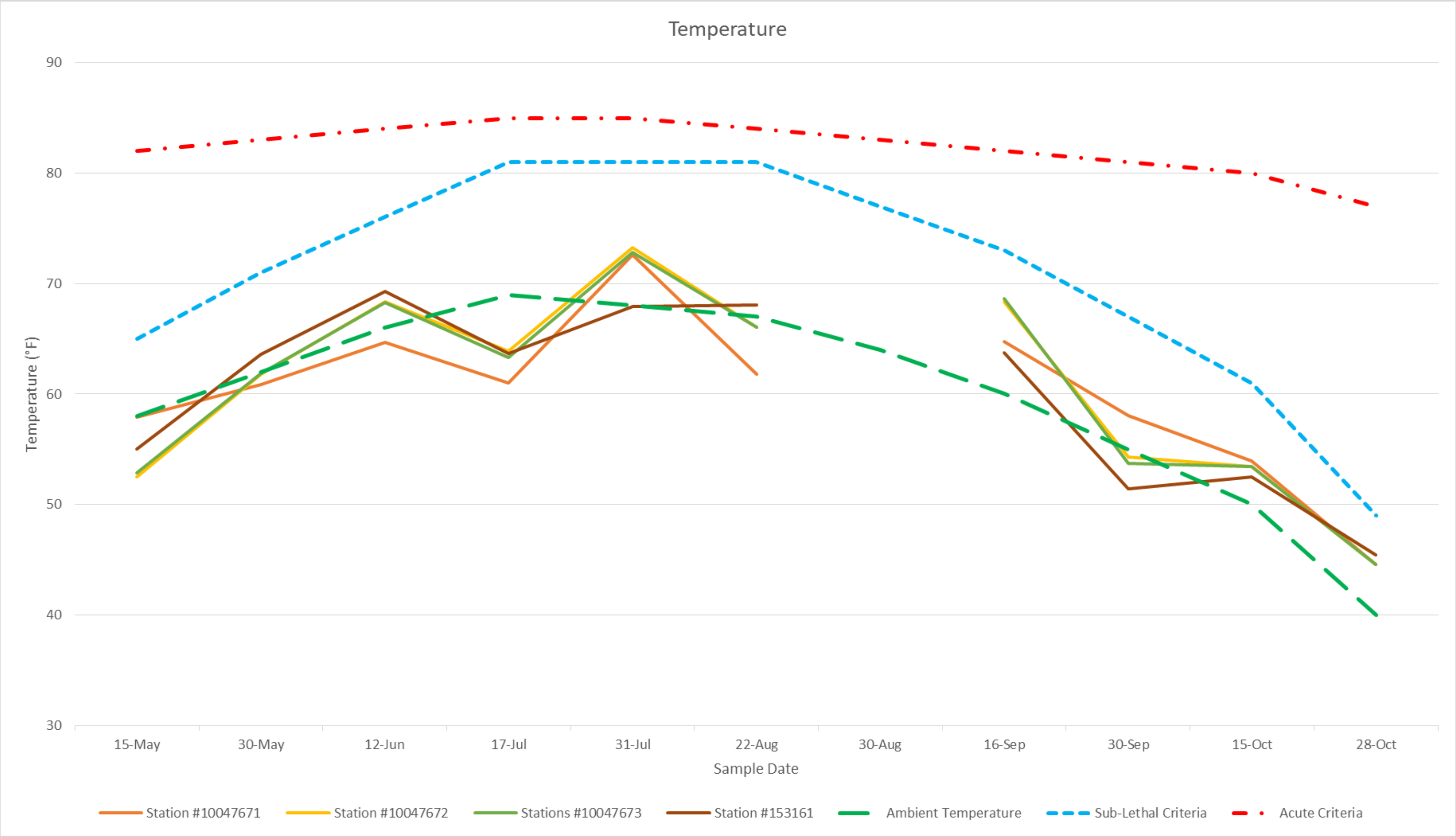

Chart 5-3. Temperature at Upstream Sites

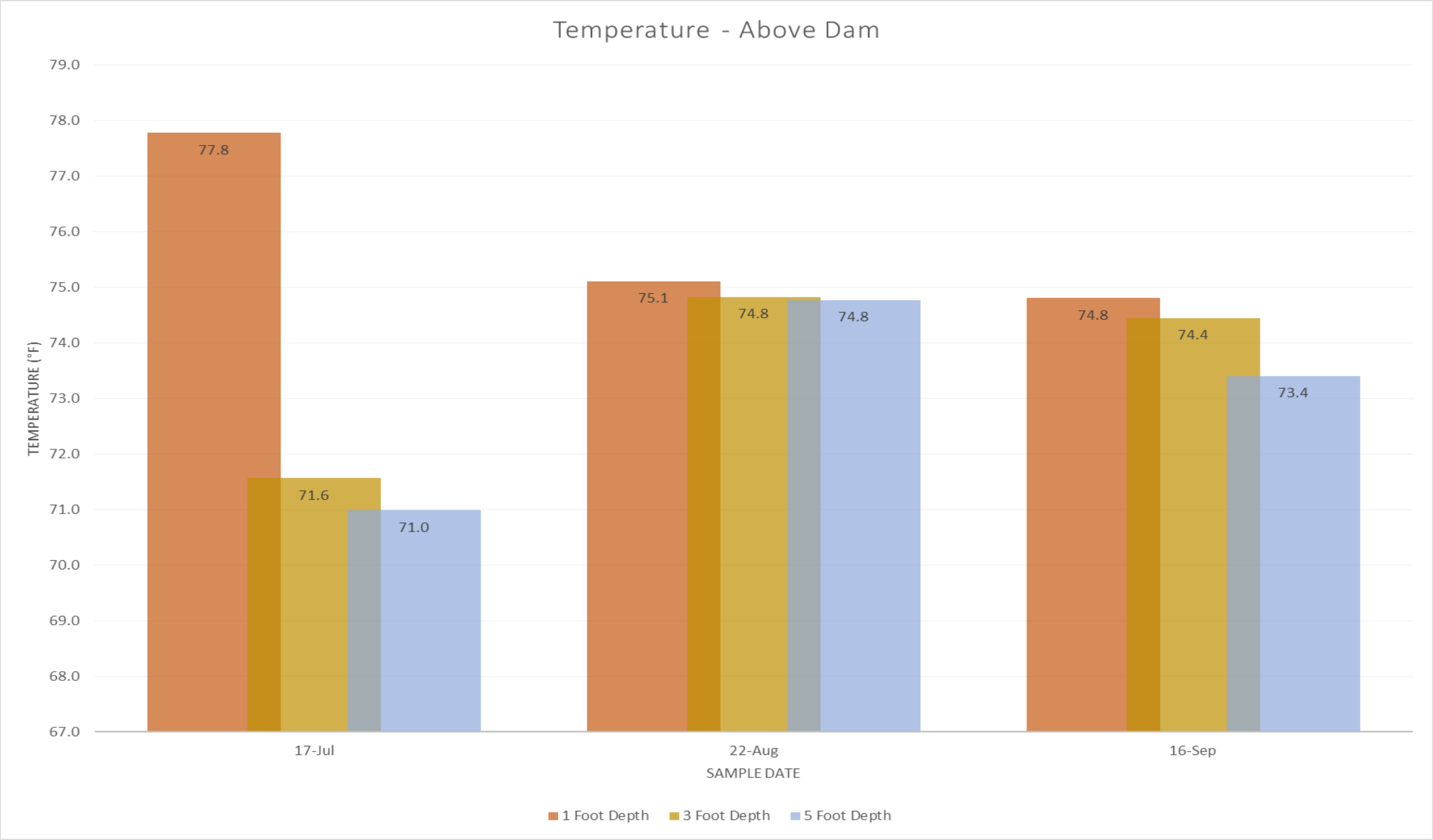

Chart 5-4. Temperature above the Dam

Dissolved Oxygen

Dissolved oxygen is the amount of gaseous oxygen that is dissolved in the water; this is a result of direct absorption from the atmosphere, aeration through rapid movement or a byproduct of photosynthesis by aquatic plants. The amount of dissolved oxygen in a waterbody represents the amount of oxygen available to aquatic organisms including, fish, invertebrates and bacteria; anything that lives in the water and requires oxygen to respire, relies on dissolved oxygen. As the concentration of dissolved oxygen in a waterbody drops, it will result in changes in the types and amounts of aquatic organisms that can survive there. The measurement of dissolved oxygen is one of the most significant parameters to measure to determine the suitability of a waterbody for fish and other aquatic life.

Oxygen is removed from the water through chemical reactions that occur during the decay process and respiration of aquatic organisms. Temperature of the water, atmospheric pressure, light penetration and water turbulence can all impact the concentration of dissolved oxygen in a waterbody. Dissolved oxygen levels can be drastically reduced by the introduction of excessive amounts of organic matter such as sewage, manure or decaying plant matter. Introduction of warm water, excess nutrients and erosion from cropland and urban sources can also drastically impact dissolved oxygen concentrations.

The State of Wisconsin has established the minimum concentration of dissolved oxygen content to support fish and aquatic life to be 5 milligrams per liter (mg/L). Dissolved oxygen concentrations in the upstream sampling locations each dropped below the 5 mg/L threshold at times throughout the sampling season (see Chart 5-5). Concentrations measured in the Millpond were below the 5 mg/L threshold at various depths in the July sample, all depths in the August sample and all depths were above 5 mg/L in September (see Chart 5-6).

pH

From a chemistry perspective, pH is the measurement of the intensity of the acidity of a solution. Acids are defined as those compounds that release a hydrogen atom, and bases are those compounds that accept protons; pH is a measure of hydrogen ion activity. Both surface and groundwater have naturally occurring ranges of pH. Changes in the pH of a waterbody can have drastic effects on aquatic life (see Table 5-1). Most organisms have adapted to a specific pH and even slight changes can have significant consequences, this is especially true of aquatic macroinvertebrates and fish eggs and fry.

Several factors affect pH in surface waters. One of the most important is the bedrock and composition of the soil through which the water moves. Additionally, pH can be influenced by the amount of plant growth and organic material that exists in the waterbody; as this material decomposes, carbon dioxide is released, resulting in a weak carbonic acid due to the interaction with the water. Another factor that affects the pH of a waterbody is the introduction of chemicals and minerals from human activity. This can be in the forms of discharge, runoff, and atmospheric depositions.

pH values that have been established for fish and aquatic life fall between 6.0 and 9.0, with no greater than a change greater than 0.5 outside the estimated natural seasonal maximum and minimum. The recorded pH for all of the upstream sites and the Millpond sampling site fell between 6.2 and 8.4.

Water pH	Effects
6.5	Walleye spawning inhibited
5.8	Lake trout spawning inhibited
5.5	Smallmouth bass disappear
5.2	Walleye, burbot, lake trout disappear
5.0	Spawning inhibited in many fish
4.7	Northern pike, white sucker, brown bullhead, pumpkinseed, sunfish and rock bass disappear
4.5	Perch spawning inhibited
3.5	Perch disappear
3.0	Toxic to all fish

Table 5-1. Impact of Acidity on Fish Species

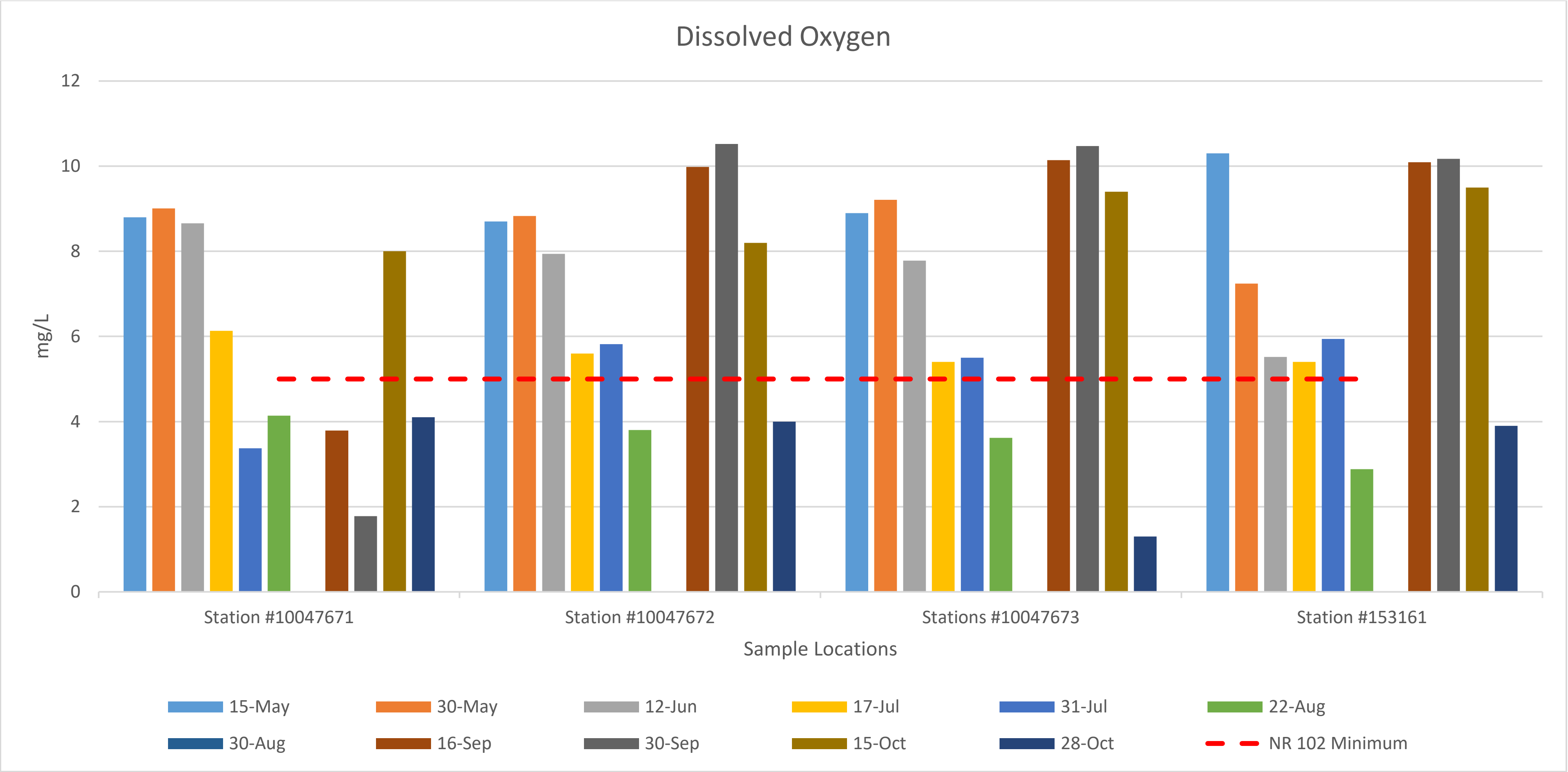

Chart 5-5. Dissolved Oxygen Concentrations in Upstream Samples

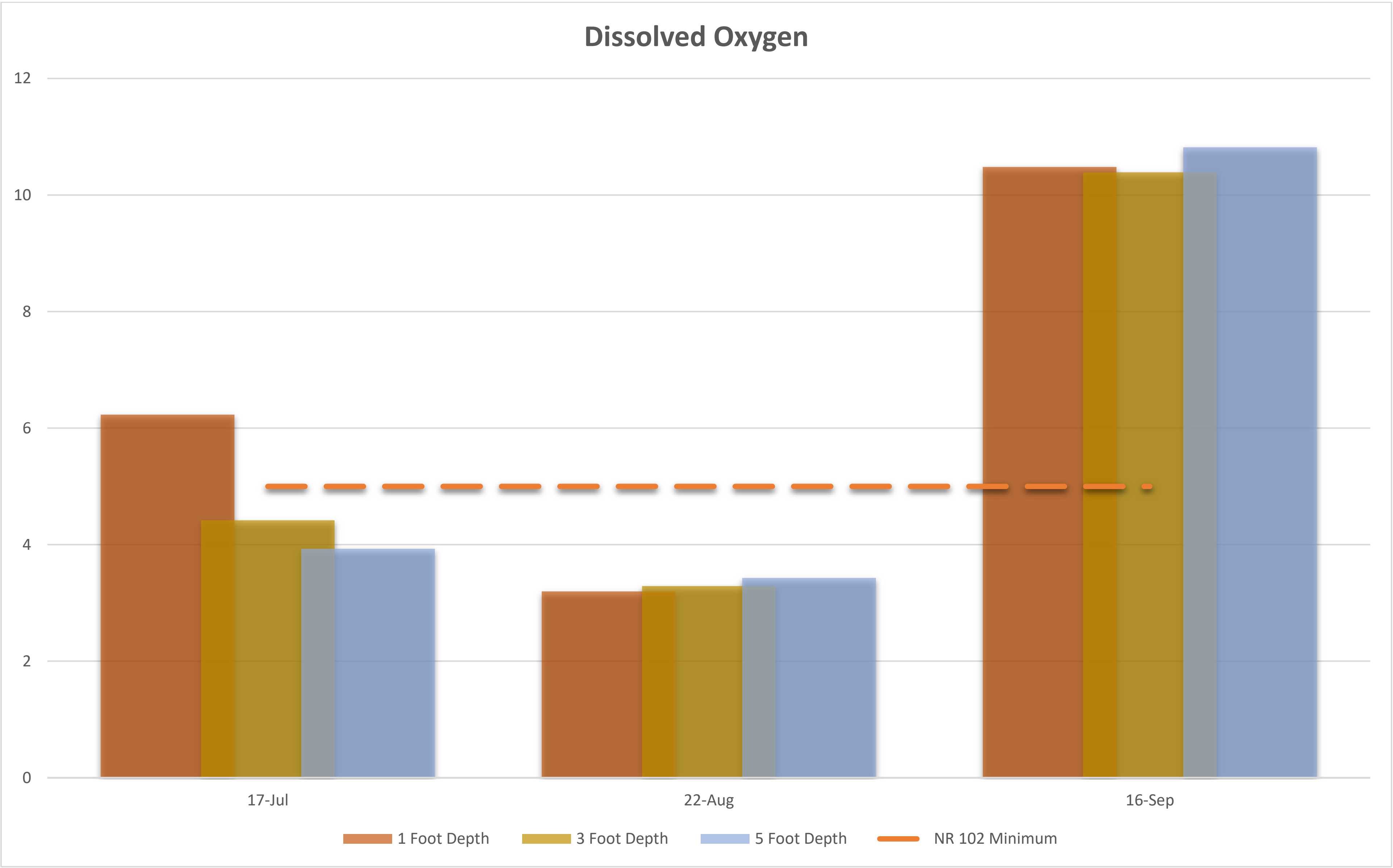

Chart 5-6. Dissolved Oxygen Concentrations in Millpond Samples

Chlorophyll-A

Chlorophyll allows photosynthesizing plants to use sunlight to convert light energy into chemical energy. Chlorophyll-A is the predominant type of chlorophyll found in green plants and algae and is used as a measure of the algae biomass in a waterbody, a symptom of degraded water quality conditions. Algae populations that grow rapidly form blooms that have the potential to create health risks and water quality concerns. Some water quality problems that arise from high concentrations leading to algae blooms can be reduced light penetration impacting aquatic plant populations, discoloration of water, taste and odor concerns and reduced dissolved oxygen resulting in less available oxygen to plants and aquatic life. Development of blue-green algae blooms can bring about the production of naturally-occurring toxins that present a health risk to people, pets, livestock and wildlife. Chlorophyll-A is one of the measurements used to estimate a lake's Trophic State Index (TSI). The TSI will be discussed in a separate section of this chapter. The generally accepted chlorophyll-A threshold for fish & aquatic life use impairment is 27 µg/L. The samples taken in July and August exceeded this threshold with values of 59 µg/L and 41.7 µg/L, respectively. The sample taken in September was 5.1 µg/L.

Nitrogen

Nitrate and Nitrite are naturally occurring, inorganic ions throughout the environment. As organic materials decompose, they release ammonia, which is in turn oxidized to form both nitrates and nitrites. The primary sources of organic nitrates include human sewage, livestock manure, fertilizers and erosion of natural deposits. Waterbodies producing nitrogen samples in excess of 0.3 mg/L in the spring have shown sufficient levels to support summer algae blooms. All samples taken in the Millpond exceeded this value.

Total nitrogen is the sum of the three forms of nitrogen that are commonly measured, total kjedhal nitrogen (ammonia, organic and reduced nitrogen) and nitrate-nitrite. Water with low dissolved oxygen may slow the rate at which ammonium is converted to nitrite (NO_2^-) and finally nitrate (NO_3^-). Nitrite and ammonium are far more toxic than nitrate to aquatic life.

The Wisconsin DNR currently regulates nitrogen as a toxic substance through implementation of the state's water quality standards for ammonia. The acute and chronic toxicity criteria is determined on a case-by-case basis, dependent on the appropriate aquatic life use category. Chart 5-7 illustrates the nitrogen concentrations measured on the Millpond.

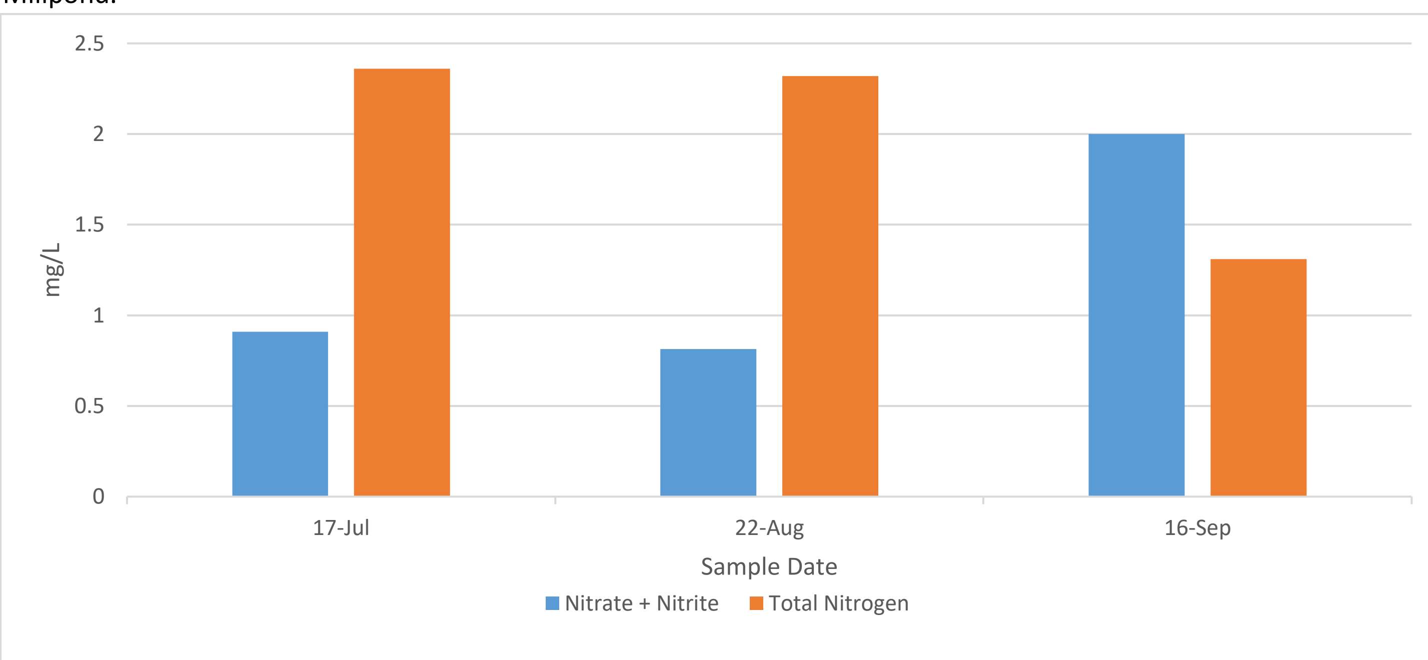

Chart 5-7. Nitrogen Concentrations in Millpond Samples

Trophic State Index

The Trophic State Index (TSI) is a classification system that rates lakes, ponds and reservoirs based on the biological activity, generally driven by nutrient loading. Classifications are as follows:

> Oligotrophic – Low nutrient levels. Low populations of aquatic plants, animals and algae.
>
> Mesotrophic – Moderate nutrient levels. Healthy and diverse populations of aquatic plants, fish and algae
>
> Eutrophic – High nutrient levels. Large populations of aquatic plants, fish and algae. Plants and algae populations often grow to nuisance levels. Fish species tolerant of warm temperatures and low dissolved oxygen concentrations.
>
> Hypereutrophic – Very high nutrient levels. Often exhibit large algae blooms. Fish populations are dominated by carp and other species that tolerate warm temperatures and low dissolved oxygen concentrations.

Based on the chemistry data collected in the 2017 season, the average summer Chlorophyll concentration was determined to be 50.4 µg/L. The summer Total Phosphorus average was 136 µg/L.

The overall Trophic State Index was 64. The TSI suggests that the Forestville Millpond ranks as eutrophic. This TSI usually suggests blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.

By contrast, results calculated in 1994 present an average summer Chlorophyll concentration of 25.4 µg/L and summer Total Phosphorus concentrations at an average 58 µg/L. This resulted in an overall TSI score of 59.

Summary of Results

There was a lot of information gathered throughout the 2017 field season. When compared to historic data, it is very telling that conditions have not changed vastly.

Suspended solids in the Millpond appear to be elevated, and the easily observable poor water quality supports this. The suspension of fine particulates is both a symptom and a driver of other issues. Less light penetration and lower dissolved oxygen are problematic and observed in the Millpond. Total phosphorus levels are elevated in several upstream samples and the majority of samples taken in the Millpond. This trend is consistent with modeled results of nutrient and sediment loading. The large agricultural landscape is likely the primary contributor to the Total phosphorus concentrations. Temperature measurements were below thresholds of concern, but dissolved oxygen levels were low at times in upstream locations and in the Millpond samples.

All of the sampling results point to a eutrophic waterbody with a steady source of sediment and nutrients. Future efforts should target improvement of these parameters.

6. Sediment Core Analysis

The use of sediment cores provides the opportunity to understand the makeup of the sediment that resides in the Millpond, as well as provides insight into the options for future action in the management decisions to be made. Analysis of accumulated sediment also provided quantification of possible contaminants that may exist.

Figure 6-1. Location of Sediment Cores

Six coring locations were identified (see Figure 6-1) and a plan which outlined procedure and analysis to be done was submitted to the Wisconsin Department of Natural Resources for review. Locations were chosen to provide a representative assemblage of the Millpond sediment. A partnership of the SWCD and UW-Oshkosh staff collaborated on October 31 and November 5 of 2017 to collect the samples. A Livingstone-type rod piston corer was used with split tubes to extrude the cores for visual inspection and collection of sample material (see Figure 6-2).

Each core was examined for stratigraphic layers, and representative samples for analysis were taken from each layer. Each sample was split into three layers with the top being loose unconsolidated material, the middle “muckier” sediments and the bottom layer was more compact (see Figure 6-3).

Figure 6-2. Sediment Core Collection

Figure 6-3. Sediment Core #3

Each core was taken and a representative sample was taken from each stratified layer in the profile, they were packaged accordingly to create eighteen discrete samples. The samples were shipped to the Wisconsin State Laboratory of Hygiene for analysis of the parameters in Table 6-1.

Parameter (All intervals of each core sample)	Analytical Method	Detection Level
PCBs	Megabore Column Chromatography	0.024 µg/g
Total Phosphorus	EPA 365.1	0.00500 mg/L
Mercury	SW846 7471	0.015 mg/Kg
Lead	EPA SW846 3050B (digestion) EPA SW846 6010B (analysis ICP)	1.0 mg/Kg
Copper	EPA SW846 3050B (digestion) EPA SW846 6010B (analysis ICP)	0.5 mg/Kg
Arsenic	EPA SW846 3050B (digestion) EPA SW846 6010B (analysis ICP)	1.0 mg/Kg
Oil & Grease	EPA SW846 9071A	5.0 mg/Kg
Particle Size (Sand/Silt/Clay)	Hydrometer	% Distribution
Chlordane	Capillary Column Chromatography	0.0085 µg/g
Dieldrin	Capillary Column Chromatography	0.012 µg/g
DDT	Capillary Column Chromatography	0.014 µg/g
DDD	Capillary Column Chromatography	0.010 µg/g
DDE	Capillary Column Chromatography	0.0050 µg/g

Table 6-1. Parameters Analyzed in Sediment Cores

Each parameter tested has a number of thresholds that are significant to the interpretation of results:

- Limit of Detection (LOD) – The lowest concentration of a measurement that can be detected by an instrument at a specified level of confidence
- Limit of Quantification (LOQ) – The lowest concentration at which the results can be reported with a high degree of confidence and are acceptable for a specified use
- Threshold Effect Concentration (TEC) – The lowest concentration effect level, adverse ecological effects are not expected from concentrations below this level
- Midpoint Effect Concentration (MEC) – This value is the midpoint between the TEC and the PEC
- Probable Effect Concentration (PEC) – The upper concentration effect level, adverse ecological effects are expected to occur more often than not from concentrations above this level

A quantification of the level of concern can be deciphered from the value of the measured concentration relative to the TEC, MEC and PEC, as established in the Consensus-Based Sediment Quality Guidelines; Level 1 represents values that fall below the TEC and Level 4 represents values that exceed the PEC (see Figure 6-4).

Level 1	→	Threshold Effect Concentration	←	**Level 2**	→	Midpoint Effect Concentration	←	**Level 3**	→	Probable Effect Concentration	←	**Level 4**

Figure 6-4. Levels of Concern in Relation to Concentration of Contaminant

Heavy Metals

An assessment of the ecological health of a waterbody includes the investigation of heavy metals that may be present in the accumulated sediments. It is generally accepted that there are two origins of heavy metals in lake sediment environments: natural process (i.e. erosion and sedimentation, weathering of bedrock or biological decomposition) and human processes. Both of these origins can negatively impact an ecosystem, but only deposits derived from human activities are considered contaminants. Introduction of contaminants can occur through both terrestrial and atmospheric sources. Sediment core analysis from the Millpond included identification of Arsenic, Copper, Lead and Mercury concentrations in each sample. Each of the metals tested were present and did reach the Limit of Detection, but not all registered concentrations that surpassed the Limit of Quantification. Most of the samples were below the Threshold Effect Concentration, with the exception of three out of eighteen samples that showed Copper concentrations and two out of eighteen samples that showed Mercury concentrations in excess of the Threshold Effect Concentration but below the Midpoint Effect Concentration (see Table 6-2) These elevated values do not present serious concern for impacts to ecological health, as they are still below the Probable Effect Concentration.

Core #	Depth (cm)	Arsenic (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
1-1	0-20	1.93	20.10	9.18	0.05
1-2	24-70	3.30	23.30	11.10	0.05
1-3	70-100	4.94	28.30	17.10	0.10
2-1	0-37	1.74	25.40	10.50	0.09
2-2	37-45	2.54	24.90	13.20	0.10
2-3	45-56	3.90	56.90	10.90	0.12
3-1	0-46	1.52	23.10	12.50	0.09
3-2	46-65	4.71	33.60	9.27	0.24
3-3	65-86	2.96	29.40	4.86	0.11
4-1	0-22	1.57	22.70	12.00	0.09
4-2	17-39	3.34	23.40	13.80	0.11
4-3	39-52	3.64	25.70	10.50	0.11
5-1	0-20	2.93	20.60	10.90	0.10
5-2	29-49	3.60	21.00	9.01	0.11
5-3	49-60	5.91	27.00	8.83	0.16
6-1	0 - 20	1.33	24.30	12.20	0.10
6-2	17-35	2.31	22.00	14.50	0.10
6-3	35-57	3.99	42.90	11.30	0.20
Limit of Detection		1.00	0.50	1.00	0.01
Limit of Quantification		2.98	1.59	2.98	0.04
Threshold Effect Concentration		9.8	32	36	0.18
Midpoint Effect Concentration		21.4	91	83	0.64
Probable Effect Concentration		33	150	130	1.1

Level 1
Level 2
Level 3
Level 4

Table 6-2. Concentration of Heavy Metals in Core Samples

Pesticides and PCBs

All collected samples were analyzed for Polychlorinated Biphenyls (PCBs) and one layer from Core #1, closest to the dam, was analyzed for several pesticides. Four of the eighteen samples showed PCB concentrations above the Limit of Detection, but did not surpass the Limit of Quantification. There was no detection of the tested pesticides in any of the analyzed samples.

Total Phosphorus

High concentrations of phosphorus are a common cause of eutrophication in fresh water lakes, reservoirs and impoundments. Phosphorus contributions in a waterbody can be from both external phosphorus sources, as well as its release and retention in the sediments. Accumulated sediments act as a sink where legacy phosphorus can be stored, and also as an ongoing source of phosphorus for the overlying water. Recycling of phosphorus from the underlying sediments that have been enriched by years of high nutrient inputs can cause a lake to remain eutrophic well after external inputs of phosphorus have been decreased. Determination of Total Phosphorus concentrations that have accumulated in the Millpond sediments is necessary for an understanding of the nutrient budget of the waterbody as a whole, as well as to provide guidance on the next steps needed to address issues in the Millpond. Total Phosphorus concentrations were quite high in all of the analyzed sample, with values ranging from 764 mg/kg to 1,870 mg/kg (see Chart 6-1); the Limit of Quantification for Phosphorus is 119 mg/kg.

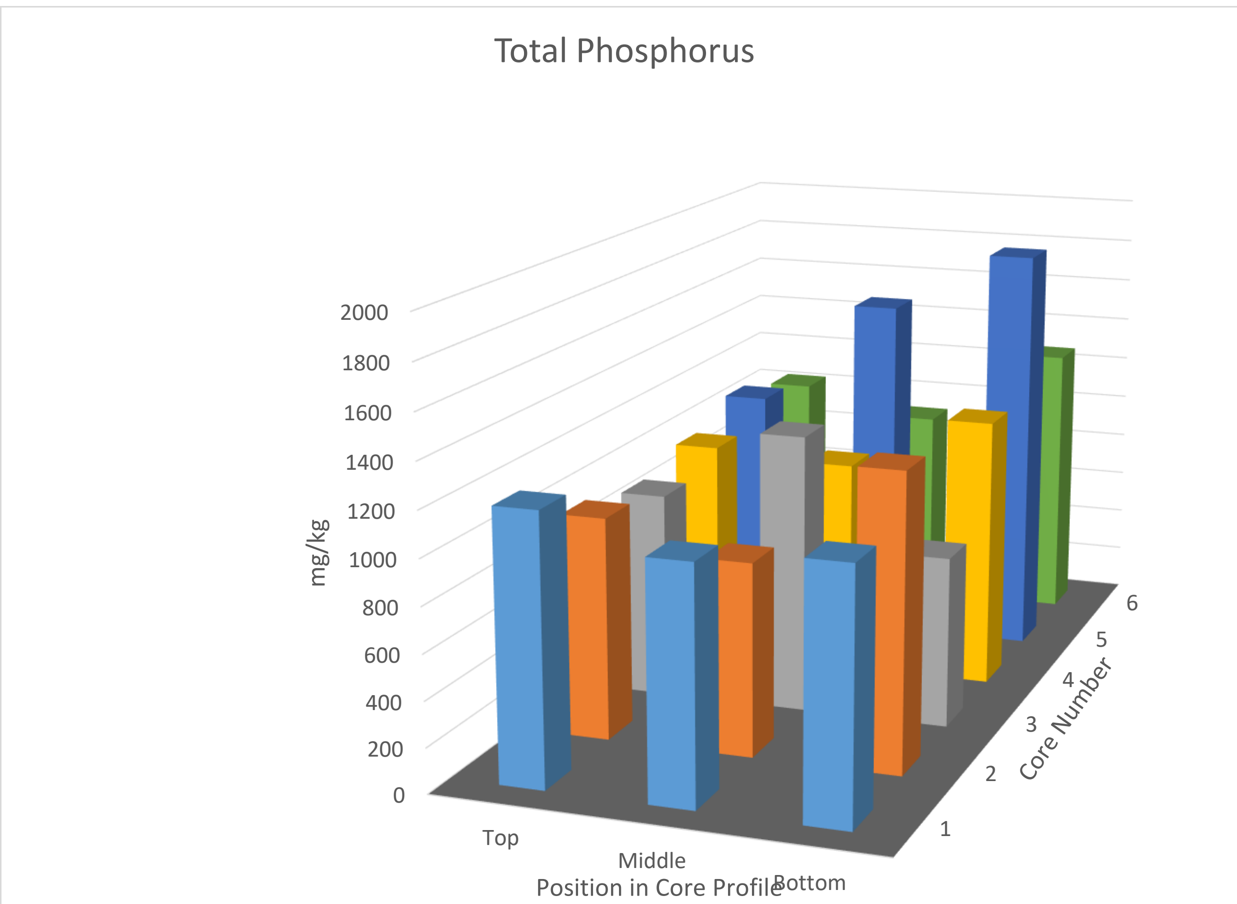

Chart 6-1. Total Phosphorus in Sediment Cores

Oil and Grease

Oil and grease are part of large group of contaminant sources named polycyclic aromatic hydrocarbons (PAHs). High concentrations of PAHs can bring considerable stress to aquatic organisms and their associated ecosystems, as well as pose a threat to human health. Most PAHs do not dissolve in water, but bind to sediments and accumulate on the bed of lakes, reservoirs or streams; accumulated sediments can be suspended in the water column and PAHs will be transported. PAHs typically originate from urban and suburban nonpoint sources and can be derived from road runoff, sewage and atmospheric circulation. Many of the samples analyzed revealed somewhat elevated concentrations of oil and grease (see Chart 6-2). While there is not a specific threshold value that has been identified, the Wisconsin DNR Wastewater Permit Program uses a value of 1,000 parts per million (ppm) when evaluating discharge limits. Concentrations determined through sediment core analysis ranged from 165 mg/kg (ppm) to 3,730 mg/kg (ppm).

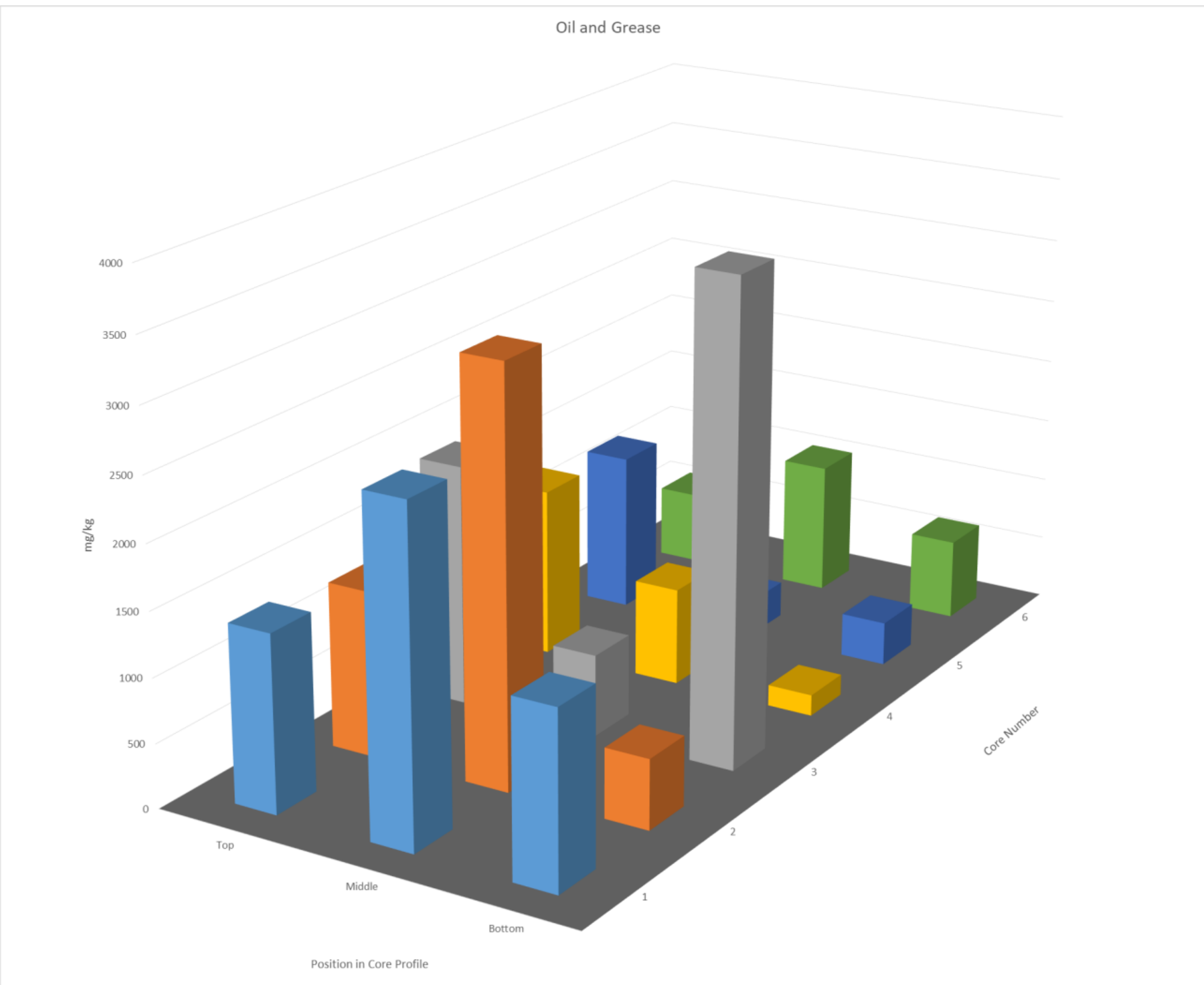

Chart 6-2. Oil and Grease Concentrations

Particle Size Analysis (Sand/Silt/Clay)

One of the parameters generated from material collected in sediment cores is a breakdown of the constituent mineral components of the sediment; the analysis is represented by a ratio of the sand, silt and clay particles present. Analysis of the Millpond cores classifies most of the samples as silty loam with some falling into the classification of sandy loam and clay loam (see Figure 6-5).

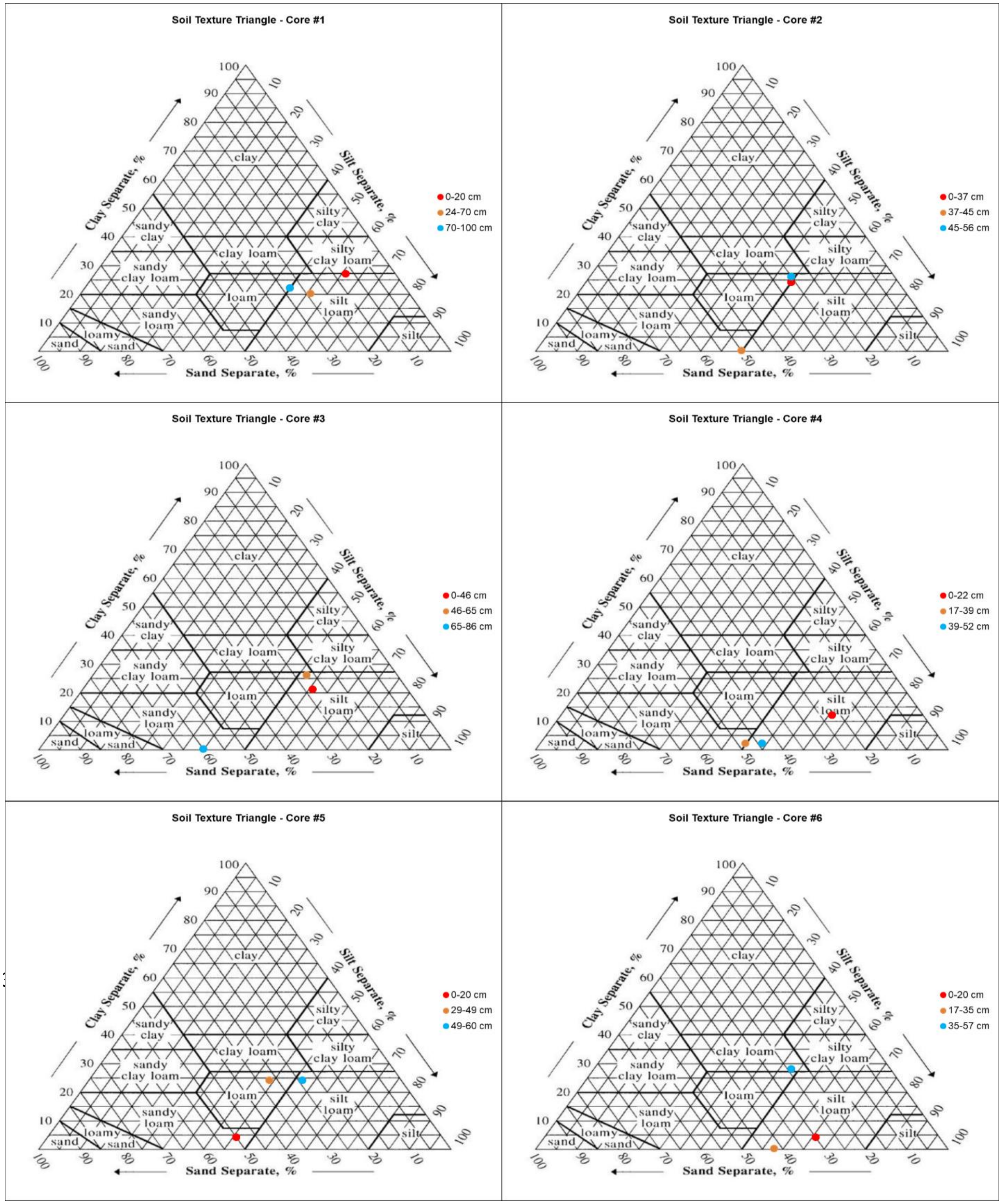

Figure 6-5. Particle Size Distribution

A cross section of the sediment cores shows a representation of the accumulation of sediments above the native soil (see Figure 6-6). In the six cores taken, silt and much deposits ranged from 1’-2” to 2’-3”. This information, when coupled with bathymetry data, provides representation of the conditions on the bottom of the Millpond.

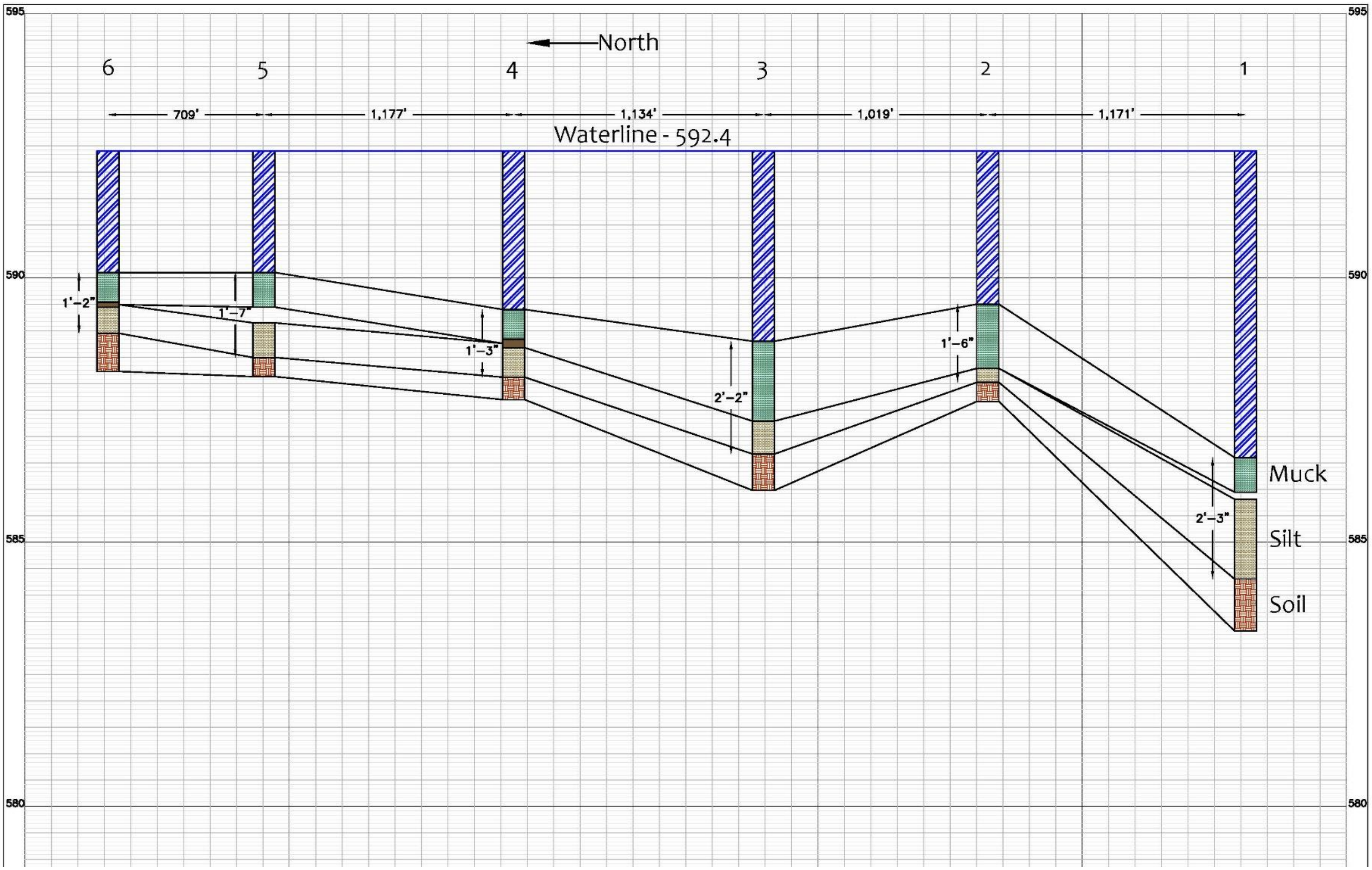

Figure 6-6. Cross Sections of Sediment Cores

Summary of Results

A thorough understanding of the composition of accumulated sediments is important for identification of their chemical makeup, as well as planning for potential relocation in a dredging scenario. Part of the process for moving ahead with sediment cores was to establish a Sampling and Analysis Plan, approved by the Wisconsin DNR, and in which the protocol for the coring process was set. Additional coring locations have been identified, and if the need for further analysis presented itself the protocol has been established.

Heavy metals were detected, but in a very random sampling, and at levels that do not warrant concern, thus no likely impact on disposal of materials that may be proposed to be removed. Total Phosphorus levels were elevated, as expected in a situation in which many decades of activity in an agricultural landscape have contributed a steady supply of nutrients and sediment. Research has illustrated that internal loading of phosphorus from accumulated sediments can continue to play a role in water quality in shallow lakes. Oil and grease concentrations were elevated in many of the samples, but context is difficult as there is not a specified threshold for those parameters.

Overall, the accumulated sediments in the Millpond fall into a classification of a silty loam, with a high percentage of very fine particles. This is to be expected with the high degree of suspended sediments and poor clarity resulting from turbid waters. From the information gathered in the samples, there is roughly two feet of loose, unconsolidated material overlying the more competent soils in the subsurface.

7. Aquatic Plant Inventory

The health of the aquatic plant community in a lake ecosystem is a determination of the aquatic plant population, both density and species, and can provide valuable information about lake conditions and can play a role in future decisions. To date, anecdotal evidence of the aquatic plant population has been developed to describe perceptions of the health of the Millpond. A formal inventory was necessary to establish solid information regarding the resident plant population.

The methodology for collection of plant survey data has been established by the Wisconsin DNR, and is outlined in the document "Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling, Field and Laboratory Procedures, Data Entry and Analysis, and Applications". The protocols laid out in that document were used in the field as SWCD staff performed aquatic plant surveys on September 6 and September 11 of 2017.

A grid was established based on a point-intercept design, which evenly distributed sample points across the lake surface. These points were uploaded to a Carlson Surveyor+ data collector to maintain horizontal control of the sampling points. Staff navigated to each point to collect survey data, and recorded the actual coordinates of the sample location (see Figure 7-1).

There were 346 sample points visited over the course of the two dates. A double-sided sampling rake was fabricated and used for sample collection (see Figure 7-2).

Data collected at each survey point included the site identification number, sample depth, dominant sediment type, collection apparatus type, rake fullness (see Figure 7-3) and a tally of each species that was observed.

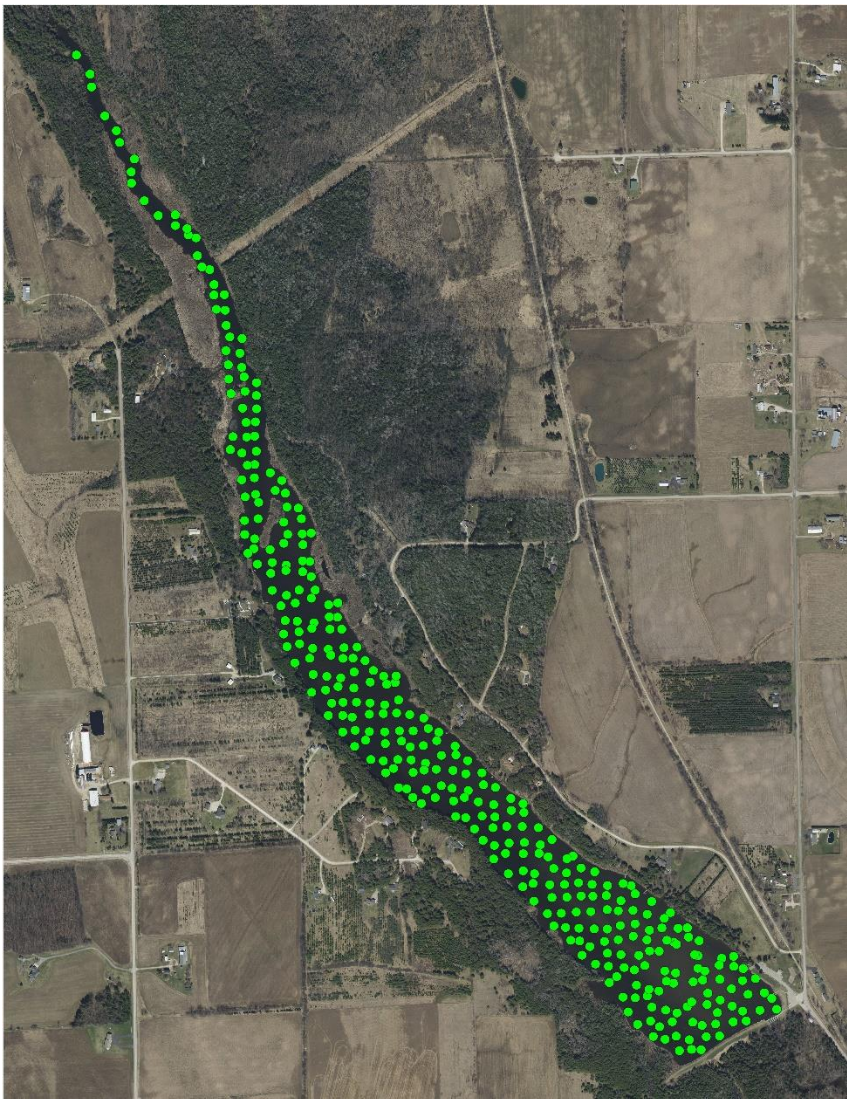

Figure 7-1. Plant Survey Sample Points.

Figure 7-2. Sample Rake.

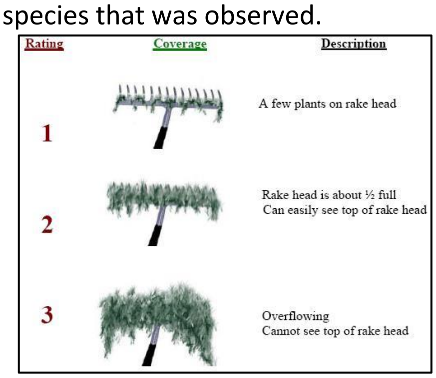

Figure 7-3. Reference of Rake Fullness - UWEX

The quantitative data collected in the field surveys were entered into spreadsheets provided by the Wisconsin DNR. Calculations were performed to develop statistical characteristics of the Millpond plant population to be able to compare with other inland lakes in the region. Other products generated by statistical analysis were the species richness, species frequency and the Floristic Quality Index value. The following tables summarize the results of the plant survey (see Table 7-1 and Table 7-2).

Total number of sites visited	346
Total number of sites with vegetation	130
Total number of sites shallower than maximum depth of plants	345
Frequency of occurrence at sites shallower than maximum depth of plants	37.68
Maximum depth of plants (ft)	5.5
Average number of all species per site (shallower than max depth)	0.42
Average number of all species per site (veg. sites only)	1.12
Average number of native species per site (shallower than max depth)	0.15
Average number of native species per site (veg. sites only)	1.04
Simpson Diversity Index	0.57
Floristic Quality Index (FQI)	18.52
Mean C (Average Conservatism – FQI)	7
Species Number (FQI)	7

Table 7-1. Aquatic Plant Survey Statistics

Species	**Sites Found**	**Relative Frequency**	**Coefficient of Conservatism**
Eurasian Water Milfoil (*Myriophyllum spicatum*)	89	61.4%	--
Curly-Leaf Pondweed (*Potamogeton crispus*)	3	2.1%	--
Small Duckweed (*Lemna minor*)	1	0.7%	4
Intermediate Pond Lily (*Nuphar ˣrubrodisca*)	4	2.8%	9
White Water Lily (*Nymphaea odorata*)	6	4.1%	6
Large-Leaf Pondweed (*Potamogeton amplifolius*)	2	1.4%	7
Illinois Pondweed (*Potamogeton illinoensis*)	4	2.8%	6
Stiff Pondweed (*Potamogeton strictifolius*)	3	2.1%	8
Water Bulrush (*Schoenoplectus subterminalis*)	33	22.8%	9

Table 7-2. Plant Species.

Floristic Quality Index

The Floristic Quality Index (FQI) is an assessment that is a standardized tool for natural areas. This method was developed to replace subjective measures of quality, such as "high" or "low", with a quantitative index. This index allows comparison of the floristic quality among many sites and tracking

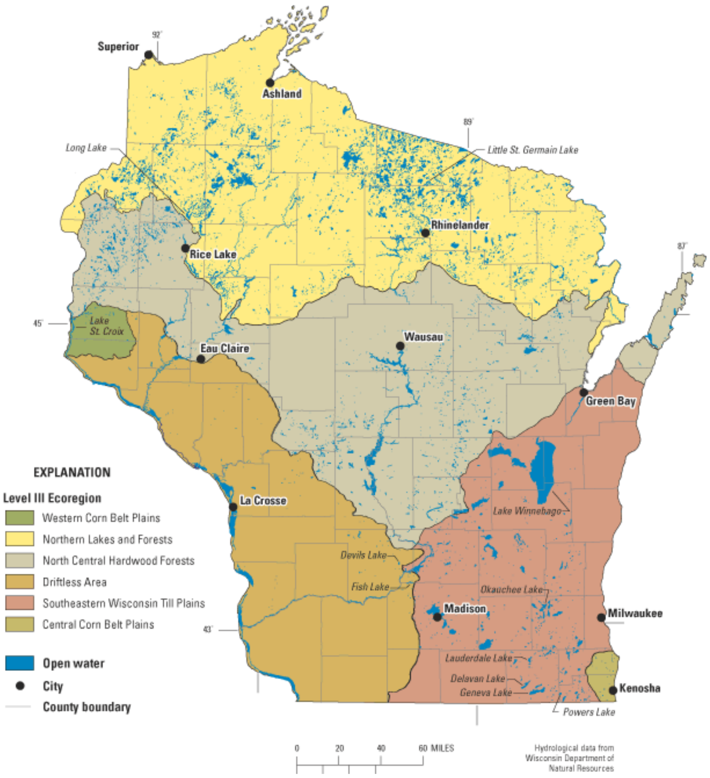

Figure 7-4. Wisconsin Ecoregions - From US Geological Service.

changes at the same site over time through evaluation of the closeness of the flora of an area to undisturbed conditions. The value developed for the index incorporates the number of floristically significant species and designates a coefficient of conservatism, a reflection of sensitivity to disturbance, to each (see Table 7-2), essentially giving weight to both high populations of particular species but also recognizing those with a greater relative conservation benefit. These results can be put into perspective when compared to lakes and flowages within the same and neighboring ecoregions; Door County is located within the North Central Hardwood Forests region and results are compared to a combination of that region and the Southeastern Wisconsin Till Plains region (see Figure 7-4). When compared to the other regions, the FQI components for the Millpond show interesting statistics. The Millpond Floristic Quality Index value of 18.5 is below the statewide value of 22.2 and the ecoregion value of 20.9. The number of species, 7, is less than the statewide median value of 8 and the ecoregion value of 10 and the mean value of the coefficient of conservatism of 7 is higher than the statewide value of 6 and the ecoregion value of 5.6. Please see the boxplots in Chart 7-1 – Chart 7-3 for a summary of these comparisons. One interpretation of this data is that although the FQI value is on the lower end of the statewide and ecoregion ranges, the fact that this results from fewer plants with higher conservation value shows that the resident plant population is scarce but is of value.

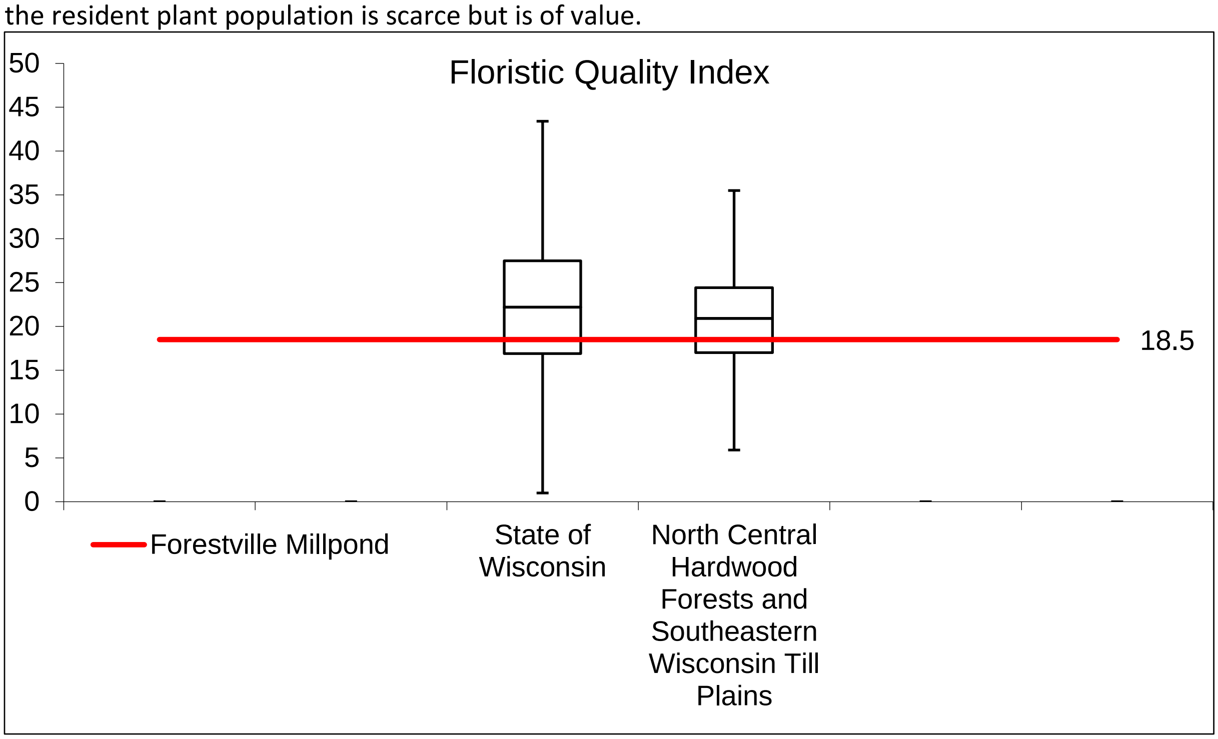

Chart 7-1. Comparison of Floristic Quality Index

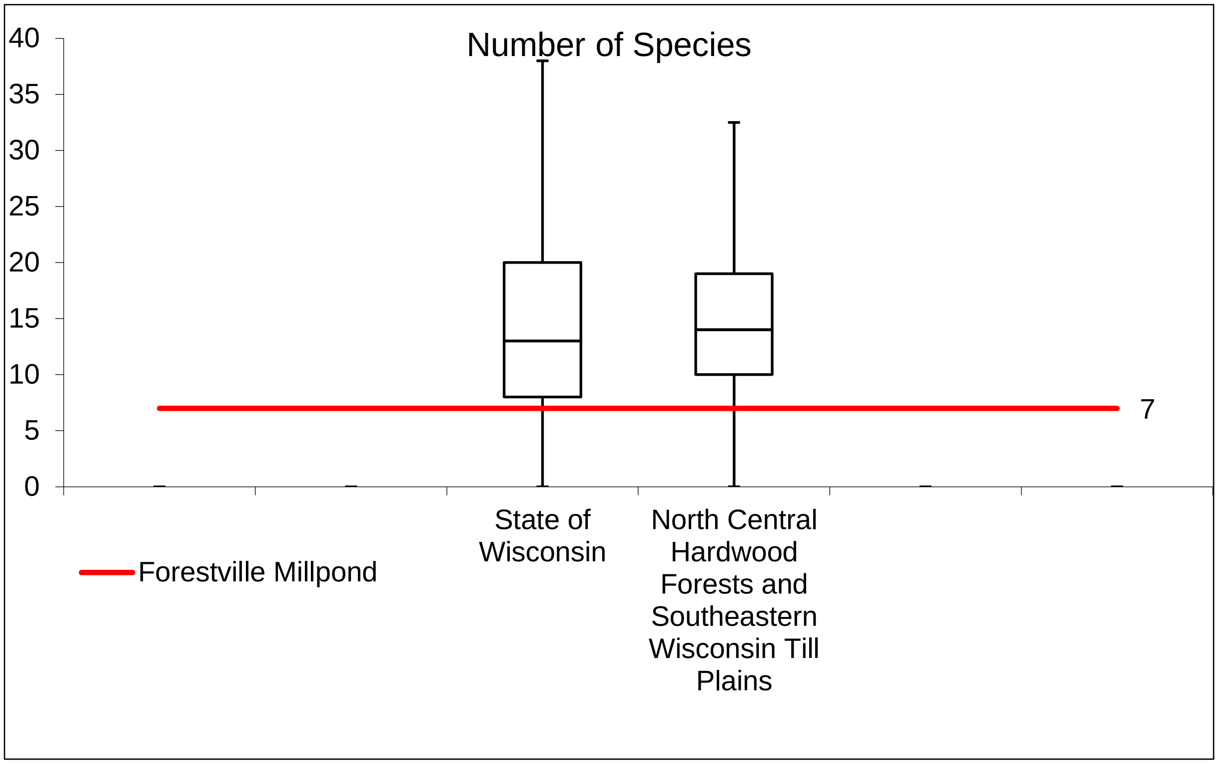

Chart 7-2. Comparison of Number of Species

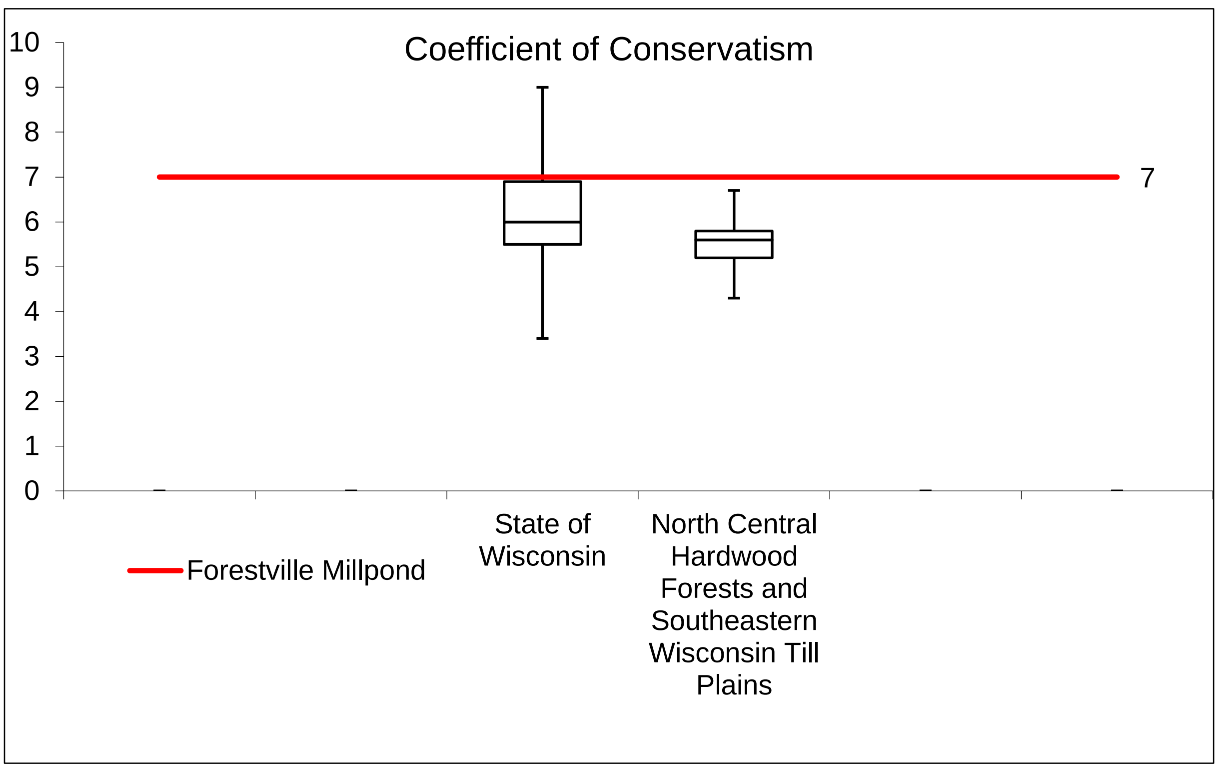

Chart 7-3. Comparison of Number of Coefficient of Conservatism

Simpson Diversity Index

The Simpson Diversity Index (SDI) is used to quantify biodiversity of an aquatic plant community based on a calculation of the number of each species surveyed (abundance) and the number of individuals per sample point. The SDI utilizes a decimal scale, with values closer to zero representing a lack of diversity and those closer to one representing a higher degree of biodiversity. The data collected in the survey of the Forestville Millpond results in an SDI of 0.57. The median SDI value for Wisconsin lakes is 0.80, as established by the 2012 National Lakes Assessment. This places the Millpond SDI below the state average, which can be anticipated by the low species count and abundance in the survey results.

Non-Native Aquatic Species

Two non-native plant species were identified in the Millpond, Eurasian Water Milfoil (*Myriophyllum spicatum*) and Curly-Leaf Pondweed (*Potamogeton crispus*). Both Eurasian Water Milfoil (EWM) and Curly-Leaf Pondweed (CLP) are natives to Europe, Asia and North Africa, and are thought to have been introduced to the United States in the late 1800s/early 1900s. Known for growing in soft sediments, these aggressive invasives will crowd out native species as well as impact natural habitats and impede recreation (see Figure 7-5). EWM was the most abundant plant species in the Millpond and inhabits much of the main impoundment area (see Figure 7-6). CLP was only identified at three locations at the south end of the impoundment, near the dam (see Figure 7-7). It should be noted that CLP is not typically found in September, so a survey earlier in the season might more accurately show the population.

Figure 7-5. Full Rake of EWM.

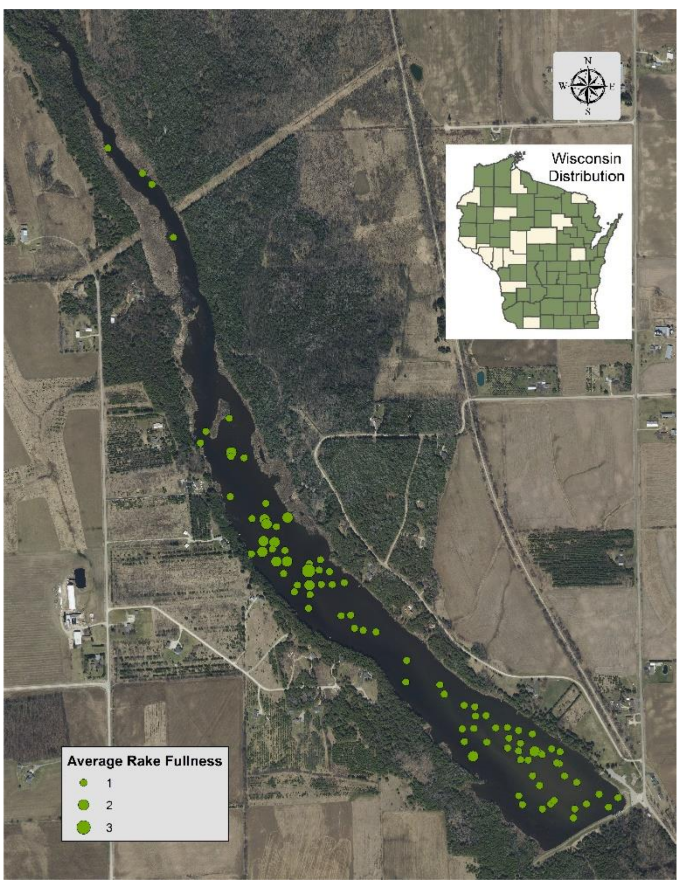

Figure 7-6. Distribution of Eurasian Water Milfoil

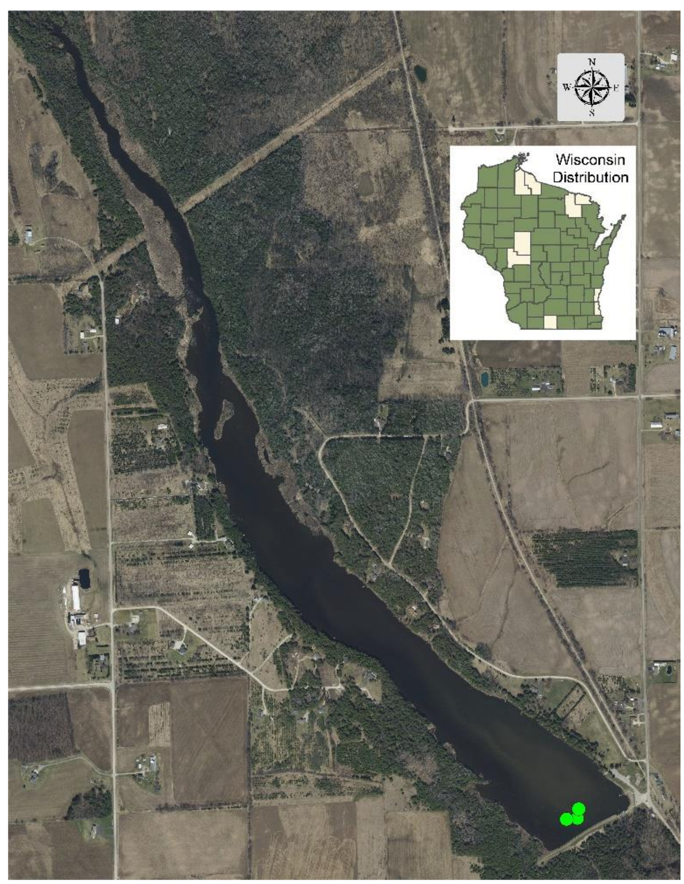

Figure 7-7. Distribution of Curly-Leaf Pondweed

Summary of Results

Just over one-third (38%) of the sampled sites contained any type of vegetation. The Forestville Millpond is a very shallow system with a dominantly muck bottom (see Figure 7-8). The maximum depth found to contain plants was 5.5 feet, and nearly all of the sites containing plants were shallower than that. The most abundant species was Eurasian Water Milfoil, an invasive. The most abundant native plant was Water Bulrush (*Schoenoplectus subterminalis*), distributed around much of the northern end of the Millpond (see Figure 7-9. Water Bulrush commonly forms underwater mats in lakes and slow-moving rivers in sediments under 48".

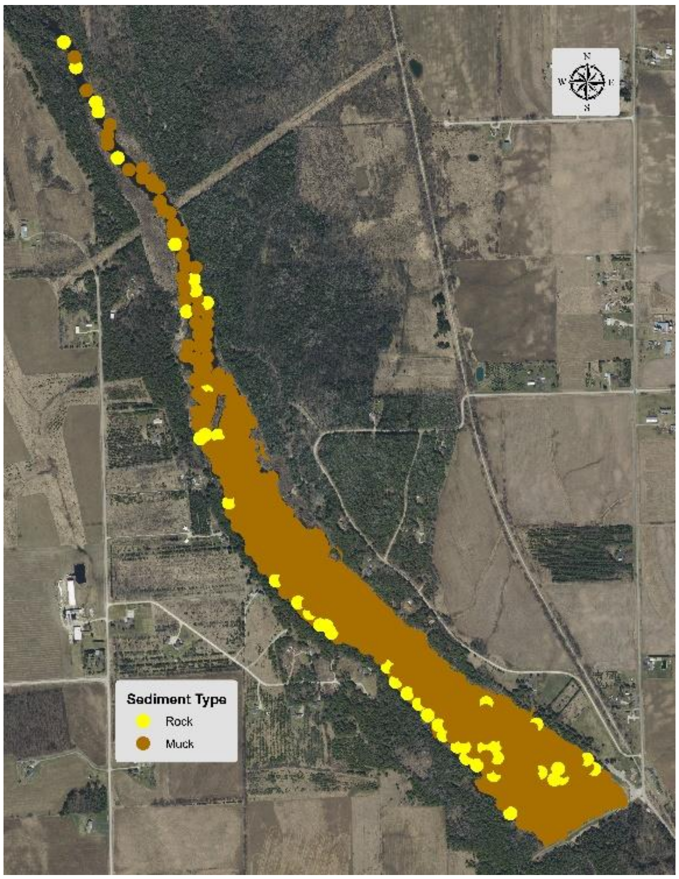

Figure 7-8. Sediment Types

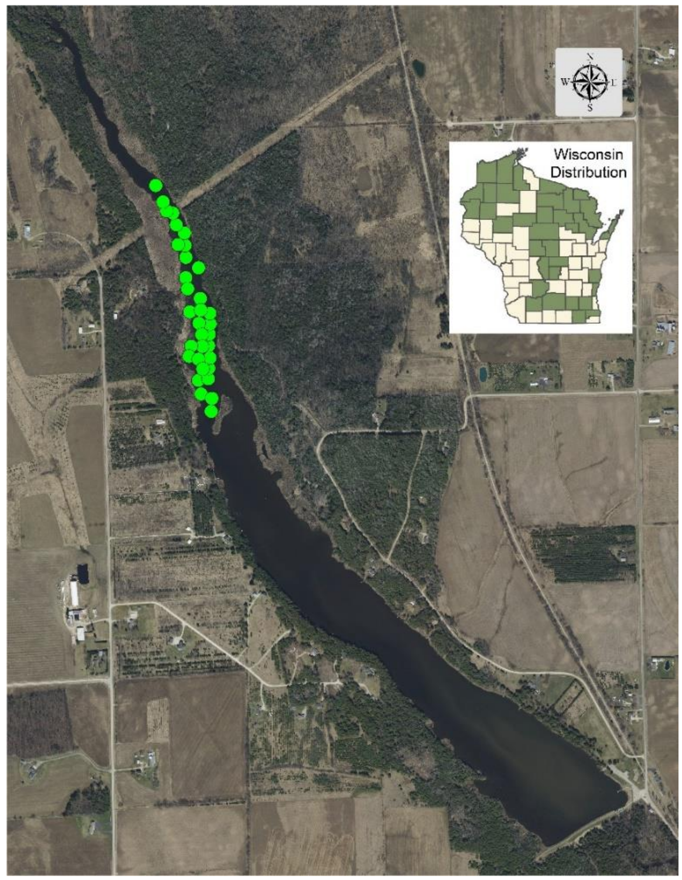

Figure 7-9. Distribution of Water Bulrush

8. Fish Survey

Throughout the history of the Forestville Millpond, it is recognized that the value as a sport fishery has been limited. This limitation has traditionally been credited to frequent winter kills. Several attempts at restocking the population were made after the 1982 reconstruction to the current dam configuration (see Table 8-1). As mentioned earlier in this document, those efforts were met with little success and were discontinued in 1993.

Year	Species	Age Class	Number of Fish Stocked	Average Fish Length (inches)
1983	Northern Pike	Fingerling	375	11
1985	Muskellunge	Fry	65,000	1
1985	Northern Pike	Fingerling	325	9
1986	Northern Pike	Fingerling	325	9
1986	Smallmouth Bass	Fingerling	2,000	3
1987	Northern Pike	Fingerling	975	9
1990	Northern Pike	Fry	100,000	1
1991	Largemouth Bass	Fingerling	7,000	2
1991	Northern Pike	Fingerling	360	7.9
1992	Largemouth Bass	Fingerling	3,250	1
1992	Northern Pike	Fingerling	2,830	5.5
1993	Largemouth Bass	Fingerling	7,000	1

Table 8-1. Summary of Stocking Efforts 1983 – 1993 – Wisconsin DNR

Determinations made in a 2008 fish survey by the Wisconsin DNR attributed the makeup of the fish community to poor water quality derived from the shallow nature of the waterbody and excessive nutrients entering from the surrounding watershed. That study noted that traditional fish populations alternated between a desirable mix of species such as northern pike, largemouth bass and panfish to one that is dominated by less desirable species such as carp and bullhead. The 2008 report included a 1.5 hour electroshocking survey of the entire shoreline. Results revealed carp as the most abundant overall species, with largemouth bass showing modest numbers as the most abundant game species (see Table 8-2).

Species	Number	% of Total	CPE (Fish/Hour)	CPE (Fish/Mile)	Average Length (mm)	Size Range (mm)
Northern Pike	4	0.95%	2.7	1.7	563 (22.2")	388 - 712 (15.3" - 28")
Largemouth Bass	57	13.54%	38	24.4	360 (14.2")	222 – 447 (8.7" - 17.6")
Yellow Perch	10	2.38%	6.7	4.3	188 (7.4")	--
Bluegill	19	4.51%	12.7	8.1	120 (4.7")	37 - 197 (1.5" - 7.8")
Black Bullhead	2	0.48%	1.3	0.9		

Black Crappie	23	5.46%	15.3	9.8	241 (9.5")	74 - 340 (2.9" - 13.4")
Common Carp	300	71.26%	200	128.2	--	--
White Sucker	6	1.43%	4	2.6	--	--
Total	421		280.7	179.9		

Table 8-2. Distribution of Fish Species from 2008 Survey – Wisconsin DNR

One of the objectives of this study, was to revisit the topic of the Millpond fishery and see what updated information would reveal about fish populations and potential trends in the health of the waterbody. Identical protocols were followed in a 2016 survey, and the results were similar. Carp dominated the overall species count and largemouth bass represented the largest segment of the gamefish population (see Table 8-3).

Species	Number	% of Total	CPE (Fish/Hour)	CPE (Fish/Mile)	Average Length (mm)	Size Range (mm)
Northern Pike	4	1.37%	2.7	1.7	473 (18.6")	413 - 537 (16.3" - 21.1")
Largemouth Bass	29	9.90%	19.3	12.4	367 (14.4")	325 - 409 (12.8" - 16.1")
Yellow Perch	37	12.63%	24.7	15.8	189 (7.4")	85 -308 (3.3" - 12.1")
Bluegill	5	1.71%	3.3	2.1	136 (5.4")	72 - 202 (2.8" - 8")
Pumpkinseed Sunfish	1	0.34%	0.7	0.4	106 (4.2")	106 (4.2")
Black Bullhead	1	0.34%	0.7	0.4	259 (10.2")	259 (10.2")
Yellow Bullhead	1	0.34%	0.7	0.4	270 (10.6")	270 (10.6")
Black Crappie	9	3.07%	6	3.8	305 (12")	297 - 312 (11.7" - 12.5")
Common Carp	190	64.85%	126.7	81.2	--	--
White Sucker	16	5.46%	10.7	6.8	--	--
Total	293		195.3	125.2		

Table 8-3. Distribution of Fish Species from 2016 Survey – Wisconsin DNR

Summary of Results

The conclusions made in past reports, and those that can be made in review of updated information, suggest that poor water quality continues to be a limiting factor for supporting a diverse and abundant fishery in the Millpond. The history of failed stocking and the observed winter kills support this and highlight the fact that excessively turbid water and low concentrations of dissolved oxygen continues to influence the makeup and total of the fish population.

9. Management Options

The following list of options represents potential management options to address the identified issues in the Forestville Millpond. This list of options was developed in the 1996 study and once again brought forward for discussion at the meeting held in 2016. A selection of a management option, or a combination of options, should be based on a clear set of goals that represent the resource needs and the desired uses of the waterbody. Each of these options will require input from a variety of sources including local and state agencies, resource professionals, political figures and the general public.

1. Do Nothing

This option will not require any further spending or action. It is highly likely that water chemistry and clarity will continue to decline. Existing carp populations would stabilize at a sustainable level with occasional winter kills. Sport fish would suffer frequent winter kills and, unless restocked, could vanish completely. Aquatic vegetation might eventually be controlled by the carp. Enhanced turbidity would likely result from the rooting activity of the carp. The pond would remain habitat for amphibians and waterfowl while being utilized for recreational activities such as hunting, canoeing and limited sport fishing for the short term. The limited impact of human activity encourages wildlife to utilize the Millpond for habitat. The Millpond currently functions as a sediment basin; the pooling of the Ahnapee River behind the dam allows sediments to settle out. This is a function which may somewhat improve water quality downstream and reduce the volume of sediment delivered to Lake Michigan.

Pros	Cons
Least Cost Management Alternative	Does Not Address Current Loading
Maintains Status Quo	Does Not Address Current Nutrient Levels
Maintain Current Level of Wildlife Benefits	Less Acceptable to Public
Next Steps	
This Option Requires No Further Action	

2. Dredge

Addresses sediment removal, excavation for beach preparation or fisheries improvement. Dredging would be a high cost, high impact alternative. An important consideration in this option is the extent of which dredging would be utilized. On a large scale, dredging could be used to reduce aquatic vegetation and sediment to increase depth over a large portion of the waterbody. It could be used on a limited scale to address specific uses, such as creation of a suitable swimming beach. Depending on the source of funding or permitting process, dredging could require an environmental analysis or impact statement. A combination of dredging with some type of drawdown could reduce the costs of sediment removal.

Pros	Cons
Temporary Solution to Sediment Accumulation	Potentially High Cost
Temporary Reduction of Aquatic Vegetation	Need for Disposal Site
Increase in Millpond Capacity	Does Not Address Nutrient and Sediment Loading
Next Steps	
Locate and Secure Funding and Professional Services	
Locate Suitable Disposal Site	
Acquire Permits	

3. Harvest Aquatic Vegetation

This option involves mechanical or chemical treatment to reduce or eliminate nuisance water weeds. Harvesting by hand is likely the most feasible method for the Millpond. Water depths are inadequate for most mechanical harvesters and use of herbicides in an aquatic environment, especially one that provides a high quality habitat to waterfowl and amphibians, is undesirable. Removal and disposal of vegetation is required by state statute and would be necessary regardless of the method used to kill the vegetation to prevent decaying plant material from leading to a future fish kill. Hand harvesting would likely be best conducted in conjunction with some form of drawdown. Some vegetation is necessary to provide cover in support of a sport fishery; therefore, total elimination of aquatic plants would be undesirable. The excess of vegetation contributes to oxygen deficits in the winter months encouraging conditions which foster winter fish kills. In order to sustain some form of sport fishery, the population of Eurasian water milfoil must be greatly reduced and controlled.

Pros	Cons
Temporary Reduction of Aquatic Plants	Limited to Accessible Plant Populations
Reduced Risk of Low Dissolved Oxygen and Winter Kills	Does Not Address Nutrient and Sediment Loading
	Potential High Cost
	Introduction of Chemicals Could Have Negative Impact
Next Steps	
Locate and Secure Funding and Professional Services	
Locate Suitable Disposal Site	
Acquire Permits	

4. Reduce Agricultural Runoff

This option would be used to enhance water quality over a long period of time by installing agricultural best management practices at livestock facilities and on cropland in the watershed. It is necessary to reduce nutrients entering the Millpond in order to slow down the eutrophication process. Agricultural activity is the primary source of human enhanced nutrient and sediment enrichment. Installing best management practices can reduce nonpoint sources of pollution which in turn will add longevity to the implementation of a management plan. Regardless of the objectives for long-term use of the Forestville Millpond, the Door County SWCD is committed to implementing this management option in the Millpond Watershed, and all watersheds throughout Door County. The advantage of implementing agricultural best management practices is that they improve the land's productivity while protecting ground and surface water resources. Continued implementation of these measures will contribute to improved water quality in the Millpond, the Ahnapee River and Lake Michigan.

Pros	Cons
Long-Term Reduction of Nutrient and Sediment Loading	Long-Term Benefits Not Immediately Perceived
Will Also Benefit Lower Ahnapee River and Lake Michigan	Potentially Low Participation
Potential Grant Funding to Assist Landowners	Potentially Costly
Will Also Benefit Groundwater Quality	
Next Steps	
Continue Development of 9-Key Element Plan and Support Steps for Future Designations of the Ahnapee River	
Locate and Secure Funding	
Outreach to Landowners to Encourage Reduction of Soil Erosion and Protection of Water Resources	

5. Develop a Lake Management District or Voluntary Lake Association

This option provides local residents with greater decision making influence. It also provides the Millpond with another potential source of revenue to fund the implementation management options. This option could provide a consistent source of revenue for management of the Millpond. Public lake management organizations include special districts, like public inland districts, town sanitary districts, and commissions formed by local governments. Voluntary lake management organizations include unincorporated associations and nonprofit corporations. A lake management association or a local civic organization (such as a sports club or a "Friends of the Forestville Millpond" could take a lead role in order to make the implementation of future management options successful. Technical support could be provided by the Wisconsin DNR, Door County SWCD, the Fish and Wildlife Service, and nearby universities. Decisions made at the local level are more likely to be acted on. Outreach and education provided by those who live in the community tends to be more effective than from a governmental body. This option invests the local community in the outcome of future management.

Pros	**Cons**
Increased Local Influence on Lake Management Issues	Potentially Low Participation
Organized Structure for Future Management Planning	Revenue for Administration Could Increase Taxes
Opportunity to Generate Revenue	
Members Have a Vested Interest and Share Costs	
Next Steps	
Determine Structure of Organization	
Develop Public Support	
Delineate Boundaries Articles of Incorporation and/or Bylaws	

6. Conduct Intensive Education Effort

This option would incorporate activities such as development of a newsletter, continuation of monitoring efforts, developing an informational bulletin board at the county park, community picnics and sponsoring watershed/shoreline trash clean-up day. This would be executed largely in conjunction with option 4 and/or 5. This option would likely be implemented by a local civic organization or a lake management association with technical support from the Door County SWCD, Wisconsin DNR, and the Fish and Wildlife Service. This is an indirect approach relying on the efforts of the community to make it effective.

Pros	**Cons**
Opportunity to Keep Landowners Informed of Issues	Indirect Approach – Might Not Be Effective
Provide Education to Those with Greatest Impact for Resource Management	
Promotes Local Ownership	
Next Steps	
Identification of a Lead to Carry Out Information and Education Activities	
Identification of a Funding Source to Carry Out Information and Education Activities	

7. Remove the Dam, Eliminate the Millpond and Return the Ahnapee River to an Uninterrupted Stream

This alternative could include the removal of the entire dam structure or just a small portion to allow the stream to return to its natural course and conditions. This may be the least cost management option for greatest impact. Many communities have used this alternative to return their streams to a natural state. This action would eliminate the pond completely and eliminate future management expenses. The Millpond's ability to trap sediment would also be lost, as well as the capacity to support certain aquatic habitats. Removal of the dam would also remove a barricade to invasive species reaching the watersheds of the Upper Ahnapee River. This option would create a dramatic change to the landscape as much of the aquatic habitat would transition to terrestrial or riparian areas. The initial cost of eliminating the dam could be high but removal of a section of the dam would be less costly.

Pros	Cons
Recreates the Ahnappe River's Natural Conditions	Less Acceptable to Public
No Further Maintenance Cost for Dam	Higher Technical Degree of Planning and Permitting
Easier to Manage the County Park	Increased Downstream Sedimentation as Part of Removal Process
Greatly Reduces Human Impacts on the System	Does Not Address Nutrient and Sediment Loading
Return the Ability of Fish to Reach the Upper Ahnapee Watersheds	Disruption of Current Wildlife Habitats
	Disposal of Excavated Dam Materials
	Removal of Barrier to Invasive Species Reaching the Upper Ahnapee River Watersheds
Next Steps	
Detailed feasibility study, planning and design	
Identify location disposal of removed materials	
Permitting process with Wisconsin DNR and Army Corps of Engineers	
Locate and Secure Funding	

8. Full-Year Drawdown of The Millpond

This action would allow bottom sediments (not in the stream channel) to encrust and compact and would be based on a predetermined schedule. Undesirable aquatic vegetation would be greatly reduced for the short-term and rough fish species may all but die out for the short-term. Weed harvesting and/or dredging activities may be undertaken while the pond is drawn down at a reduced cost. When the pond is refilled, the quality of the water and the available capacity would be improved. Rates of a drawdown would be strictly regulated according to Wisconsin DNR standards. Restocking the Millpond with selected fish species would be a necessary measure after the drawdown if an enhanced sport fishery is a desired objective. Reductions of aquatic vegetation, compaction or removal of bottom sediment and control of the rough fish population would be the greatest benefits of this measure. The elimination or reduction of the carp population resulting from drawdown would improve water clarity.

Pros	Cons
Eradication of Undesirable Fish and Plant Species	Visually Unappealing During Drawdown
Sediments Would Compact and Increase Capacity	Potential Odors as Plant Material Deacys
Improvement of Millpond Aesthetics	Disruption/Destruction of Aquatic Habitats
Low Cost Management Option	Potential Downstream Impacts During Drawdown and Refill
Next Steps	
Detailed Planning	
Permitting process with Wisconsin DNR and Army Corps of Engineers	

9. Winter Season Drawdown of The Millpond

This option would have similar impacts as option 8, with the exception of the compaction of the accumulated sediments. This option may be more acceptable to the local community because the Millpond will not be drawn down during the summer months; however, a winter-season drawdown would not be as effective as the full-year drawdown.

Pros	Cons
Eradication of Undesirable Fish and Plant Species	Visually Unappealing During Drawdown
Improvement of Millpond Aesthetics	Potential Odors as Plant Material Deacys
Low Cost Management Option	Limited Disruption/Destruction of Aquatic Habitats
	Potential Downstream Impacts During Drawdown and Refill
Next Steps	
Detailed Planning	
Permitting process with Wisconsin DNR and Army Corps of Engineers	

10. Reconstruct Bottom Gates and Spillway

This option would change the current configuration of the dam to drain through the bottom. Excess sediments would be allowed to flow downstream. Support of this option seeks to more closely replicate the conditions of the original dam structures. Older community members recall the unregulated short-term drawdowns that would occur when community members would remove gate planks which discharged bottom sediments. They urged that this practice was the reason for a better sport fishery than exists today and attributed the perceived decline in the fishery on the existing dam. Observations of the 1984 draw down indicated that flushing of bottom sediments occurred in areas immediately adjacent to the dam and in the stream channel itself; water movement in pooled areas was at too low of a flow rate to re-suspend settled sediments. It is unlikely that reconstructing the dam would better management the sediments.

Pros	Cons
Potential Greater Rate of Water Turnover	Expense of Retrofitting Existing Structure
Some Flushing of Sediment Near Gates	Negative Impacts Downstream from Sedimentation
May Reduce Aquatic Vegetation Near Gates	
Next Steps	
Detailed feasibility study, planning and design	
Permitting process with Wisconsin DNR and Army Corps of Engineers	
Locate and Secure Funding	

10. Public Survey

A crucial component of the process for determining a viable management option is to develop a solid understanding of what various groups feel a healthy millpond looks like. This well-rounded representation should include resource professionals, local and state agencies and members of the public. To develop a better understanding of public understanding and expectations, a survey was developed to determine public knowledge of the millpond, how it's used, perception of conditions and opinion of what should be done to manage the millpond.

The survey was mailed throughout the entire watershed, totaling 997 landowners. 322 surveys were filled out and returned, representing a return rate of 32%. Of the 322 respondents, 282 identified themselves as area residents, 33 identified themselves as visitors and 7 did not answer that specific question. Part of the series of questions tried to establish residency status of the respondents and how the property is utilized (see Chart 10-1 and 10-2). The majority of respondents recorded that their property is a full-time residence and is developed as a residential lot.

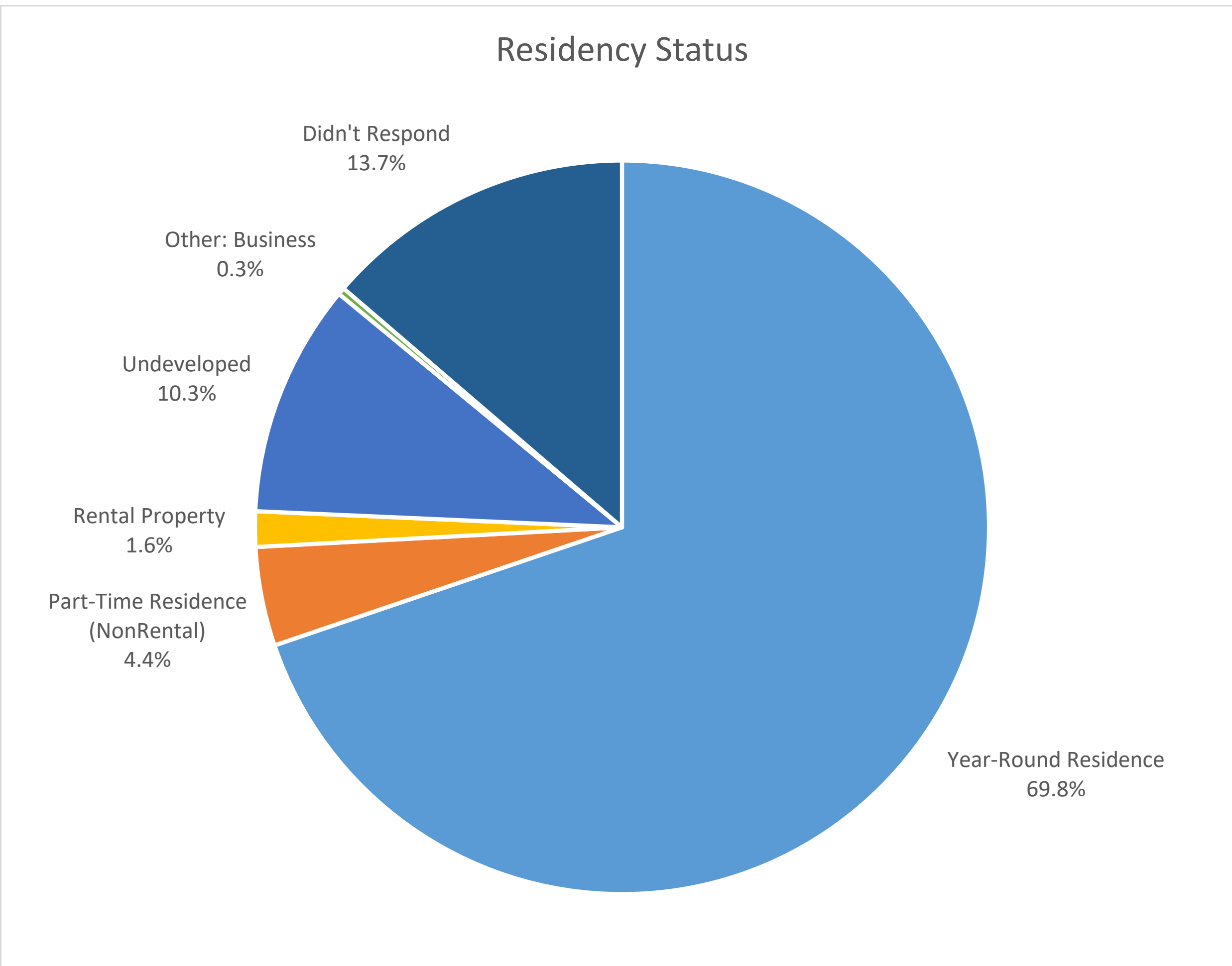

Chart 10-1. Residency Status in Millpond Watershed

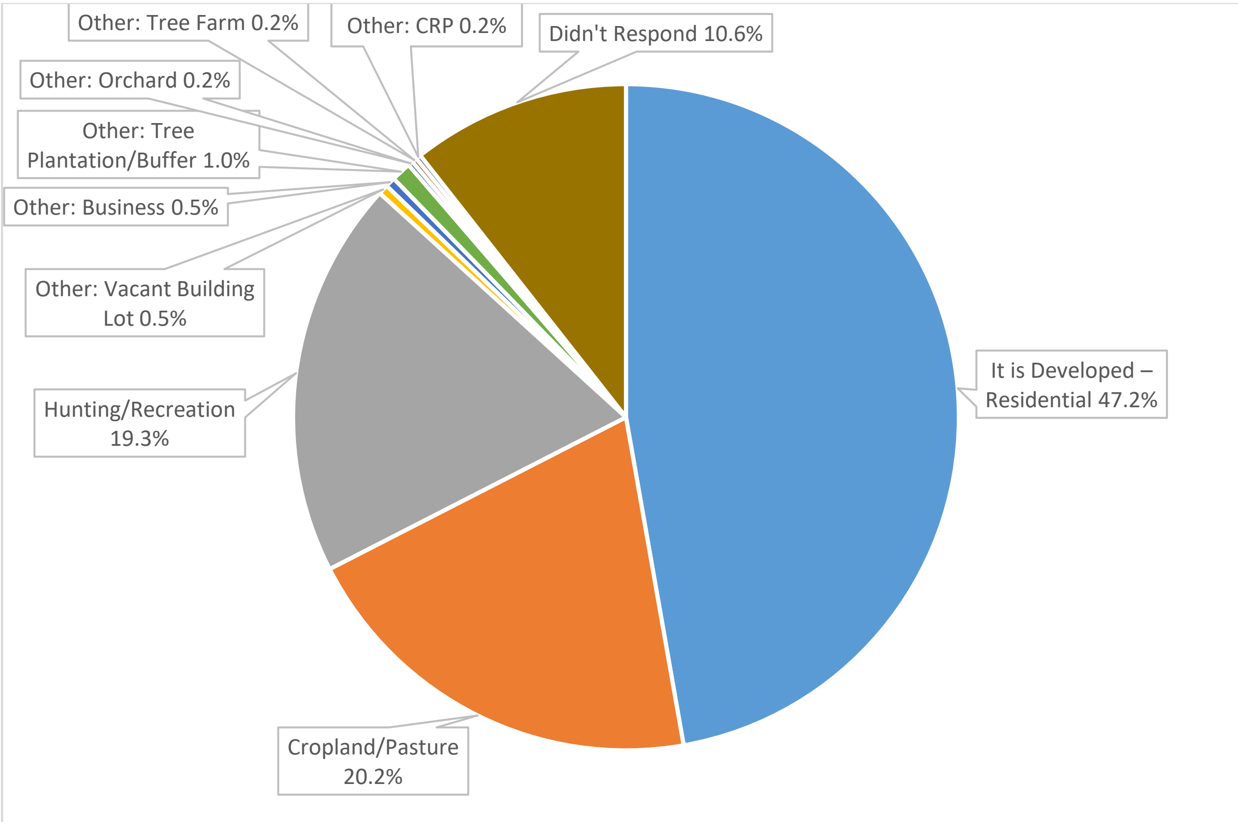

Chart 10-2. Property Use in Millpond Watershed

Consideration was also given to how long each respondent owned or rented their property, as well as how long they had been familiar with the millpond. The survey asked to distinguish waterfront property, and how often the respondent visits the millpond (see Chart 10-3 – Chart 10-5).

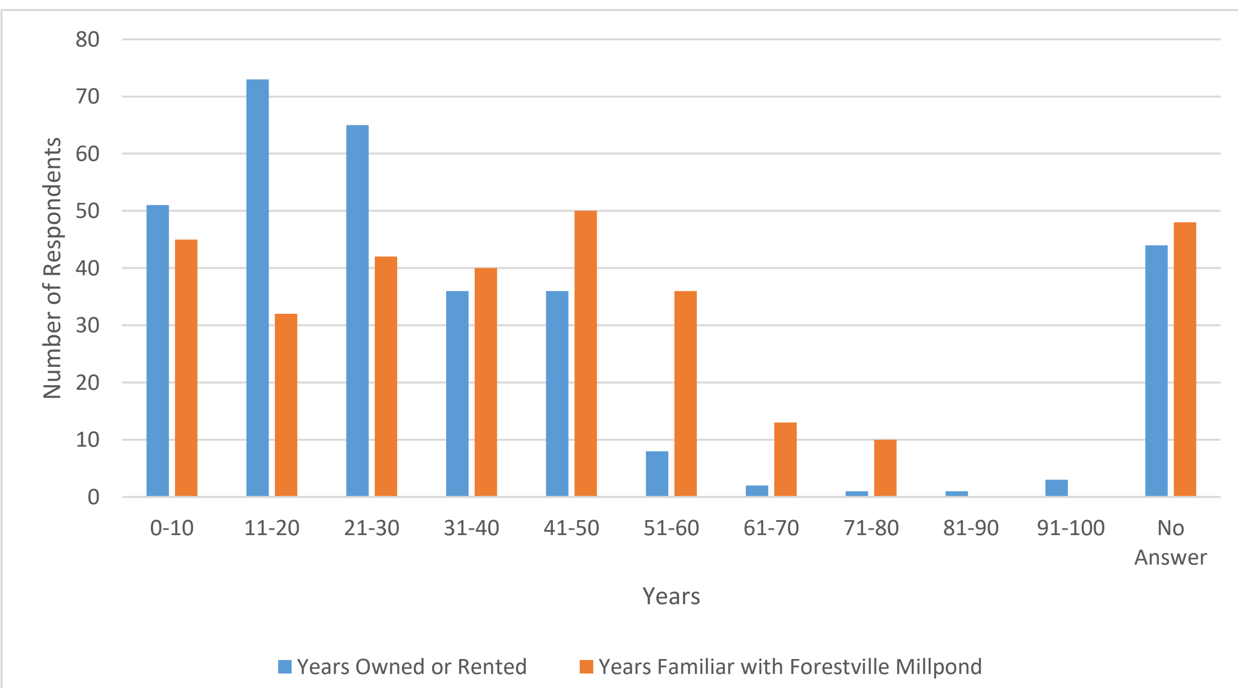

Chart 10-3. Years of Ownership and Familiarity

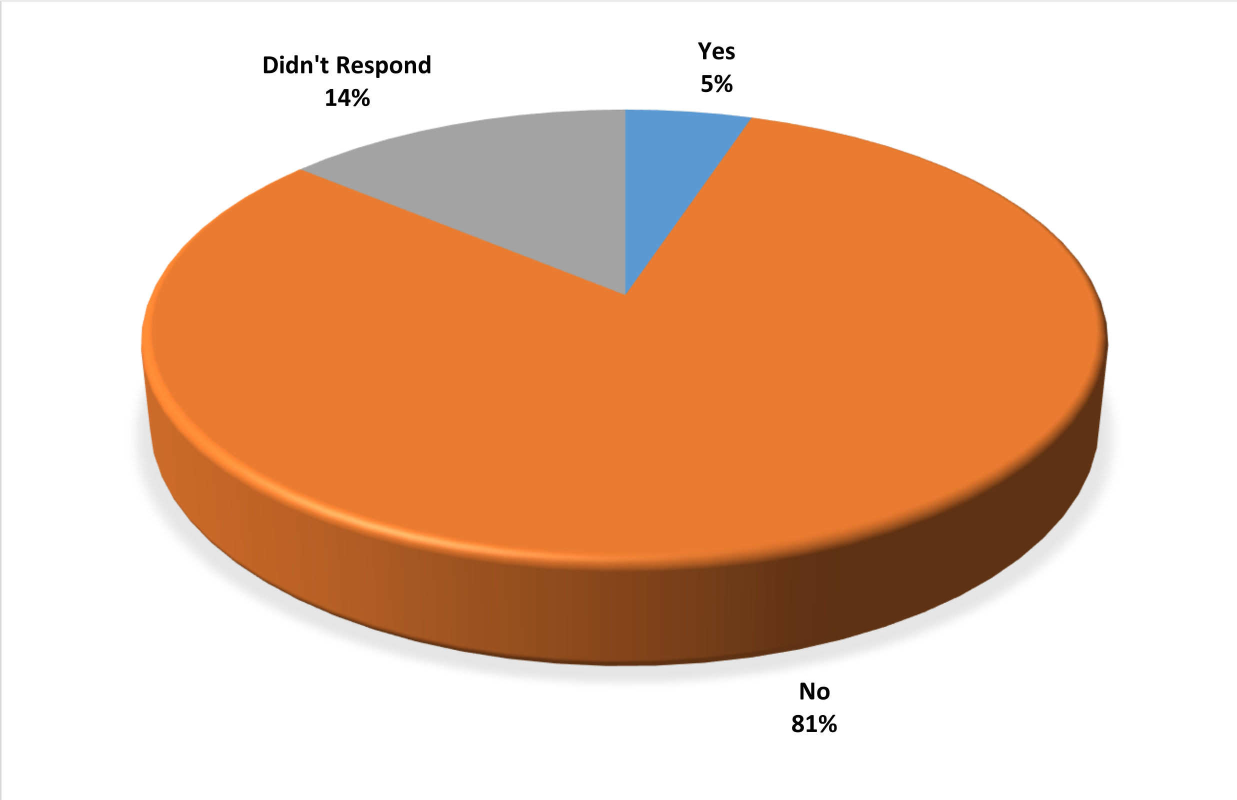

Chart 10-4. Landowners with Property Waterfront to the Millpond

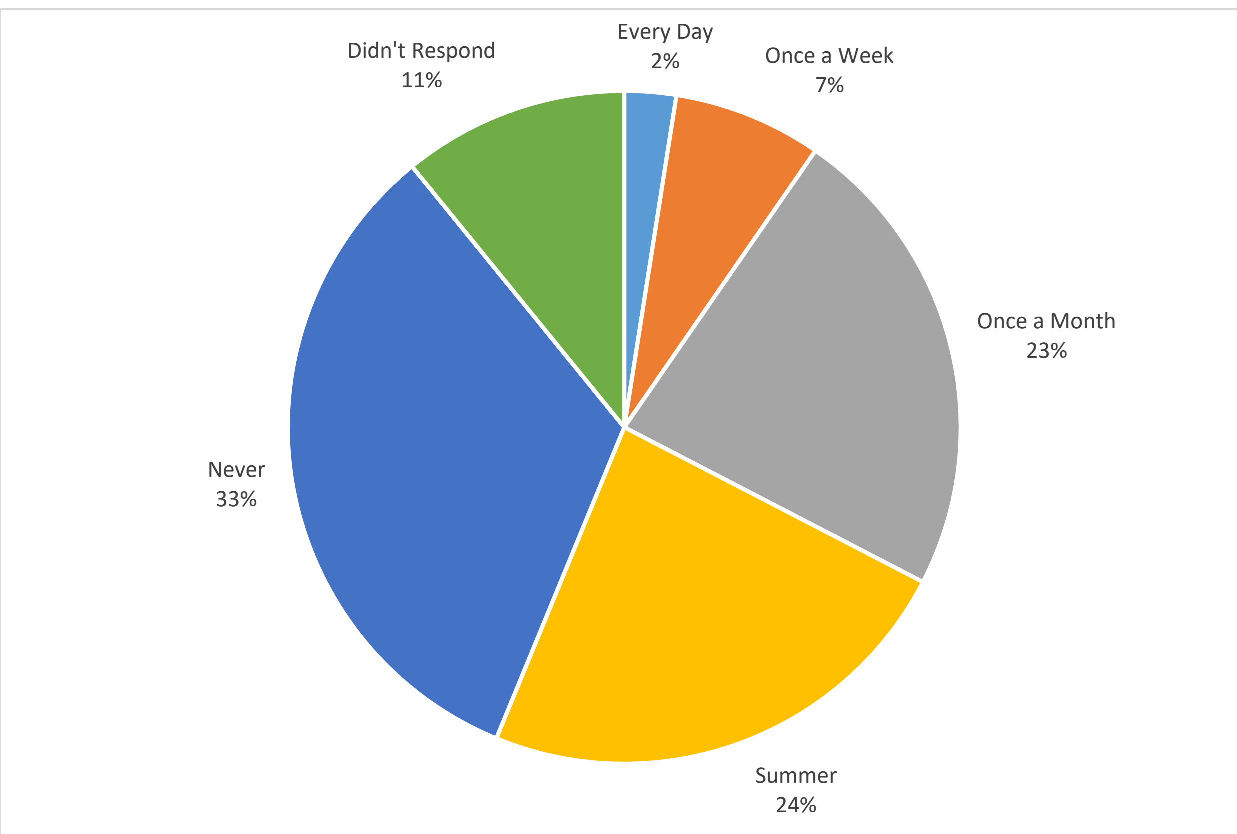

Chart 10-5. Frequency of Visits to the Millpond

Additional questions provided insight into how survey respondents used the Millpond, as well as their favorite use of the Millpond; the first question inviting them to answer all that apply, the second prompting them to choose only one (see Chart 10-6 - Chart 10-7).

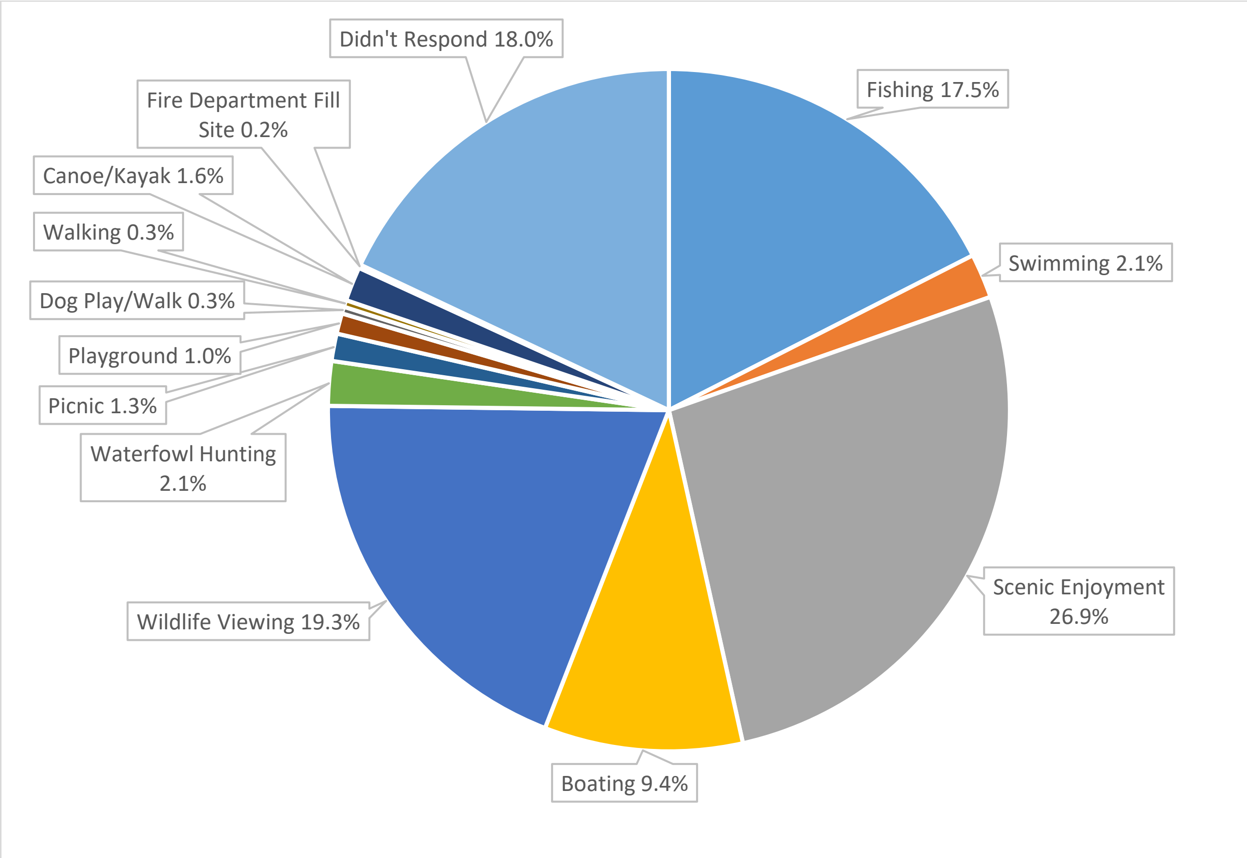

Chart 10-6. Uses of the Millpond

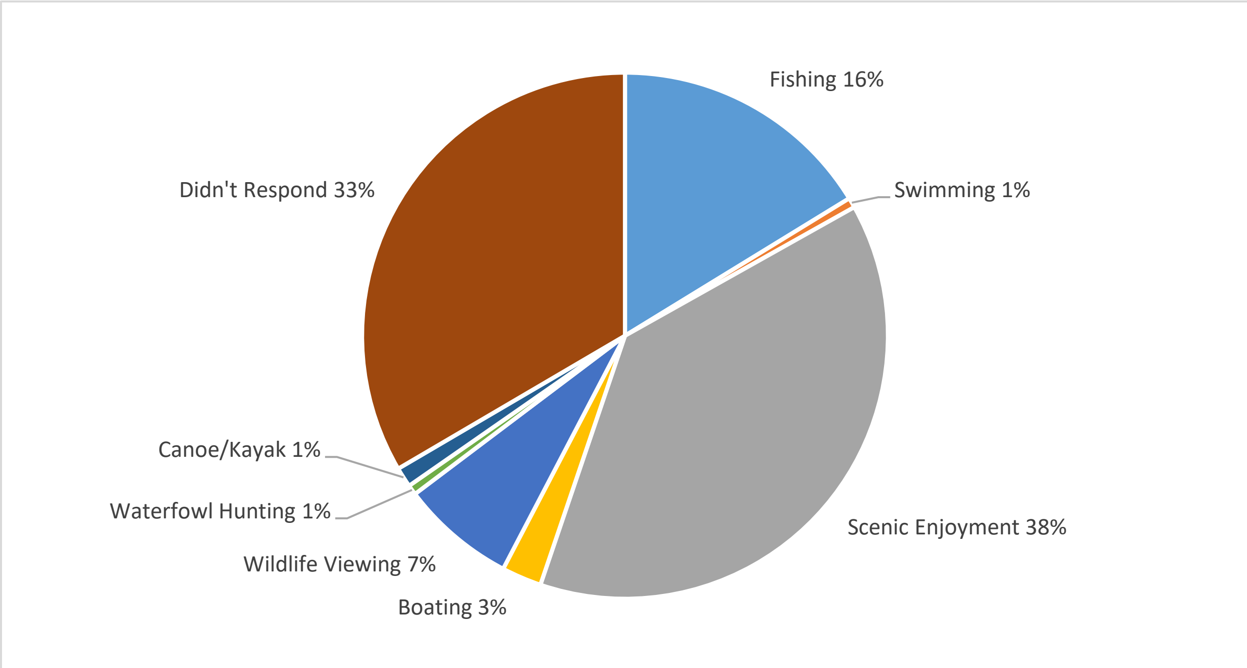

Chart 10-7. Favorite Use of the Millpond

Further questions in the survey considered the respondents opinion of water quality in the Millpond and how it has changed since they first became familiar with the waterbody (see Chart 10-8 and Chart 10-9).

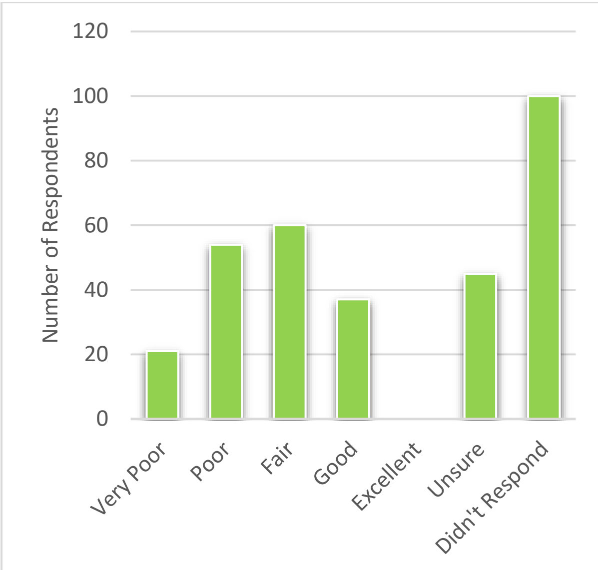

Chart 10-8. Opinion of Millpond Water Quality

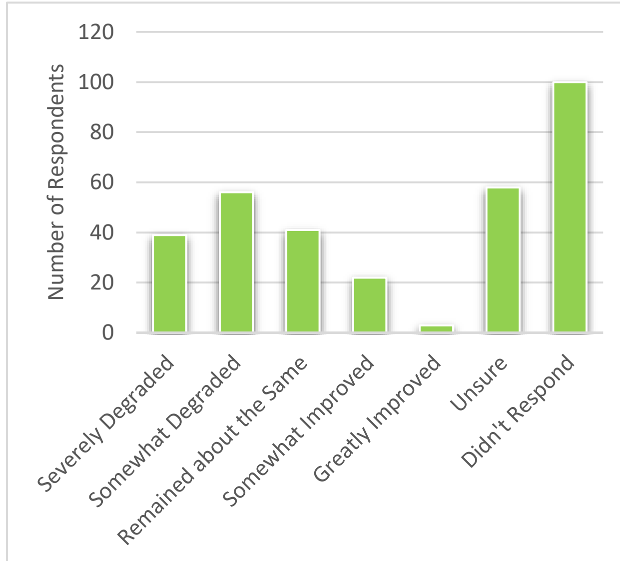

Chart 10-9. Perception of Water Quality Change

The last segments of the survey were much more specific in the perceived cause of impairments to the Millpond, as well as opinions of future management options. The impairments were chosen based on historic and current observations by county department staff, state and federal agencies, local government officials and the general public. Many of these perceived impairments have continued to be listed as concerns at the Millpond. Likewise, the suggested management options are those presented over the years by many of the same groups. These options were disseminated in the 1996 study, and revisited as part of this effort. A summary of the perceived issues and the potential management options are as follows in Chart 10-10 and Chart 10-11.

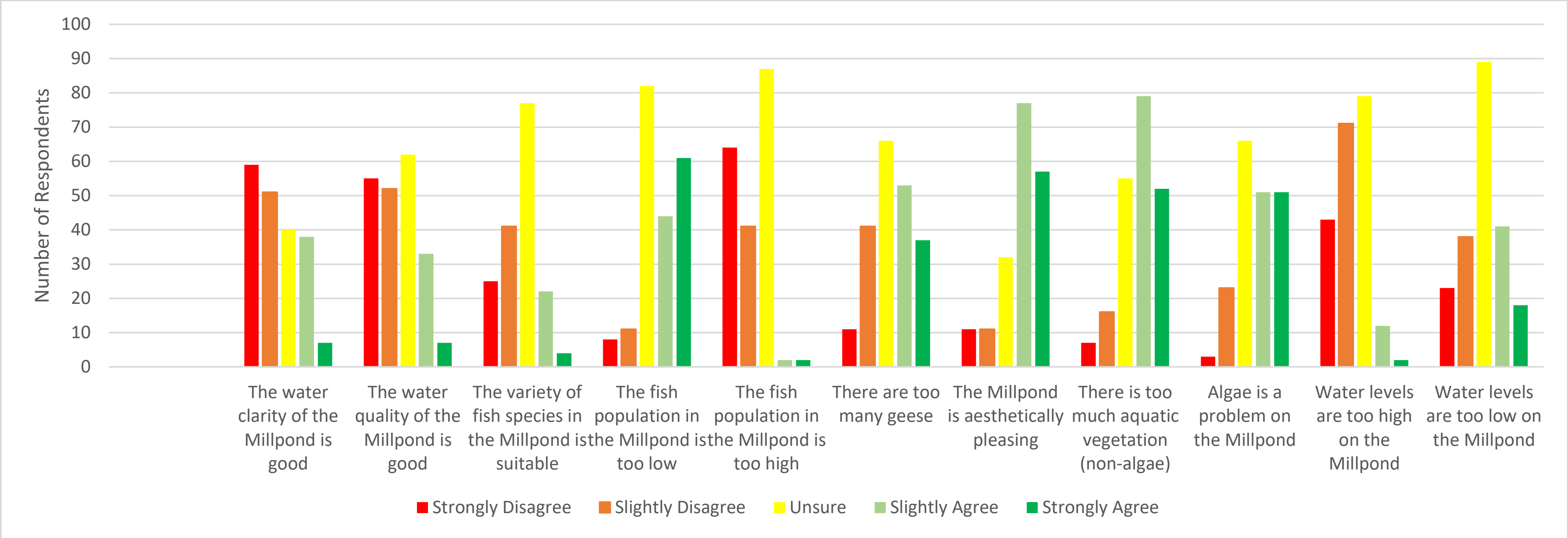

Chart 10-10. Perceived Issues Impairing the Millpond

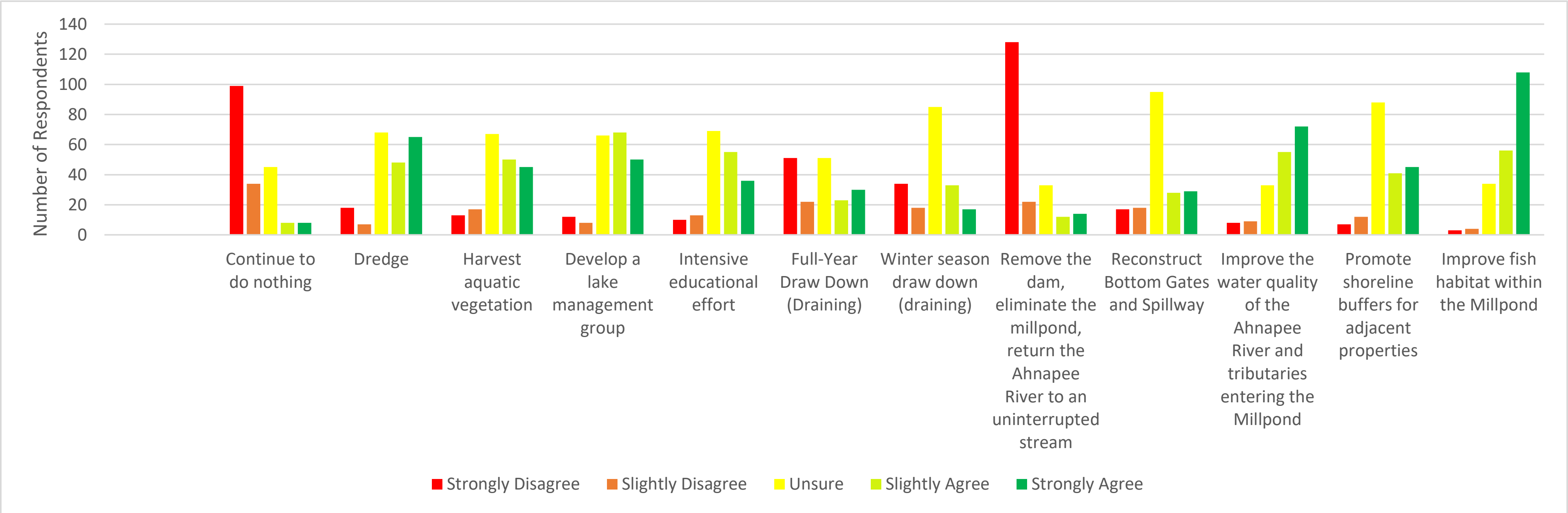

Chart 10-11. Opinion of Potential Management Options

Summary of Results

The return on the mailed surveys was very good, over 30% were returned to provide a good sample set of watershed-wide opinions regarding the Forestville Millpond.

The survey respondents were overwhelmingly local, year-round residents with most identifying their property as being developed for residential use, but a significant amount also signifying that the property was cropland/pastureland or hunting/recreational.

The Most popular response for use of the Millpond was scenic enjoyment and a majority of the responses rated the water quality as poor or fair. The largest opinion of changes to the Millpond was that the water quality has become somewhat degraded.

Answers to the questions on perceived issues are somewhat spread out across the full spectrum of replies. A general analysis of results shows:

- Respondents are inclined to disagree that the water quality and water clarity of the Millpond is good
- Respondents are unsure on the suitability of the variety of fish
- Respondents are inclined to agree that the fish population is too low and to disagree that the fish population is too high
- Respondents are unsure, or slightly agree that there are too many geese
- It is agreed that the Millpond is aesthetically pleasing
- It is agreed that there is too much aquatic vegetation and algae on the Millpond
- Most respondents are unsure on the adequacy of water levels, but responses lean more toward disagreement that the water levels are too high

Upon review of the responses to potential management options, it becomes clear that the sample set is fairly evenly distributed for each option. The management options that have a clear majority opinion are as follows:

- A majority of respondents disagree with the option of continuing to do nothing
- A majority of respondents disagree with the option to remove the dam and eliminate the Millpond to return the Ahnapee River to an uninterrupted stream
- Respondents are inclined to agree with the options of improving the water quality of the Ahnapee River and its tributaries, promoting shoreline buffers and improving fish habitat within the Millpond

Of the 322 respondents, sixteen identified themselves as owning property waterfront to the Millpond. An analysis of responses from this sample set was done separately and the results were nearly identical with opinions of perceived issues and potential management options.

11. Next Steps

The final report and associated data completes the requirements for the Wisconsin DNR Lake Management Planning Grant Project #LP162317. It was presented to the Door County Land Conservation Committee and Facilities & Parks Committees at a joint meeting on June 21, 2018 for their review and acceptance.

Following completion of the final report the next steps are to make solid recommendations on one or more management options to address the degraded conditions of the Ahnapee River and the Forestville Millpond. A sequenced effort will be used to encourage public participation in the process and build acceptance of the selected management options:

1. SWCD will assemble a technical stakeholder committee to use the contents of the final report to vet the management options, evaluate the pros, cons, and costs of each, and to prioritize them. This will include detailed discussions of goals and objectives of a possible future project and the ways in which each management option achieves those goals. The stakeholder committee will meet up to three times and consist of a balanced representation of local conservation professionals such as Wisconsin DNR water quality and fisheries staff, local conservation and/or friends groups, and one-two members of the LCC and/or Facilities & Parks Committees.
2. SWCD will hold an informational meeting for the public. This will inform interested people and provide them factual information so they can understand current conditions and the prioritized management options.
3. The Land Conservation Committee and Facilities & Parks Committee will review and approve the recommended management options identified by the technical stakeholder committee.

Time Frame	**Action**	**Responsible Entity**
June 2018	Accept Final Report	Land Conservation Committee, Facilities & Parks Committee
June 2018	Submit Final Report and grant documentation to WDNR	SWCD
August, September & October 2018	Up to three technical stakeholder meetings to identify preferred management option(s)	SWCD
Fall 2018	Public Meeting	SWCD
November 2018	Review management option(s) recommendations	Land Conservation Committee, Facilities & Parks Committee
December 2018	Approve management option(s) recommendations	Land Conservation Committee, Facilities & Parks Committee
Ongoing thereafter	Identify funding sources to complete detailed plans/designs. Implement the selected management option.	Land Conservation Committee, SWCD

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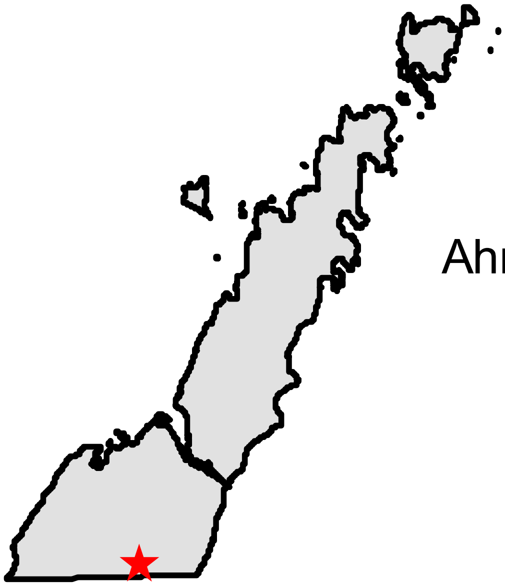
Wisconsin Department of Natural Resources
Chapters: NR 102, NR 104, NR 105, NR 347.

Water Chemistry Raw Data

Suspended Solids - mg/L	15-May	30-May	12-Jun	17-Jul	31-Jul	22-Aug	30-Aug	16-Sep	30-Sep	15-Oct	28-Oct
Station #10047671	0.00	2.50	4.25	2.50	0	4.0	7.2	11.3	12.5	7.75	6
Station #10047672	4.75	3.25	5.50	3.60	3.0	5.6	2.6	2.4	0	14.8	0
Stations #10047673	0.00	3.50	6.75	3.00	2.8	7.8	2.8	0	0	9	2
Station #153161	0.00	4.67	7.25	8.00	11.3	12.0	10.2	4.4	2.6	7	3.6
FMP (1 foot)				22		22.5		5.8			
FMP (3 foot)								7.6			
FMP (5 foot)											
Total Phosphorus - mg/L	15-May	30-May	12-Jun	17-Jul	31-Jul	22-Aug	30-Aug	16-Sep	30-Sep	15-Oct	28-Oct
Station #10047671	0.0368	0.0360	0.0412	0.052	0.0196	0.0258	0.0333	0.165	0.334	0.13	0.0456
Station #10047672	0.0286	0.0431	0.0614	0.0662	0.0327	0.0392	0.0227	0.018	0.0201	0.261	0.0419
Stations #10047673	0.0290	0.0454	0.0652	0.0813	0.0369	0.0568	0.0270	0.0181	0.02	0.0793	0.0376
Station #153161	0.0204	0.0590	0.107	0.0974	0.1200	0.108	0.0904	0.023	0.0258	0.0576	0.0423
FMP (1 foot)				0.136		0.0851		0.0355			
FMP (3 foot)								0.0348			
				0.02		0.02		0.02			
	0.0750	0.0750	0.0750	0.0400	0.0750	0.0400	0.0750	0.0400	0.0750	0.0750	0.0750
Chlorophyll A - µg/L	15-May	30-May	12-Jun	17-Jul	31-Jul	22-Aug	30-Aug	16-Sep	30-Sep	15-Oct	28-Oct
FMP (1 foot)				59		41.7		5.1			
FMP (3 foot)								6.44			
FMP (5 foot)											
Nitrate + Nitrite - mg/L	15-May	30-May	12-Jun	17-Jul	31-Jul	22-Aug	30-Aug	16-Sep	30-Sep	15-Oct	28-Oct
FMP (1 foot)				0.909		0.815		2.00			
FMP (3 foot)								2.04			
FMP (5 foot)											
Total Nitrogen- mg/L	15-May	30-May	12-Jun	17-Jul	31-Jul	22-Aug	30-Aug	16-Sep	30-Sep	15-Oct	28-Oct
FMP (1 foot)				2.36		2.32		1.31			
FMP (3 foot)								1.22			
FMP (5 foot)											
Temp - C	15-May	30-May	12-Jun	17-Jul	31-Jul	22-Aug	30-Aug	16-Sep	30-Sep	15-Oct	28-Oct
Station #10047671	14.4	16.0	18.1	16.1	22.57	16.55		18.19	14.46	12.2	7
Station #10047672	11.4	16.5	20.2	17.7	22.91	18.91		20.21	12.4	11.9	6.98
Stations #10047673	11.6	16.6	20.2	17.4	22.67	18.93		20.35	12.09	11.9	6.99
Station #153161	12.8	17.6	20.7	17.6	19.95	20.02		17.64	10.81	11.4	7.45
Ambient Temperature											
Sub-Lethal Criteria											
Acute Criteria											
FMP (1 foot)				25.43		23.95		23.78	18.4		
FMP (3 foot)				21.98		23.79		23.58	18.39		
FMP (5 foot)				21.66		23.76		23	18.28		
Air Temp - C	15-May	30-May	12-Jun	17-Jul	31-Jul	22-Aug	30-Aug	16-Sep	30-Sep	15-Oct	28-Oct
Station #10047671	14	14	21	16	22	20	19	29	11	11	4
Station #10047672	14	14	21	16	22	20	19	29	11	11	4
Stations #10047673	14	14	21	16	22	20	19	29	11	11	4
Station #153161	14	14	21	16	22	20	19	29	11	11	4
FMP (1 foot)				16		20		29	11	11	4
FMP (3 foot)				16		20		29	11	11	4
FMP (5 foot)				16		20		29	11	11	4
Dissolved Oxygen - mg/L	15-May	30-May	12-Jun	17-Jul	31-Jul	22-Aug	30-Aug	16-Sep	30-Sep	15-Oct	28-Oct
Station #10047671	8.8	9.0	8.7	6.13	3.37	4.14		3.79	1.78	8	4.1
Station #10047672	8.7	8.8	7.9	5.6	5.82	3.8		9.98	10.52	8.2	4
Stations #10047673	8.9	9.2	7.8	5.4	5.5	3.62		10.14	10.47	9.4	1.3
Station #153161	10.3	7.2	5.5	5.4	5.94	2.88		10.09	10.17	9.5	3.9
FMP (1 foot)				6.23		3.2		10.48	10.11		
FMP (3 foot)				4.42		3.29		10.39	10.11		
FMP (5 foot)				3.93		3.43		10.82	10.17		
			5.0	5		5		5	5		
pH	15-May	30-May	12-Jun	17-Jul	31-Jul	22-Aug	30-Aug	16-Sep	30-Sep	15-Oct	28-Oct
Station #10047671	8.5	8.3	8.3	7.4	7.13	7.92		6.17	6.18	6.2	8.02
Station #10047672	8.4	8.6	8.3	7.7	8.28	8.06		7.16	8.07	6.9	7.96
Stations #10047673	8.4	8.7	8.5	7.6	8.16	8.04		6.98	6.81	5.9	8.02
Station #153161	8.4	7.8	8.3	6.6	7.87	7.79		6.8	6.43	5.9	7.96
FMP (1 foot)				8.11		8.29		6.66	8.14		
FMP (3 foot)				7.82		8.39		7.63	8.32		
FMP (5 foot)				7.72		8.42		8.05	8.37		



Sampling & Analysis Plan for the Ahnapee River/Forestville Millpond Dredging Project

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Brian Forest
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Appendix B

Sampling & Analysis Plan
for the
Ahnapee River/Forestville Millpond Dredging Project

August 23, 2017

Parameters to be analyzed:

Parameter (All intervals of each core sample)	Analytical Method	Detection Level
PCBs	Megabore Column Chromatography	0.024 µg/g
Total Phosphorus	EPA 365.1	0.00500 mg/L
Mercury	SW846 7471	0.015 mg/Kg
Lead	EPA SW846 3050B (digestion) EPA SW846 6010B (analysis ICP)	1.0 mg/Kg
Copper	EPA SW846 3050B (digestion) EPA SW846 6010B (analysis ICP)	0.5 mg/Kg
Arsenic	EPA SW846 3050B (digestion) EPA SW846 6010B (analysis ICP)	1.0 mg/Kg
Oil & Grease	EPA SW846 9071A	5.0 mg/Kg
Particle Size (Sand/Silt/Clay)	Hydrometer	% Distribution
Parameter (Target Dredge Depth plus 2-feet increment of sample 1 only)	**Analytical Method**	**Detection Level**
Chlordane	Capillary Column Chromatography	0.0085 µg/g
Dieldrin	Capillary Column Chromatography	0.012 µg/g
DDT	Capillary Column Chromatography	0.014 µg/g
DDD	Capillary Column Chromatography	0.010 µg/g
DDE	Capillary Column Chromatography	0.0050 µg/g

Sampling Location Map:

- Please see attached for six samples to be collected for analysis and additional eight cores to be collected for future analysis

Planned sectioning of cores at each sample location:

- Cores will be comprised of material from the sediment surface (0 feet) to 6 or 8 feet, depending on total depth of sediment to bedrock. If bedrock is not encountered, cores will be collected to the proposed dredge depth plus 2 feet.
- Each core will be examined for stratigraphic layering. If present, the cores will be analyzed based on the stratigraphic units.
- If there is no stratigraphic layering present, each core will be sectioned and analyzed in 2-foot increments: 0 – 2 feet, 2 – 4 feet, 4 – 6 feet and 6 – 8 feet.
    - Sample #1 will be located adjacent to the dam structure will be segmented as outlined above, plus one additional sample at the target dredge depth plus 2 feet. This sample will be analyzed for the following: Chlordane, Dieldrin, DDT, DDD & DDE. If results indicate the presence of these pesticides, and additional information is necessary, additional analyses will be performed on the stored samples taken from other cores adjacent to the dam structure. These will test for the above pesticides, as well as the following: Aldrin, Endrin, Heptachlor, Lindane and Toxaphene.

Sampling methods & handling procedures:

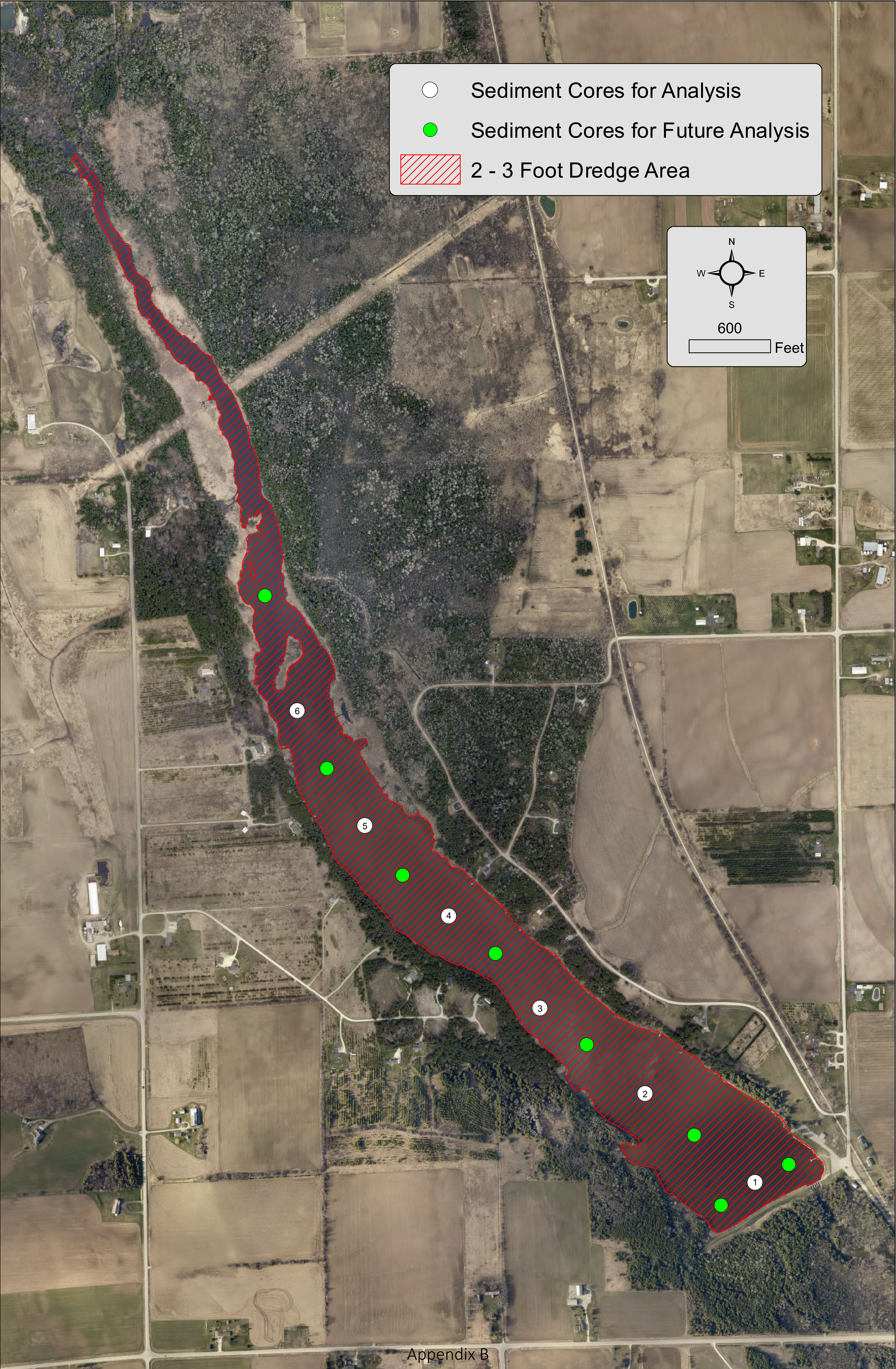
- The contractor will obtain samples with a core sampler in a vertical, continuous length of sediment, at the designated locations
- Each sediment core will be accompanied by a field report documenting the GPS coordinates, length of the interval, odor, texture and color of the representative strata

- Documentation for each core location will also include water depth and total sediment thickness.
- Sample storage equipment and methods will be done in the following manner:
  - A clean pair of new, non-powdered, disposable gloves will be worn each time a different location is sampled and the gloves should be donned immediately prior to sampling. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised.
  - Sample containers with samples suspected of containing high concentrations of contaminants will be stored separately.
  - All background samples will be collected and placed in separate ice chests or shipping containers.
  - Sample collection activities will proceed progressively from the least suspected contaminated area to the most suspected contaminated area if sampling devices are to be reused.
  - Samples of waste or highly contaminated media will not be placed in the same ice chest as environmental (i.e., containing low contaminant levels) or background samples.
  - If possible, one member of the field sampling team will take all the notes and photographs, fill out tags, etc., while the other members collect the samples. Samplers will use new, verified and certified-clean disposable or nondisposable equipment cleaned according to procedures contained in SESD Operating Procedure for Field Equipment Cleaning and Decontamination, SESDPROC-205, or SESD Operating Procedure for Field Cleaning and Decontamination at the FEC, SESDPROC-206, for collection of samples for trace metals or organic compound analyses.
  - Detergent will be a standard brand of phosphate-free laboratory detergent such as Liquinox® or Luminox®.
  - Samples collected for PCB, pesticide and other organic analyses will be collected and processed using metallic equipment
  - Samples collected for other chemical analyses will be collected and processed using non-metallic equipment
  - Cores that are stored for future analyses will be kept at -80°

<u>Contactor and Certified Lab information</u>:

Contractor: UW – Oshkosh Environmental Research & Innovation Center
783 Pearl Avenue, Oshkosh WI, 54901
(920) 424-3148

Certified Lab: Wisconsin State Laboratory of Hygiene
2601 Agriculture Drive, Madison WI, 53718
(920) 224-6202


Sediment Cores for Analysis
Sediment Cores for Future Analysis
2 - 3 Foot Dredge Area
N
W
E
S
600
Feet
1
2
3
4
5
6

Appendix C

Sediment Core Raw Data

Core #	Depth (cm)	Oil & Grease (mg/kg)	Arsenic (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Phosphorus (mg/kg)	Mercury (mg/kg)	PCB (ug/g)	DDE (ug/g)	DDT (ug/g)	Chlordane (ug/g)	Dieldrin (ug/g)	DDD (ug/g)	Solids (%)	Sand (%)	Silt (%)	Clay (%)	PCB Detected
1-1	0-20	1380	1.93	20.1	9.18	1190	0.0532	ND						16.4	12	61	27	
1-2	24-70	2590	3.3	23.3	11.1	1040	0.0548	ND	ND	ND	ND	ND	ND	20.9	24	56	20	
1-3	70-100	1370	4.94	28.3	17.1	1100	0.1	ND						28.3	28	50	22	
2-1	0-37	1290	1.74	25.4	10.5	989	0.0896	0.039						26	34	42	24	Aroclor - 1254
2-2	37-45	3230	2.54	24.9	13.2	857	0.101	ND						19.6	50	50	0	
2-3	45-56	546	3.9	56.9	10.9	1310	0.116	ND						48.3	25	49	26	
3-1	0-46	1890	1.52	23.1	12.5	925	0.0887	ND						18.3	23	55	21	
3-2	46-65	642	4.71	33.6	9.27	1250	0.235	0.04						59.7	22	52	26	Aroclor - 1254
3-3	65-86	3730	2.96	29.4	4.86	764	0.111	0.055						19.6	60	40	0	Aroclor - 1254
4-1	0-22	1330	1.57	22.7	12	1000	0.0856	ND						19.7	22	66	12	
4-2	17-39	764	3.34	23.4	13.8	968	0.106	ND						32.3	48	50	2	
4-3	39-52	165	3.64	25.7	10.5	1220	0.114	ND						31.9	44	54	2	
5-1	0-20	1250	2.93	20.6	10.9	1100	0.0952	ND						25.1	50	46	4	
5-2	29-49	282	3.6	21	9.01	1590	0.11	ND						45.1	32	44	24	
5-3	49-60	342	5.91	27	8.83	1870	0.162	ND						57.7	24	52	24	
6-1	0 - 20	577	1.33	24.3	12.2	1030	0.1	ND						20.9	30	66	4	
6-2	17-35	1040	2.31	22	14.5	907	0.0992	0.035						25.3	42	58	0	Aroclor - 1254
6-3	35-57	633	3.99	42.9	11.3	1270	0.204	ND						43.2	24	48	28	
LOD		23.9	0.995	0.497	0.995	39.8	0.0144	0.024	0.005	0.014	0.0085	0.012	0.01	0.002				
LOQ		23.9	2.98	1.59	2.98	119	0.0431	0.08	0.016	0.045	0.028	0.041	0.033	0.002				
TEC			9.8	32	36		0.18	60	3.2	4.2	3.2	1.9	4.9					
MEC			21.4	91	83		0.64	368	17	33.6	10.6	32	16.5					
PEC			33	150	130		1.1	676	31	63	18	62	28					

State of Wisconsin

CORRESPONDENCE/MEMORANDUM

DATE: September 28, 2016 FILE REF: [Click **here** and type file ref.]

TO: Mike Donofrio
Forestville Millpond File

FROM: Steve Hogler
Steve Surendonk

SUBJECT: 2016 Forestville Millpond Fish Survey

The Forestville Millpond (WBIC-95700) is a 65 acre impoundment of the Ahnapee River located in southern Door County (WDNR 2001). The millpond has a maximum depth of 6 feet, an average depth of 2 feet and is located in an agricultural watershed. Historical records indicate that the first dam was constructed at this location in 1877 and the river has been impounded the majority of years since (Door County SWCD 1996). The current dam was reconstructed in 1982.

Historically the fishery found in the millpond has alternated between a desirable mix of Northern Pike, Largemouth Bass and panfish to one dominated by bullhead and Common Carp (Lychwick 1984). Poor water quality has likely been the driver of the make-up of fish community due to the shallow nature of the millpond and the level of nutrients that enter the millpond from the watershed. High nutrient levels have led to algae blooms which have then been followed by frequent winter kills caused by low dissolved oxygen as algae decomposed over winter. Following the fish kills, the millpond has been restocked with a desirable mix of fish (Lychwick 1984)

Following reconstruction of the dam in 1982, DNR Fish Management chemically treated the millpond using rotenone to remove undesirable fish species and restocked gamefish species (Lychwick 1984). Although the entire stream above the millpond was not treated, it was believed that the vast majority of Common Carp found in the impoundment were removed by the rotenone treatment. Following the rotenone treatment the millpond was restocked with a mixture of Largemouth Bass, Smallmouth Bass and Northern Pike (Table 1).

Table 1. The summary of fish stocked into the Forestville Millpond following the 1984 rotenone treatment.

Year	Species	Age Class	Number Fish Stocked	Average Fish Length (IN)
1983	NORTHERN PIKE	FINGERLING	375	11
1985	MUSKELLUNGE	FRY	65,000	1
1985	NORTHERN PIKE	FINGERLING	325	9
1986	NORTHERN PIKE	FINGERLING	325	9
1986	SMALLMOUTH BASS	FINGERLING	2,000	3
1987	NORTHERN PIKE	FINGERLING	975	9
1990	NORTHERN PIKE	FRY	100,000	1
1991	LARGEMOUTH BASS	FINGERLING	7,000	2
1991	NORTHERN PIKE	FINGERLING	360	7.9
1992	LARGEMOUTH BASS	FINGERLING	3,250	1
1992	NORTHERN PIKE	FINGERLING	2,830	5.5
1993	LARGEMOUTH BASS	FINGERLING	7,000	1

Although it initially appeared that stocking had been successful, additional large fish kills occurred on the millpond by 1996 (Door County SWCD 1996). Both were attributed to low dissolved oxygen levels in the millpond likely caused by excess nutrients entering the millpond which fueled large algae blooms followed by the resultant decomposition of the dead algae.

The last fishery survey was conducted in 2008 when Forestville Millpond was electroshocked during the evening of May 6, 2008 to assess the lake's gamefish populations (Hogler and Surendonk 2008). Survey results indicate that the Largemouth Bass population was doing well with above average growth although several young age classes were missing and that the Northern Pike and panfish catches were less than expected based on past surveys. Common Carp was the dominant species captured during the survey likely indicating that poor water quality was still an issue in the millpond.

2016 Survey Methods and Results:

Following Wisconsin lake sampling protocols, Forestville Millpond was surveyed during the evening of June 1, 2016 to assess the lake's fish populations. During the 1.5 hours of electrofishing, the entire shoreline was surveyed and an attempt was made to net all observed fish. All landed fish were identified, measured to the nearest millimeter and then released. Spines from Largemouth Bass and scales from Black Crappie were collected for age analysis before these species were released. Common Carp and White Sucker were not netted although they were counted if netters could touch the fish.

During the 1.5 hours of shocking we captured 293 individual fish representing ten species. Total CPE was 195.3 fish per hour or 125.2 fish per mile shocked. Common Carp dominated the catch followed by Yellow Perch and Largemouth Bass with fewer fish of other species captured (Table 2).

Table 2. Abundance and CPE of fish captured during 2016 spring electrofishing on the Forestville Millpond.

Species	Number	CPE (Fish/ HR)	CPE (Fish/Mile	Average Length (mm)	Size Range (mm)
Northern Pike	4	2.7	1.7	473 mm (18.6")	413-537 mm (16.3" to 21.1")
Largemouth Bass	29	19.3	12.4	367 mm (14.4")	325-409 mm (12.8" to 16.1")
Yellow Perch	37	24.7	15.8	189 mm (7.4")	85-308 mm (3.3" to 12.1")
Bluegill	5	3.3	2.1	136 mm (5.4")	72-202 mm (2.8" to 8")
Pumpkinseed Sunfish	1	0.7	0.4	106 mm (4.2")	106 mm (4.2")
Black Bullhead	1	0.7	0.4	259 mm (10.2")	259 mm (10.2")
Yellow Bullhead	1	0.7	0.4	270 mm (10.6")	270 mm (10.6")
Black Crappie	9	6.0	3.8	305 mm (12")	297-312 mm (11.7" to 12.5")
Common Carp	190	126.7	81.2	--	--
White Sucker	16	10.7	6.8	--	--
Total	293	195.3	125.2		

Gamefish

Largemouth Bass were the most common gamefish captured during this survey (Table 2). The 29 handled bass ranged in length from 325 mm to 409 mm (12.8” to 16.1”) and had an average length of 367 mm (14.4”) (Table 3). Twenty-one of the twenty-nine captured bass (72.4%) were longer than the 356 mm (14”) minimum harvest size limit imposed on anglers.

Table 3. The length frequency of fish captured from Forestville Millpond during the June 2016 survey.

Length (in) mm	Largemouth Bass	Northern Pike	Yellow Perch	Bluegill	Pumpkin-seed Sunfish	Black Bullhead	Yellow Bullhead	Black Crappie
70				1				
80			4					
90			2					
(4”) 100			2		1			
110				1				
120								
130				1				
140			1					
(6”) 150			1	1				
160			2					
170			1					
180			1					
190			3					
(8”) 200			2	1				
210			2					
220			5					
230			5					
240			4					
(10”) 250						1		
260			1					
270							1	
280								
290								1
(12”) 300			1					6
310								2
320	1							
330	1							
340	4							
(14”) 350	3							
360	8							
370	4							
380	6							
390								
(16”) 400	2							
410		1						
420								
430								
440								
(18”) 450		1						
460								
470								
480		1						
490								
(20”) 500								
510								
520								
530		1						
Total	29	4	37	5	1	1	1	9
Ave. Length	367 (14.4”)	473 (18.6”)	189 (7.4”)	136 (5.4”)	106 (4.2”)	259 (10.2”)	270 (10.6”)	305 (12”)
S.D.	18.4	52.0	59.9	48.1	--	--	--	5.0

Dorsal spine samples were collected from all captured bass to estimate age. Analysis of the spines indicated that in our sample, captured bass ranged in age from age 4 through age 7 (Table 4). Most bass were either age 4 or age 5, with fewer bass in the other age categories. Comparison to the most recent survey and statewide length at age information found on the state fish database indicates that in 2016, length at age was similar to results found in 2008 and was near to statewide averages across Wisconsin for bass (Table 5). Since few bass were captured overall and since few bass were greater in age than age 6, growth information should be viewed cautiously.

Table 4. The distribution of age of Largemouth Bass captured from Forestville Millpond, June 1, 2016.

Length (in) mm	Largemouth Bass	Age						
		1	2	3	4	5	6	7
(12") 300								
310								
320	1				1			
330	1					1		
340	4				3	1		
(14") 350	3				3			
360	8				3	4		1
370	4				1	3		
380	6					3	3	
390								
(16") 400	2						1	1
Total	29				11	12	4	2
Ave. Length	367 (14.4")				355 (14")	368 (14.5")	390 (15.4")	383 (15.1)
S.D.	18.4				13	13.6	12.9	30.4

Table 5. Comparison of statewide length at age averages to those of Forestville Millpond for Largemouth Bass captured during surveys in 2008 and 2016. Lengths are in mm and inches (in).

Largemouth Bass	AGE 1	AGE 2	AGE 3	AGE 4	AGE 5	AGE 6	AGE 7	AGE 8	AGE 9
2016	--	--	--	355 (14")	368 (14.5")	390 (15.4")	383 (15.1")	--	--
2008	--	222 (8.7)"	279 (11")	348 (13.7")	385 (15.2")	393 (15.5")	415 (16.3")	374 (14.7")	--
State Average	97 (3.8")	165 (6.5")	229 (9")	290 (11.4")	338 (13.3")	384 (15.1")	414 (16.3")	447 (17.6")	454 (17.9")

Only four Northern Pike were captured during this survey (Table 2). The pike that were captured ranged in length from 413 mm to 537 mm (16.3" to 21.1") and had an average length of 473 mm (18.6") (Table 3).

Panfish

Yellow Perch were the most abundant panfish captured during this survey (Table 2). The 37 perch ranged in length from 85 mm to 308 mm (3.3" to 12.1") and had an average length of 189 mm (7.4") (Table 3). Most of the measured perch were between 140 mm (5.5") and 240 mm (9.5") in length, with fewer small fish captured.

Black Crappie, Bluegill and Pumpkinseed Sunfish were also captured during electrofishing (Table 2). The 9 Black Crappie ranged in length from 297 mm to 313 mm (11.7" to 12.5") and had an average length of 305 mm (12") (Table 3). Ages were determined for seven of the crappie. Age 4 and Age 5 were the only two age classes identified in our sample. Five of the seven Black Crappie were age 5.

The 5 Bluegill captured had an average length of 136 mm (5.4") and the single Pumpkinseed Sunfish was 106 mm in length (4.2") (Table 3).

<u>Other Species</u>
Common Carp was the most abundant species seen during our survey (Table 2). The 190 fish that were counted should be viewed as a minimum number because in one small bay an extremely large number of rolling carp were observed outside our electric field. White sucker and bullhead were also seen in low numbers but were not netted.

Discussion and Conclusions:

It appears that poor water quality continues to be an issue in the millpond. With the dominance of Common Carp in our catch, it is likely that turbid water and low dissolved oxygen levels continue to influence the composition of the fish community in the millpond.

The Largemouth Bass population appears to be in reasonable numbers with good growth rates although no fish smaller than 325 mm (12.8") in length and only few year classes were present in our sample. Poor water quality that may have negatively impacted recruitment of recent year classes may be responsible for the lack of small bass in the millpond. Growth based on length at age comparisons with state averages indicates that bass are growing near state rates in the millpond. Since over 72% of the captured bass were greater than the minimum size limit, it appears that the millpond has the potential to produce large size bass.

The northern pike catch was less than expected. The undeveloped portions of the shoreline of the millpond along with upriver sections of the Ahnapee River should provide amble spawning habitat for northern pike. It is not clear if poor survival of pike stocked following the rotenone treatment, poor recruitment or if angler harvest was responsible for the lack of Northern Pike seen during this survey.

Panfish numbers were also lower than expected based on past surveys of this productive waterbody. Since, most of the panfish captured, Black Crappie and Yellow Perch, are more tolerant to low dissolved oxygen levels than are Bluegill, it is likely that environmental factors favor these species at this time. However, since we captured yearling Bluegill, Pumpkinseed Sunfish and Yellow Perch in our catch, it appears that panfish are successfully reproducing in the lake. Panfish, especially Black Crappie and Yellow Perch, show the potential of reaching large size in this productive millpond.

Two or three years of northern pike stocking should be considered to improve pike abundance in the millpond and upper Ahnapee River.

References:

Door County SWCD. 1996. Final Report to the Wisconsin Lake Management Planning Grant for the Forestville Millpond. Door County Soil and Water Conservation Department. Sturgeon Bay, Wisconsin. 28 pages.

Hogler, S and S. Surendonk, 2008. 2008 Forestville Millpond Fish Survey Memo. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 6 pages.

Lychwick, T. 1984. Chemical Rehabilitation of Forestville Millpond. Unpublished. Wisconsin Department of Natural Resources. Madison, WI. 10 pages.

WDNR. 2001. The State of the Lakeshore Basin Appendices. Wisconsin Department of Natural Resources, Publication WT 667A 2001. Madison WI. 60 pages.

Forestville Millpond Comprehensive Lake Management Plan

Anonymous Stakeholder Survey

The Door County Soil and Water Conservation Department (SWCD) conducted an assessment of the Forestville Millpond in 1996. These data are outdated, as there have been many changes across the landscape and throughout the watershed that contributes to the Ahnapee River and the Millpond.

As interested groups have begun to revisit the topic of what to do about the millpond, it was recognized that there isn't a lot of recent information to help in that process. The SWCD has been awarded a Lake Management Planning Grant from the Wisconsin DNR to collect information regarding the conditions of the Millpond.

One of the methods that will be utilized to collect information regarding the use and the public perception of the Millpond will be to execute a survey of the users and residents. Please take a few minutes to complete the following questions.

1. Do you consider yourself a resident of the area or a visitor?
   a. Area Resident
   b. Visitor – Skip to Question 8
2. Do you own or rent your property on or near the Forestville Millpond?
   a. Own
   b. Rent
3. What is the residency status of your property?
   a. Year-Round Residence
   b. Part-Time Residence (NonRental)
   c. Part-Time Residence (Rental)
   d. Rental Property
   e. Undeveloped
   f. Other (please specify)__________________
4. How is your property utilized? (Select all that apply)
   a. It is Developed – Residential
   b. Cropland/Pasture
   c. Hunting/Recreation
   d. Other (please specify)_________________
5. How long have you owned or rented the property?
   __________ Years (If less than 1 year, write 1)
6. How many years ago did you first become familiar with the Forestville Millpond?
   __________ Years (If less than 1 year, write 1)
7. Is your property waterfront to the Millpond?
   a. Yes – Skip to Question 9
   b. No
8. In a typical year, how often do you visit the Millpond?
   a. Every Day
   b. Once a Week
   c. Once a month
   d. Summer (Memorial Day – Labor Day)
   e. Never – Skip to Question 15
9. How do you use the Forestville Millpond? (Select all that apply)
   a. Fishing
   b. Swimming
   c. Scenic Enjoyment
   d. Boating
   e. Wildlife Viewing
   f. Waterfowl Hunting
   g. Other (please specify)_________________
10. What is your favorite use of the Forestville Millpond? (Select one)
    a. Fishing
    b. Swimming
    c. Scenic Enjoyment
    d. Boating
    e. Wildlife Viewing
    f. Waterfowl Hunting
    g. Other (please specify)_________________

11. What is your opinion of the water quality in the Forestville Millpond?
    a. Very Poor
    b. Poor
    c. Fair
    d. Good
    e. Excellent
    f. Unsure

12. How has the water quality of the Millpond changed, if at all, since you first became familiar with it?
    a. Severely degraded
    b. Somewhat degraded
    c. Remained about the same
    d. Somewhat improved
    e. Greatly improved
    f. Unsure

13. Over the years, people have expressed concerns with various issues on the Millpond. What is your opinion of the following statements?

	Strongly Disagree	Slightly Disagree	Unsure	Slightly Agree	Strongly Agree
The water clarity of the Millpond is good	☐	☐	☐	☐	☐
The water quality of the Millpond is good	☐	☐	☐	☐	☐
The variety of fish species in the Millpond is suitable	☐	☐	☐	☐	☐
The fish population in the Millpond is too low	☐	☐	☐	☐	☐
The fish population in the Millpond is too high	☐	☐	☐	☐	☐
There are too many geese	☐	☐	☐	☐	☐
The Millpond is aesthetically pleasing	☐	☐	☐	☐	☐
There is too much aquatic vegetation (non-algae)	☐	☐	☐	☐	☐
Algae is a problem on the Millpond	☐	☐	☐	☐	☐
Water levels are too high on the Millpond	☐	☐	☐	☐	☐
Water levels are too low on the Millpond	☐	☐	☐	☐	☐
Other ______________	☐	☐	☐	☐	☐
Other ______________	☐	☐	☐	☐	☐

14. Addressing the condition of the Millpond can be accomplished by a number of management methods. Please indicate your opinion of potential management through each of the following:

	Strongly Disagree	Slightly Disagree	Unsure	Slightly Agree	Strongly Agree
Continue to do nothing	☐	☐	☐	☐	☐
Dredge	☐	☐	☐	☐	☐
Harvest aquatic vegetation	☐	☐	☐	☐	☐
Develop a lake management group	☐	☐	☐	☐	☐
Intensive educational effort	☐	☐	☐	☐	☐
Full-Year Draw Down (Draining)	☐	☐	☐	☐	☐
Winter season draw down (draining)	☐	☐	☐	☐	☐
Remove the dam, eliminate the millpond, return the Ahnapee River to an uninterrupted stream	☐	☐	☐	☐	☐
Reconstruct Bottom Gates and Spillway	☐	☐	☐	☐	☐
Improve the water quality of the Ahnapee River and tributaries entering the Millpond	☐	☐	☐	☐	☐
Promote shoreline buffers for adjacent properties	☐	☐	☐	☐	☐
Improve fish habitat within the Millpond	☐	☐	☐	☐	☐
Other:	☐	☐	☐	☐	☐
Other:	☐	☐	☐	☐	☐

15. What support would you be willing to provide to the Forestville Millpond project? Your response will not obligate you to any commitment, this is simply an evaluation of potential support.
    a. Financial support
    b. Volunteer my time
    c. Donate equipment or services
    d. Participate in a lake association or Friends of the Millpond group
    e. Not interested

16. Please provide any additional comments or concerns that you have:

Please return this survey by **October 31, 2017**, in the envelope provided.

Feel free to contact the Soil and Water Conservation Department with any questions that you might have regarding the survey, or any other aspects of the Millpond project.

Door County Soil and Water Conservation Department
421 Nebraska Street
Sturgeon Bay, WI 54235
920-746-2214
swcd@co.door.wi.us

Thank you for your participation.

Public Survey Comments

- Must stop manure runoff in the entire Ahnapee River
- Drain…Put two islands in the center
- Cattails on shoreline
- This spring, water levels were approximately 4'-5' across the entire Millpond according to boat depth sonar - this was much more than the past few years
- Someone must have planted a bunch of carp in the pond - more carp than anything!
- I own 30 acres of the Black Ash Swamp for 25 years now. I grew up on a farm in this Forestville area. Since my ownership of that part of the swamp I've seen a 80% die off of my arbor vitae. I think farming practices have changed during my lifetime. Pesticides, herbicides and liquid manure. If these farming chemicals aren't biodegradeable that means they are accumulating in the areas watershed system/water quality. Toxic Cocktail? I think the testing of the soils/water for these chemicals/levels is a priority. Good Luck. - Joey
- Keep jet skis and water skiers off to save the shoreline
- Make pond electric motor or oar only - kayak friendly
- Increase depth of pond to help fish population
- Remove sediment
- It's a nice place to place to take my grandkids
- Provide fishing platforms for handicap/elderly, and to take my grandchildren
- Apply separate creole limits for fish to maintain healthy population; not state regulations apply (Bluegill 25 - 5'!!) Reduce limits of fish taken home. Recreate. Great opportunity to start young fishers!!
- Must dredge to provide healthy depth for fish throughout summer/winter (survival!!)
- Inspect dam (working?). Has worked well for many years, even under stressed high water conditions; amazing!
- Silt fill is a primary concern long term; wished I had the soil in the bottom; best of topsoil!
- Better access from Mill Road parking to dike for fishing pond. Must cross dam!
- Please research Lake Neshonoc restoration in West Salem, WI (LaCrosse County); I grew up there!! Similar (but bigger); Devastated by flood waters this past summer; Lax River Watershed
- Thank you! A great resource to expand on!! Could be better and good for all!! - J Zellmer
- Concerned about invasive phragmites in area wetlands
- Concerned about manure runoff
- Just needs to be updated
- Small restaurant there
- Was a special place as I grew up-swimming, tubing and fishing-but also a place to just sit
- I have left several acres return back to their natural state, which used to be farmland, creating a runoff buffer zone for Silver Creek, County H, and the headwaters of the Ahnapee River. An additional 10 acres which were also farmed are now planted in pine and natural grasses as additional buffers to the waterways because of the mega farms.
- Property is 7 miles upstream, so I don't think the project concerns me
- I don't use the Millpond for swimming or fishing or boating, so I don't feel I can give a true picture of what its needs are. I like the view and the picnic area is nice. Our family used the area much more when our kids were young and at home. I am retired now.
- CAFOs have brought a fundamental change to land farming processes which have increased nutrients, diminished water retention of soil, increased nutrients in runoff as well as sediment in creeks and rivers and into Lake Michigan. The water will not be improved until farming practices are returned to what they were like before farms and dairy cattle are no longer leaked out like huge toilets. -William Faller
- More fish!
- Need more Panfish
- It seems this area could be developed to attract more people to the area

- The big farm runoff from the fields where they put manure
- Grandkids love it
- This survey is a waste of time and money. The DNR already know what they r going 2 do. Get a brain people!!
- The dam should have flushing on the bottom like the old dam. Most rivers get rid of the sediment by doing this.
- Concerns of removing habitat for wildlife
- You won't do it right. You must redo the dam.
- At this time, no opinion, but it should be saved if possible!
- Many years ago I was a member of the Ahnapee Watershed Group as the water from my land slowly south across 57 to the Millpond. Also some water goes north to C and Sand Bay Creek.
- All big farms require digester for permit to operate
- Berms required to stop raw sewage from getting in our water - streams - lake
- As a private land and home owner I am required to have by law my septic inspected every 3rd years or else!!
- I guess water quality of the river. I don't know what it is but I'm a landowner north of the Millpond. I deer hunt on a small tributary of Ahnapee downstream of S&S Dairy. I watched them put manure on fields during Thanksgiving and later sometimes covering them three times in a weeks time. I planted a small food plot it was never worked or farmed but it is near creek I had soil test and it came back phosphorus numbers top of chart so I don't know what water quality is but that has got to affect it. I know they need to apply it but it seems they try to empty there storage pond right before freeze up close to their farm. They may be doing it according to rules but watching it I think certainly wasn't like this years ago.
- Personally more concerned with farmers dumping endless amounts of manure into ground and tainting wells with no repercussions. They seem to own the land they farm and the land under everyone else's feet. I'm sure this also contributed to the pollution of the Millpond.
- What is the Forestville Millpond?
- I work for the DNR and appreciate receiving this
- Forget the pond, fix the roads
- We enjoy visiting the dam - would be nice to see it in a healthy state. Thank you.
- It is great to see a stream pond and dam to show your family how these water systems work together in nature
- Not sure why this is an issue - if anything the water has improved the past few years. We don't want the dam removed.
- I think the Millpond looks stagnant. Would like to see a more natural flow of water instead of a dam.
- Years ago when we canoed regularly, the Millpond and the Ahnapee River were favorite canoeing sites: easy access, not subject to strong winds, like water sites, interesting wildlife, low cost, not many other users. - Paul Lambeck
- As a lifetime permanent resident, the Millpond is a strong asset for visitors and residents alike. With proper care and development, usage and its place as an economic asset to the county could greatly increase.
- Years ago these same management issues were discussed. There were concerns by SWCD about invasive vegetation. A professor, someone form SWCD and a professional fisherman went out in a boat for several hours and determined the fishing was quite good, and it has gotten better since. I, and several neighbors regularly catch largemouth bass, bluegill, perch and occasional crappie and northern pike. Perhaps fertilizer run-off from farmland could be addressed.
- The pond is nice as is. It attracts a lot of people. If developed to much there will be too much boat activity and family activity will diminish. As is the pond is nice for non-motorized boats and family activities.
- I think it's a beautiful landmark. The property should be restored. Enhancing fishing would be nice - stocking with perch, bluegill, bass, pike, etc…
- We need to pinpoint the origin of pollutants or polluters - 1)They need to stop dosing the Millpond 2) Make these responsible polluters pay for the clean up
- Do something about the "big" farm runoff past my house alone for 3 days or more they are steady hauling manure. You can't tell me that is good for anyone - wildlife or fish included.

- I have fished at the Millpond since I was a kid. We used to have northern pike and some muskie - now you're lucky you get a bullhead. It's sad when we were young we even swam there now I wouldn't dream of that. It is a really beautiful resource that is being polluted and ruined just like the lake and bay are getting.
- I don't even know where the Millpond is!
- I live on the water side of the pond and really enjoy the dam pond. If it were drained, I would really hate to see it empty and not improved. Before that would happen, I would sooner let it alone. It could be improved but if the job were started and something happened that funds ran out or whatever and it were left in an unfinished state, that would be terrible and I would be very upset. Sooner to let it as it is.
- Don't ever see anybody use it
- Our family and many others we know enjoy fishing and visiting the park
- Allow fish through dam year round
- Perch, bluegills, crappies and pike make it so kids can fish like I did 54 years ago. Make the lake deeper no matter what it takes.
- Make the lake like lakes all over Wisconsin. It's a shame to have this lake and nothing in it and the DNR does nothing. The last time they drained it was done all wrong I guess they ran out of money. 50 years ago I would come down and fish every day and swim. It was great for kids, for things to do in a boring town. Every little lake has something special, this lake has nothing anymore. This is 2017, somebody should be able to make it right. This lake needs a lot of work. It has to be made deeper and dredged as far as it goes back. You can't even run a motor without hitting something. It would be nice to see happy kids fishing and swimming again. No reason why it can't happen.
- Millpond has been a mainstay in the area for some time and should remain, as it continues to provide recreation and pleasure! It should be monitored to remain a clean water.
- We like having the Millpond for environmental support and enjoyment
- Get the carp out
- Kill weeds and or dredge
- Create barriers to protect from ag contaminated water getting into river
- There are only a few ponds/water places in this great county. I appreciate the upmost attention and procurement of these water recourses for all to enjoy! Thank you for interest and involvement in this matter.
- Your survey is foolish. Let the residence decide. You stay out of it.
- Put a cap on expansion on nearby CAFOs
- Limit or abolish any nearby manure spreading by CAFOs to protect water quality/clarity!
- As a child 50 years ago there was a changing house and kids would swim there all summer long - no cattails, clean beach, fairly clean water - that does not happen today!
- Fish population of the Millpond consists mostly of rough fish with a few bass. In summer, the Millpond is clogged with weeds which may support these rough fish, but little else. The weeds have an obnoxious odor. I've always thought that the Millpond was a very pristine/beautiful body of water that should be rejuvenated for everyone's enjoyment.
- It would be nice to have a "cleaner" water quality of the Millpond and Ahnapee River. I do see fisherman a lot and it's neat to have the dam there. My kids love walking on it and watching the water. Kayaking is always nice but again - water quality. Just throwing this out there too - kind of would be nice to have a little swimming area like Clarks Lake if it was ever to get cleaned up.
- We believe strongly that a healthy Millpond is good for the area. If a full draw down is the best solution, we would obviously support it - but we feel strongly that dredging should occur all the way to the island.
- Thank you for your continued work to help us with the most beautiful part of our property. We love the pond!
- Back in the 1960s we were taking swimming lessons by the dock - what happened?
- I wasn't sure what is meant by "Millpond" until reading through the questionnaire and realized that it is the area above the Forestville Dam - I fished there, but it has been a long time since I have been there (25 years ago). We would go swimming from the dock - we did enjoy the time there.
- It needs a good swimming beach

- It would be nice if it was dredged out deep enough to be able to fish it year round. It has a county boat launch for summer fishing. If it was deep enough it could be fished in the winter more than the river channel only.
- It needs more variety of fish
- It's just how to keep the silt from filling it back up
- It was nicer when they had the 2nd run on the west side when I was younger
- Millpond is a hidden gem in Door County that is getting greatly overlooked!
- I do live, or own property, on a small tributary to the Ahnapee River. I am very concerned with fertilizers leaking into the river, both manure and commercial fertilizers.
- When my children were young, they swam down there. I saw what the water looks like now and I would not let me children swim there. Most of the kids in the village would go there and had a lot of fun and stayed out of trouble
- I think that big factory farms are the biggest problem for the water quality. I live by the Ahnapee and there is too much manure being put on fields close to the river and tributaries
- I am an elderly person and I won't be able to contribute. I remember when my children swam there when they were young and feel the water quality should be kept clean for swimming
- I assume you have increased my taxes as a result of the Millpond. I know nothing about the use of it. Thanks for the double on my taxes.
- I may not use this resource as much as I perhaps should but I believe it is a valuable asset to the community and should be cared for properly
- What's up with the Millpond? Please provide some more background information regarding this matter
- Not sure what a Millpond is
- Questionnaire is premature. More information is required for present water quality information. Given my current understanding, questions were answered.
- If dredging is an option it would only benefit the park and not property owners north of the dam. That is a disservice to surrounding property owners
- Shoreline buffers are a must and should include tributaries. Limits on planting over/thru these areas and limit manure spreading!
- Draining seems extreme and detrimental to wildlife, aquatic and amphibian life. The natural environment would be stressed.
- I am not aware of the Millpond project
- I would like to see more information regarding the dam and Millpond. Most of my answers are an uneducated guess.
- I definitely do not want to see it go away as I see many families enjoying the park facilities. Many good memories are made there.
- Manure runoff has to be a big concern. We are simply allowing way too much liquid manure to be spread in the county. It’s destroying our lakes and streams. Make the corporate farms pay for the clean-up!
- There seems to be more emphasis on fighting the symptoms of problems with almost no mention of the source of the majority of the problems e.g. farmland runoff. The clarity of the water is worst during late spring, summer and early fall.
- Find enclosed letter - Colin Sacotte
- We have way too many fields around here pounding crap into the ground and runoff goes into the water. I thought the reason they wanted the liquid manure was to protect runoff into streams and ponds but now they may as well pour it right in. As a kid we swam in the Millpond...now I make my grandkids wash their hands after they play in that water. We have such a beautiful area here, please let’s try to keep it that way.
- Have Soil and Water inspector on site monitoring manure dumping by CAFOs or any corporation that dumps a designated amount on properties qualified for those amounts. Large CAFOs and corporations can pay hourly for inspector fees. Same as property owners have to pay inspection fees for remodeling or making improvements to their homes.
- If it was kept up and worked on, people would use it. We always did when we were younger.

- Stop so much farming runoff. Last year watched 70 loads of liquid manure put on a 30 acre field only 3/4 mile away from Ahnapee River
- My land is upstream of the Millpond about 3 1/2 north of Hwy J. Ahnapee and east branch of Ahnapee join together near south line fence. Concerns: Agricultural runoff and Emerald Ash Borer
- This Millpond is a Southern Door treasure. We need to think carefully about the changes needed for long term use.
- The Millpond also supports a lot of wildlife in addition to fish, which would be lost if the pond was drained. Almost every day in summer we see Blue Herons, Green Herons, Eagles, Otters, Osprey and many varieties of ducks in spring
- In the past I have helped pick up trash along the shores of the pond and consider water flowing from my property to the Ahnapee River via the pond. The land is used for hunting and dog training. I will have to have the phragmites treated. Otherwise all efforts are made not to pollute the water. Sometimes quarries butting onto the property divert water...this damages my wetlands hardwood. I call the quarry to correct.
- I'm just amazed how you can turn a blind eye to Schmidts - they park semis on the road - pump thousands of gallons of manure on scarce topsoil land to the point it sits in the ditches until it runs into the Ahnapee or Stoney Creek, then to the dam. Door County is becoming the land of sh__ instead of the beautiful vacation land it once was. When someone or a village dies because of contaminated water, maybe you'll wake up!
- It is my hope that the future of the Millpond will be decided based on scientific information and the expert advice provided by the professionals at Door County Soil and Water Conservation Department in order to achieve sustainable improvements in water quality. The Millpond has been enjoyed by many generations of my family and there is a sentimental attachment to seeing it remain the same. However, I strongly feel that the priority should be to create a healthy environment for people and wildlife so that future generations can benefit from a well-managed natural area.
- I prefer restoring to pre dam break level (1974 or 75)
- Our family has roots to the community, much of the village land was donated or purchased from my maternal grandparents. Prior to the dam breaking around 1975, the millpond was deeper and cleaner! Since developed, the adjacent property owners have benefited but also complained the most when mishaps (flooding) occur. The river and the barren millpond suffered!
- The pond is shallow. I would not be opposed to a winter draw down if some pond bottom excavation was to occur. I don't see the point in a full year draw down. I think what has happened here is the river has washed silt into the pond making it shallow. Then again, it's always been shallow.
- I've boated all over southeastern Wisconsin and the one place that I own has the nastiest water. The river leaves a brown film on my boat that has to be scrubbed off. I don't know how the fish can see anything in that river. The dam must stay, removing it would be a mistake.
- If businesses are built they have to make a water retention area to help trap runoff from paved areas. When Highway 57 was developed to 4 lanes they drain the highway for 1/2 mile each way on to my neighbors and my property. I've had oily water standing on my property since the 4 lane development. The DNR, Army Corps of Engineers and DOT do what they want if it is for the state but doesn't care when it comes to the little resident. If they say everyone is treated the same they are full of shit.
- Something has to be done soon. We cannot enjoy the Millpond because of low water levels, very cloudy water and excessive vegetation. The dam should be replaced to more efficiently flush out sediment and allow fish to come up river to spawn. Yearly shoreline weed management is necessary.
- Would love to know if it's ok to swim
- Thank you for asking. It's a beautiful space - our family treasures it
- I think a dredging would be in order to sustain a good fishing habitat. I don't fish but I have family and friends that do. I'm sure the bottom is full of silt and old tires and crap. It would be nice to see it a destination spot for anglers and people who just want to picnic on some sort of beach.
- Regulate and limit agricultural runoff prior to other intervention/management strategies.
- Need grant money, because too much $$$ are needed beyond what individuals can do and professional equipment.

- Monitor manure spreading that occurs near millpond, streams, creeks and river!!
- The locals should not be burdened with any expenses of the pond. If the shoreline property owners are complaining, let them pay for any improvements.

9-29-17

To SWCD Dept

I received your survey regarding Mill Pond. We live near Southern Door and have no idea why we are getting this survey. However we are very concerned about the thousands of gallons of cow manure being spread on soil of 2 to 3 inches. These mega farmers have contaminated wells with little or no consequence. Are you waiting for Southern Door or Sevastopol schools to have their wells contaminated? We counted 27 semi loads dumped approximately 300 yards from our drive way from 8 to 12 am and this continued the rest of the day and until noon the next day. There is a creek that runs south across Cty K only about 200 yards west where the manure was spread.

The mandatory upgrade of private septic systems is a step in the right direction. So get pro active and not reactive on land spreading from mega farms.

Colin Sacotte