

ATTACHMENT B  
STAGE 2 CONSULTATION

## Study Summary

## Darrin Johnson

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**From:** Darrin Johnson  
**Sent:** Monday, August 2, 2021 5:06 PM  
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**Cc:** Miller, Matthew J; Crotty, Scott A; Shawn Puzen  
**Subject:** Proposed Study Summary for Hayward and Trego Hydroelectric Project relicensing  
**Attachments:** 20210802 Hayward and Trego Study Sum sent to agencies for comment.pdf

Good Afternoon,

Please find enclosed a copy of the Proposed Study Summary for the Hayward (P-2417) and Trego (P-2711) Hydroelectric Projects. Please provide any comments you may have within 30 days. Any comments received will be addressed prior to submittal to FERC. NSPW will be also developing individual detailed study plans for each of the studies to be conducted. The study plans will also be sent out for review and comment once they have been developed. If you have any questions, feel free to contact me.

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# Summary of Study Comments and Responses

## Hayward Project

FERC Project No. 2417

Namekagon River

Sawyer County, Wisconsin

## Trego Project

FERC Project No. 2711

Namekagon River

Washburn County, Wisconsin

Report prepared for



Eau Claire, Wisconsin

Report prepared by



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August 2021

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## 1. Study Requests Received From<sup>1</sup>:

- National Park Service (NPS)
- Trego Lake District (TLD)
- Wisconsin Department of Natural Resources (WDNR)

## 2. Summary of Study Comments and Action Items

### A. Aquatic Plant Survey – WDNR

#### **WDNR Comment(s):**

*The In-water plant community data is limited within the Project boundary. The goal of the study is to provide baseline information on the condition of the aquatic plant community in the Project(s).*

*Methodology – The information collected from this study includes an assessment of the density and diversity of macrophytes, which includes frequencies of occurrence of different plant species, as well as estimates of species richness, abundance, and maximum depth of plant colonization. The aquatic invasive species study should be conducted according to the department's Recommended Baseline Monitoring of Aquatic Plants in Wisconsin.*

#### **NSPW Response:**

NSPW will complete a point-intercept survey according to the WDNR's Recommended Baseline Monitoring of Aquatic Plants in Wisconsin methodology as part of the Aquatic and Terrestrial Invasive Species (ATIS) Study described in **Section I** below. NSPW will rely on the WDNR to provide the point intercept grid.

### B. Assessment of Current Dam Operations – WDNR

#### **WDNR Comment(s):**

*Determine if the Project is meeting the requirements of minimum flows and run-of-river operations; including documenting how downstream river flows are managed appropriately to limit water level fluctuations. Conduct a desktop review of inflow and outflow data, including an evaluation report of run-of-river operations and requirements.*

#### **NSPW Response:**

The Licensee will complete a desktop review of existing flow data and provide an evaluation report in the DLA. It should be noted that routine drawdowns are not a regular occurrence at either Project. In a review of the Licensee's records, only two drawdowns were noted at Trego Flowage. The first was an 11-foot drawdown in 1978 to repair concrete on the dam. The second was conducted in 1988 when a 3-foot fall drawdown of the Trego Flowage was conducted at the request of the Trego Lake District to perform lake management activities. The only drawdown on record at Hayward, under the current license, occurred in 2004 on behalf of the City

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<sup>1</sup> Actual Study Request Letters are enclosed in Appendix 1.

of Hayward to help facilitate repairs to their water main. A discussion of the frequency and procedures for any future planned drawdowns will be provided in the DLA.

**C. Assessment of Minimum Flow and Resource Impacts Downstream of the Tailwater – WDNR**

**WDNR Comment(s):**

*Provide an assessment of the average range of flows, including minimums and maximums and their relevance, associated with run-of-river operations and facility capacity. Evaluate the minimum flow of 8 cfs at the Hayward Project and target reservoir elevations of the Trego Project are providing sufficient flows and environment for aquatic resources.*

*Methodology – Conduct an in-stream flow study, which includes a description of current habitat conditions within the bypass channel under current operation and flows to determine if the current minimum flows are impacting available habitat, fish, and macroinvertebrate communities. Assess various flow regimes to determine what is appropriate to minimize and avoid adverse impact on the cold-water resource.*

**NSPW Response:**

The Licensee will provide an assessment of the average range of flows, including minimums and maximums and their relevance, associated with run-of-river operations and facility capacity in the DLA.

The Hayward Project has a short (approximately 120 foot long) bypassed reach. In conjunction with the last re-licensing effort, NSPW conducted a shoreline stabilization and habitat improvement project within the bypassed reach. The project involved improving the habitat within the bypassed reach by making improvements to the spillway channel. Improvements included the installation of a rock wing deflector extending about 45-50 feet downstream that diverts river flow to approximately two thirds of the original channel width. Approximately one foot of channel material was also removed. The work increased the velocities in the spillway channel to encourage scouring in the pool area to maintain satisfactory pool depths. The eroding shoreline in the area downstream of the spillway was also stabilized and the canoe portage put-in was re-routed to correct erosion issues along the bank.

Based on a 1992 joint flow-release exercise, NSPW and WDNR agreed that a continuous minimum flow of 8 cfs was sufficient to protect aquatic resources. In their comments, WDNR indicated that the flow “was more than adequate for sustaining aquatic organisms downstream” (NSPW, 1991; FERC, 1995). FERC also determined that the minimum flow of 8 cfs provided adequate aeration to maintain water quality in the bypass reach, including the shallow pool and other downstream areas during the critical low flow, high temperature period (FERC, 1997).

The Hayward and Trego Projects are operated in a run-of-river mode that parallels stream flow, so any water level variance experienced in the Namekagon River downstream (from the bypass reach at Hayward and from the dam at Trego) reflects natural conditions. Therefore, the Licensee is not proposing to conduct an in-stream flow study.

**D. Assessment of Riverine and Reservoir Habitat – WDNR**

**WDNR Comment(s):**

*Having updated habitat assessment information is critical for evaluating the effects of the project(s) on the reservoir and downstream ecosystem. It will provide baseline data to current conditions and assist with management recommendations of any current or future needs. The data can be used to help guide water resource management associated with the Project(s).*

*Obtaining recent habitat assessment information is critical for future management actions and establishing baseline data. Water level fluctuations due to drawdowns may affect aquatic habitat. Obtaining information on how/if new water levels will cause shoreline erosion as a new ordinary high-water mark is established.*

*Methodology – The riverine habitat within the project area downstream from the dam should be evaluated with the department Quantitative Habitat Assessment methodology in wadable stretches of the project (s) at the time of each fish survey. For the reservoir, department shoreland habitat protocol should be used. Newly impounded areas and any wetlands that could be affected by the new water level should be mapped. Please work with the department to determine which protocol should be used for different locations.*

**NSPW Response:**

The Projects are operated as run-of-river facilities with only the minimum allowable fluctuation to respond to changing inflows and outflows. NSPW is not proposing a change from run-of-river operation or reservoir elevations such that a new ordinary highwater mark will be established. Therefore, the requested data is unnecessary to assess the impacts of the operation of the hydroelectric project. In addition, there is existing WDNR fishery survey information from within and downstream of each Project reservoir. NSPW is proposing to conduct a point-intercept vegetation survey and an analysis of vegetation along the reservoir shorelines as part of the ATIS Study as discussed in **Section I**. This information will help to provide an evaluation of aquatic habitat within the Project reservoirs and terrestrial habitat along the Project shorelines. Therefore, the Licensee is not proposing to conduct a specific riverine and reservoir habitat study. Any changes to the acreage, amount of impounded area, or wetlands that could be affected by allowed water level fluctuations are already mitigated through the existing and proposed operational requirements.

**E. Assessment of Stream Flows, Channel Dimensions, and Linear Gradient – WDNR**

**WDNR Comment(s):**

*The relicensing of Hayward and Trego has the potential to have short term and long-term impacts on the aquatic community downstream of the impoundment. These impacts include, but are not limited to, dewatering and limiting available aquatic habitat in the downstream river channel depending on stream discharge and dam operation. These impacts can vary by season as well as daily. Proper management of the resource will help ensure that adequate flows are available to aquatic life at the proper time and thermal regime.*

*Goal – Determine impacts the Project has on the existing stream flows, channel dimensions and linear gradient of the Namekagon downstream of the Project(s).*

*Methodology – Conduct a flow study to determine stream morphology downstream of the Project at various flow, including width, depth, wetted perimeter, and substrate composition. The study should identify any wetlands that are flooded. This should include available aquatic habitat under current operation through flood flow conditions. Quantitative Habitat Assessment Methodology should be used to document habitat conditions. Refer to existing management efforts (recreational, resource, habitat) to investigate the impacts the proposed Project(s) would have.*

**NSPW Response:**

A discussion of habitat conditions within the Hayward bypassed reach is located in **Sections C and D**, above.

The Hayward and Trego Projects are operated in a run-of-river mode that approximates natural stream flow. Any water level variability experienced in the Namekagon River downstream (from the bypass reach at Hayward and from the dam at Trego), reflects natural flow conditions. Therefore, no study of stream flow, channel dimensions, or linear gradient are warranted or proposed.

## **F. Cultural/Historical Resources Study – NSPW**

**NSPW Proposed Study:**

The Hayward Project was evaluated for the National Register of Historic Places (NRHP) in 1989 and determined ineligible. The Trego Project was evaluated for the NRHP in 1991 and determined eligible. No further NRHP evaluations of either site are planned as part of the relicensing process.

Archaeological shoreline surveys of both projects have been conducted at 10-year intervals per the terms of each Project's Historic Resource Management Plan and at the recommendation of the qualified archaeologist completing the surveys. Surveys were last completed in 2013. NSPW will conduct shoreline surveys within the Area of Potential Effect (APE)<sup>2</sup> of each Project according to the terms of the Programmatic Agreement. NSPW will search for impacts to known archaeological sites and previously unidentified archaeological sites along currently eroding areas. As a result, currently eroding shoreline areas and failing shoreline stabilization measures will be identified and evaluated as part of the study.

The study plans and study reports will be distributed to the SHPO and interested THPOs for comment. Stakeholder comments will be addressed in the final study plan and final study report.

This study will be completed in 2022.

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<sup>2</sup> The APE for each Project includes all lands within the current and proposed Project boundaries.

## **G. Trego Fishery Study – WDNR**

### **WDNR Comment(s):**

*Define the diversity and abundance of the fish community within the Trego Project.*

*Data is limited within the Project area downstream of the dam. Fisheries data is available within the White River Flowage as part of the Project reservoir.*

### **Methodology-**

*Trego Project – Seasonal catch per unit effort (CPUE) surveys in the spring summer and fall to quantify fish populations relative abundance and summary report to document the species available to recreational fishers and general fish community composition.*

***Early Spring Fyke Netting:*** 3-5 nets (front frame of 4' x 6") set the week of ice-out.

***Early Spring Electroshocking:*** Maxi boom to survey the entire shoreline with two dippers, when water temps are between 45-55 degrees.

***Late Spring Electroshocking:*** Maxi boom to survey the entire shoreline with two dippers, when water temps are between 60-70 degrees.

***Summer Fyke Netting (June-early August):*** Three to five fyke nets (front frame 4'x6'), set when water temps are approaching 55-65 degrees.

### **NSPW Response:**

Fishery survey information provided by WDNR indicates that fish surveys were conducted on the Trego reservoir in 2003 (summer netting, fall shocking), 2004 (spring netting), 2011 (fall shocking), 2016 (fall shocking), and 2019 (spring, summer, and fall shocking). Downstream of the Trego Dam, fish surveys were conducted each year from 2003-2006 (fall shocking), 2007 (summer shocking), 2008-2010 (fall shocking), 2014 (summer shocking), and 2018 (summer shocking). This existing data provides information on the species assemblage within and downstream of the reservoir. Therefore, due to the amount of recent fisheries data and because NSPW is not proposing a change in the operation of the facilities, no additional fisheries surveys are proposed.

## **H. Fish Entrainment and Fish Movement Study – WDNR**

### **WDNR Comment(s):**

*The department has concern on Lake Sturgeon entrainment at Trego Dam. Assess fish entrainment at the Trego Project and Hayward Project and better understand fish movement from above to below the dams*

**Trego:** *The department has documented at least seven lake sturgeon that have entrained the dam (from Trego Lake to Namekagon River below) and survived to be recaptured below the Trego Dam. There are likely many more sturgeon and other fish species that are entraining*

*below Trego Dam and surviving. The department suspects that muskellunge are also doing this but haven't been able to document that through our fish surveys.*

*The dam is a major block to fish passage and migration for the Namekagon River, the most notable species that is impacted are Lake Sturgeon. Lake Sturgeon are currently stocked by the department in the Namekagon River (above Trego Lake) and Trego Lake in hopes of re-establishing this population. However, with entrainment, larger adult sturgeon can leave the lake by cannot return.*

*Hayward: Department fisheries biologists are interested in the fishery below the Hayward dam, and some of the most popular fish species are species coming from Lake Hayward upstream.*

*Having current fish movement information (e.g.) when fish are passing the dam, how many fish are passing the dam) and survival information will help department staff make informed management decisions regarding the fishery.*

*Methodology- Model a tagging study after existing research to look at entrainment of sturgeon, muskie, and walleye. The research could use radio tagging or hydroacoustic telemetry.*

#### **NSPW Response:**

Any entrainment studies need to focus on entrainment into the powerhouse because entrainment through the gates or over the spillway is not an operational effect that is under the control of NSPW. The WDNR concern appears to be concerned about lack of passage downstream, but also cites the inability to stop Lake Sturgeon from moving downstream out of Trego Lake as an adverse impact. The WDNR statement is muddy and inconclusive by stating increased entrainment through the gates as being an adverse impact by allowing Lake Sturgeon to leave Trego Lake through the spillway gates. To derive a specific potential adverse operational impact out of the inconclusive study request made by the WDNR, the only potential operational effect under the control of NSPW is entrainment through the powerhouse. The reduced passage of Lake Sturgeon out of Trego Lake is not a project purpose. Therefore, NSPW has completed the following analysis with existing data to review the potential adverse effect from entrainment through the powerhouse.

The Trego Project has trash racks with 1.5 inch clear spacing and an intake velocity of 1.2 feet/second at maximum flow. The Hayward Project has trash racks with 1.5 inch clear spacing and an intake velocity of 1.5 feet/second at maximum flow. The Chippewa River Fish Protection Study Report identified sizes of fish that can pass through various sized trashracks and the sustained and burst swim speeds of several different fish species based on fish length (Kleinschmidt, 2016). The study indicated that 1.5-inch spacing, the same trashrack spacing present at Hayward, would exclude yellow perch in excess of seven inches, bluegill and black crappie in excess of ten inches, walleye and lake sturgeon in excess of twelve inches, and muskellunge in excess of sixteen inches with respect to the existing intake velocity at Hayward. The study also concluded that 1.5-inch trashrack spacing, the same trashrack spacing at Trego, would exclude yellow perch in excess of six inches, bluegill and black crappie in excess of eight inches, walleye and lake sturgeon in excess of ten inches, and muskellunge in excess of thirteen

inches with respect to the existing intake velocity at Trego. Excluded fish would not be able to pass through the trashracks and therefore would not be subject to turbine mortality. The study also indicated that fish larger than six inches in length have sustained swim speeds of at least 1.5 feet/second and would be able to swim away from the racks and would only be subject to volitional entry into the turbines (Kleinschmidt, 2016). This would result in only small fish under six inches in length being unable to escape turbine entrainment. The study also indicated that turbine passage survival for target fish species that were able to fit through the trashracks would see high survival rates, generally over 90%<sup>3</sup> (Kleinschmidt, 2016).

Fishery survey information provided by WDNR indicates that fish surveys were conducted on the Hayward Reservoir in 2001 (fall shocking), 2002 (spring netting, fall shocking), 2003 (summer netting, fall shocking), 2004 (fall shocking), 2005 (spring netting, spring shocking), 2006 (fall shocking), 2007 (fall shocking), 2008 (spring netting, summer shocking), 2013 (spring netting), 2014 (spring netting), and 2018 (summer netting). Downstream of the Hayward Dam, fish surveys were conducted in 2003 (spring shocking), 2004 (fall shocking), and via summer shocking in 2005, 2007, 2010, 2012, 2014, 2016, and 2018.

Fishery survey information provided by WDNR indicates that fish surveys were conducted on the Trego reservoir in 2003 (summer netting, fall shocking), 2004 (spring netting), 2011 (fall shocking), 2016 (fall shocking), and 2019 (spring, summer, and fall shocking). Downstream of the Trego Dam, fish surveys were conducted each year from 2003-2006 (fall shocking), 2007 (summer shocking), 2008-2010 (fall shocking), 2014 (summer shocking), and 2018 (summer shocking).

The information above demonstrates that neither entrainment nor mortality is expected to provide a significant adverse impact and therefore specific mitigation measures are unnecessary as part of the future license conditions. Similarly, the available fisheries survey information provides sufficient data regarding the abundance and diversity of fish within and downstream of both projects. Therefore, the Licensee is not proposing to complete a fish entrainment and movement study.

## **I. Aquatic and Terrestrial Invasive Species (ATIS) Study – WDNR**

### ***WDNR Comment(s):***

*The project may influence invasive species that have the potential to directly or indirectly cause economic or environmental harm or harm to human health, including harm to native species, biodiversity, natural scenic beauty and natural ecosystem structure, function or sustainability; harm to long-term genetic integrity of native species; harm to recreational, commercial, industrial, and other uses of natural resources in the state; and harm to the safety or wellbeing of humans including vulnerable or sensitive individuals. -per NR40.*

*Methodology – Use WDNR Early Detection Early Response Protocols. Additional methodology may be needed for terrestrial species, and other methodologies such as point-intercept may be appropriate if combining this study with other studies.*

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<sup>3</sup> Predicted turbine passage survival was determined using trashracks with a 1" spacing.

**NSPW Response:**

NSPW is proposing to complete an aquatic invasive species survey on the reservoir and tailrace of both Projects, and the bypass channel at the Hayward Project. On the reservoir, a point-intercept survey and a rapid-response survey will be completed in areas up to 15 feet in depth according to protocols previously developed in consultation with the WDNR. Additional information on riverbed/lakebed substrates will be collected at each point-intercept sample point. Under normal protocols, the bed substrate is classified into one of three types; muck, sand, or rock. In order to provide additional information regarding available habitat, bed substrates will be classified into one of the following nine substrate types: clay, silt, sand, gravel, cobble, boulder, bedrock, wood, or organic. In the tailwater and bypass channel areas, a rapid-response plan will be developed and implemented that is safe and corresponds with published WDNR protocols.

NSPW is also proposing to complete terrestrial aquatic invasive species surveys in areas where project operations have the potential to impact or spread terrestrial invasive species. These include project facilities, recreation sites, project tailwater, and project reservoir shorelines. NSPW lands with project facilities or recreation sites and the project tailwater areas will be surveyed for terrestrial invasive species in conjunction with the aquatic rapid response survey. The survey will consist of a meandering survey to identify, locate, and define the perimeter of occurrences of terrestrial plant species listed in NR 40. NSPW will survey the reservoir shoreline for terrestrial invasive species by boat concurrent with the aquatic invasive species survey. In addition to surveying for invasive species, an overall characterization of the terrestrial plant community will be made.

A final report will include mapping of identified colonies of species listed in NR 40 with bathymetric data and estimation of plant abundance and relative density. The study plan and study report will be distributed to interested stakeholders for comment. Stakeholder comments will be addressed in the final study plan and final study report. This study will be completed in 2022.

**J. Macroinvertebrate Study – WDNR****WDNR Comment(s):**

*Assess the water quality using macroinvertebrate bio-indicators downstream of the impoundment.*

*Collect a wadable macroinvertebrate sample, if possible, downstream of the flowage using the Department's guidelines for Collecting Macroinvertebrate Samples from Wadable Streams (2017). If the stream is not wadable, a large river macroinvertebrate sample should be collected. Data should be analyzed using the current department WISCALM Guidance. Macroinvertebrates should be collected upstream of the reservoir in the riverine reach, in the bypass channel, and downstream of the powerhouse in the fully mixed zone.*

**NSPW Response:**

The purpose of the study according to the WDNR is to assess water quality with the use of macroinvertebrates as a bio-indicator. NSPW has agreed to complete water quality monitoring for numerous parameters as described in **Section R**. This will include sampling within the reservoir, upstream of the reservoir in a riverine reach, and in the Namekagon River downstream of the

dams at each Project. The data collected in the water quality monitoring study should provide sufficient information to determine water quality within and immediately downstream of both Projects. No additional macroinvertebrate sampling is proposed.

#### **K. Mink Frog Survey at Hayward Project – WDNR**

##### **WDNR Comment(s):**

*Mink Frogs are listed as a species of Special Concern in Wisconsin. In an effort to better understand the abundance and distribution of this species, several survey and management efforts are taking place across northern Wisconsin within a number of different river systems. Presence/absence surveys are an example of existing work that is being done across the range of this species in Wisconsin, which is primarily the northern one-third of the state. The overall goal of this survey request is to further the knowledge of the distribution of Mink Frogs within the watershed more broadly. The main objective of the study request is to determine if Mink Frogs are present within the Project boundary of the dam.*

*WDNR indicates in their study request that mink frogs are known to be present within this Project boundary, however, survey data is limited.*

##### **Methods:**

*Calling or presence /absence survey for Mink Frogs: Follow the Mink Frog Survey Protocols where suitable habitat is present: [https://witri.net/inventory/frogtoadsurvey/Volunteer/Mink/MinkFrog\\_SurveyProtocols.pdf](https://witri.net/inventory/frogtoadsurvey/Volunteer/Mink/MinkFrog_SurveyProtocols.pdf).*

*Presence absence surveys for Mink Frogs, June 6-July 15: Two surveys per week for four weeks.*

##### **NSPW Response:**

WDNR tracks the known locations of threatened, endangered, and special concern species in the NHI database. An Endangered Resources Review (ER Review) encompassing the entire Hayward Project area (ER Log #20-683) was conducted on September 10, 2020. The review did not identify the potential presence of mink frogs within the Project boundary or its associated buffer area. Since the ER Review did not indicate the potential presence of the mink frog, continued operation of the Project is not likely to impact the species. Therefore, no mink frog surveys are proposed.

#### **L. Mussel Study – WDNR**

##### **WDNR Comment(s):**

*The goal of the study is to determine effects of barriers to mussel distribution and diversity within the Project area and the Namekagon River. Determine freshwater mussel density and diversity, including characterizing mussel habitat within each Project area. The study would provide information on freshwater mussel species present, their diversity, density, and a better understanding of baseline conditions and associated management needs for the Project area.*

*The operations of the Project(s) could influence the freshwater mussel species located within the Project boundaries. The results of the survey will provide essential information to determine if*

*any protection measures, restoration, or enhancements would be necessary as a management requirement associated with the relicensing of the dam(s).*

*A qualitative and quantitative survey for freshwater mussels should be conducted within the project area and downstream of the dam structure on the Namekagon River. Some methods that can be used are the department's Guidelines for Sampling Freshwater Mussels in Wadable Stream and the department's Quantitative Habitat Assessment Methodology. Methodology should be discussed with the department for quantitative surveys. A Mussel Survey Plan should be submitted to the department for review at least 2 weeks (1 month preferred) prior to implementation.*

*Qualitative timed searches should first be conducted to assess habitat suitability and presence of freshwater mussels. Sites will be located below each barrier in the study area, plus one site upstream of the Project area. Starting locations should be representative of available habitat within the sampling reach. As a minimum, timed searches will be 4 pers/hrs. or a total search distance of 200 m in riverine sections of the project area and up to 8 pers/hrs. within reservoirs.*

*Based on qualitative surveys, quantitative surveys may be required. Quantitative sampling using quadrat samples will be used to determine population density, community composition, age, and total length distributions, living/dead, and sex ratios. One quantitative site will be located on the Project area where mussel habitat is determined suitable and where past sampling has occurred. The sampling unit will consist of a transect with 10 equally spaced 1/4m<sup>2</sup> quadrats every three meters along the unit. Each transect runs perpendicular to shore.*

**NSPW Response:**

NSPW will complete a mussel survey at each Project. One riverine reach upstream and one riverine reach downstream of each dam will be surveyed. Each reach will be 1,000 meters in length. Transects will be spaced every 100 meters within the reaches creating a series of 10 transects. A random number selector will be used to select 5 transects within each reach to survey.

Surveys along each transect will be completed in 10-meter-long segments and will extend 0.5 meters on each side of the transect. A rapid visual search for signs of freshwater mussels (living or shell material) will be performed within each segment. The rapid visual search entails an initial search of 0.2 minutes per square meter along each 10-meter segment to determine if mussels are present. If mussels are present in a segment, a semi-quantitative search will be triggered, and the time will be extended to 1 minute per square meter. During the semi-quantitative survey, divers will visually inspect and probe the substrate as well as turn over rocks to detect small, burrowed mussels.

General stream conditions and morphology within the study area will be recorded including bottom substrate composition using the Wentworth Scale. The surveys will be conducted only when visibility at depth is at least 20 inches.

Live mussels will be identified to species, counted, and sexed by the team malacologist. Dead shell specimens will be scored as fresh dead, weathered dead, or subfossil. Detailed digital

images of the study area and representative mussel species will be recorded. A station location data sheet will also be populated per the Guidelines for Sampling Mussels in Wadable Streams.

If any living or dead federally listed or state listed species are encountered, the Licensee will notify WDNR and USFWS per surveyor collection permit requirements. Any listed mussel species encountered will be individually hand placed to their places of origin. No live mussels will be harmed or taken during the study.

The study plan and report will be distributed to interested stakeholders for comment. Stakeholder comments will be addressed in the final study plan and final study report. The study will be completed in 2022.

#### **M. Project Boundary Study – WDNR**

**WDNR Comment(s):**

*The goal of the study is to conduct a quantitative assessment of acres of wildlife habitat and surface water that would be modified with a proposed change in the project boundary. This includes impacts to public access and recreational activities.*

*Methodology – Desktop evaluation of wetland and riparian habitat. Identify changes in acre in wetland and habitat, as well as changes in acreage and use in recreational features. Additionally, identify if any of the areas proposed to be excluded from the Project boundary provide habitat for listed species.*

**NSPW Response:**

NSPW will provide additional information regarding any lands proposed to be removed from the existing Project boundary in the DLA. This will include changes to the amount of upland, wetland, and reservoir acres, different types of land cover, and potential impact to listed species, recreation sites, and historic/archaeological sites.

#### **N. Rare and Endangered Species Study – WDNR**

**WDNR Comment(s):**

*Rare plants and animals have been found within, adjacent to, and in habitats similar to the study area. It would be recommended to complete plant and animal surveys for these species to determine if they occur within the study area and to further our understanding of their populations within this area. This will also inform the licensee as to where these plant and animal locations are.*

*The relicensing has the potential to have short-term and long-term impacts on vegetation and animals-in particular, wood turtles and their habitat-in particular, wood turtles and their habitat. Proper management of the resource will help to minimize any adverse impacts associated with the removal restoration and relicensing activities.*

*Methodology – Using a qualified botanist knowledgeable in area vegetation and specific species, identify, classify, and delineate on a map rare, threatened, or endangered plant species within the project area. Using a qualified biologist or ecologist, conduct presence absence surveys for specific rare, threatened, or endangered animal species.*

**NSPW Response:**

Endangered Resource Reviews for the Hayward Project (ER Log #20-683) and Trego Project (ER Log #20-684) were completed on September 10, 2020. The ER Reviews identified potential threatened, endangered, and special concern species within the vicinity of each Project.

In conjunction with development of the DLA, the Licensee will provide an analysis of the vegetation cover types within each Project boundary and potential Project impacts to listed species. If the analysis determines that listed species may be impacted by continuing Project operations, the Licensee will consult with WDNR (for state listed species) and FWS (for federally listed species) to propose mitigation measures. Mitigation measures may include options such as using the USFWS Step-by-Step Guidance to determine whether proposed activities may impact bald eagles, restricting vegetation management activities to occur outside of sensitive periods, or conducting surveys prior to conducting ground disturbing or vegetation clearing activities.

The presence of wild rice has been confirmed on Trego Flowage. Wild rice, while not a special concern, threatened, or endangered species, will be identified during the point-intercept plant survey conducted as part of the ATIS Study discussed in **Section I**. Other than the Wood and Blanding's turtle study discussed in **Section T**, and Mussel Study discussed in **Section L**, no other specific rare species surveys are being proposed by the Licensee.

**O. Recreation Study – WDNR**

**NPS Comment(s):**

*Evaluate current recreational uses, including opportunities for low flow and high flow events, public access, natural scenic beauty, trails, water sports, and fishing with consideration of the different seasonal uses.*

**Methodology –**

*An inventory of recreation opportunities and facilities; determining recreation demand using field observations, user surveys, and focus groups; and estimating recreation needs based on the data gathered is consistent with generally accepted practices employed during hydroelectric licensing proceedings. Evaluating outdoor recreation facilities per the Architectural Barriers Act Accessibility Guidelines.*

*The area of focus for the recreation facilities condition assessment and demand analysis consists of existing targeted formal and informal recreation areas within the existing project boundaries. The Applicant proposes to change the Trego Lake project boundaries therefore it is important to include recreation facilities within the existing project boundaries in the evaluation of recreation needs and the proposed project boundary changes.*

### Study Sites

*The facilities and recreation sites to be inventoried for the recreation study should include targeted developed recreation sites and an informal access site. The inventory should identify current use, current conditions, and any impacts the project might have on these. The study report should identify which Trego Lake recreation facilities would be omitted if the proposed project boundaries were approved.*

*Trego Lake: Recent permanent closures of two access sites east of U.S. Highway 53, one managed by NPS and the other, Wisconsin Department of Transportation, leaves the Trego Town Park as the only public access site to the headwaters. The only other remaining Trego Lake access is Trego Landing located mid-impoundment, approximately 1.75 miles away. These Trego sites are recommended for study:*

- *Trego Town Park Landing*
- *Trego Landing*
- *Xcel's Trego Lake Canoe Access and nearby shoreline (possible angling)*
- *Xcel's tailwater fishing access (north and south)*

*These Hayward Lake Sites are recommended for study:*

- *Commission approved project recreation facilities including the canoe portage, carry-in access on the impoundment and informal shoreline fishing area.*
- *Hayward Lake Bartz's Bay; undeveloped and informal ice fishing access site off Chippewa Trail.*

### Study Methods

*This recreation study has four components: (1) Facility inventory and condition assessment, (2) recreational facilities accessibility assessment, (3) a recreation use and demand analysis, and (4) a recreation needs assessment.*

#### Existing Facility Inventory, Condition Assessment

*The existing facility inventory and condition assessment portion of this recreation study consists of two steps: (1) Site facility inventory and (2) field reconnaissance/condition assessment. The facility inventory and condition assessment inform the demand analysis and evaluates the condition of each of the facilities at the listed recreation sites. The inventories done in preparation for the 2021 Recreation Reports will form a base upon which to build more information.*

#### Step 1- Site Inventory

*The existing facility inventory should include identification and location of parking spaces, picnic units, boat landings/ramps, bathrooms, and other facility components (e.g., informational signage). Informally created user trails and sites (i.e., sites along shorelines frequented by recreation users but not identified as designated facilities) will also be identified and assessed.*

### *Step 2 - Field Reconnaissance/Condition Assessment*

*The field reconnaissance should include a physical condition inspection of existing recreation facilities and trails, as identified under Step 1. The reconnaissance should also identify observable use patterns and field verify if recreation amenities are constructed and in a condition that serves user needs. User created sites should be identified for observable use and wear patterns.*

*The following steps should be taken to complete the facilities inventory:*

- 1. Complete reconnaissance level field research: conduct fieldwork to create a detailed inventory on the conditions of existing recreation facilities and other user created sites within the study area.*
- 2. Assemble the results and create maps of data collected in the field.*

*The condition assessment will be qualitative based on a range of repair/replacement/maintenance needs to acceptable appearance and function to evaluate the condition of recreation facilities. Photos should be taken of facilities, all signs, trailheads, etc., and cataloged based on feature type or location. Other user created sites with observable wear patterns within the project areas should be cataloged for further evaluation within the recreation study.*

### *Facility Accessibility Assessment*

*The inventory of targeted sites should identify features that do not meet current Americans with Disabilities Act (ADA) accessibility standards, Architectural Barriers Act (ABA), and Universal Design Principles as well as opportunities for modifications to improve accessibility.*

### *The Recreation Use and Demand Component*

*The recreation Use and Demand Component of this Recreation Study consists of 6 steps: (1) observational survey; (2) visitor use questionnaire; (3) interviews with user/friend's groups and recreation providers; (4) review of research publications and existing information; (5) assessment of regional uniqueness and significance of the project area's primary recreation opportunities; and (6) regional demand assessment. The steps are described in more detail below.*

#### *Step 1 - Observational Survey*

*Observed recreation use occurring in the project areas based on observational surveys should be used to estimate existing use. Observational surveys should be conducted during seasons of use for each location e.g., winter surveys for ice fishing at Bartz's Bay on Lake Hayward. Timing and sampling frequencies should be based on estimated use levels and the surveys should be conducted at peak times during the day (e.g., peak angler time of day, dawn, and dusk; water skiing, afternoon), on different types of days (weekday, weekend, holiday, or opening of fishing season). The observation data that should be recorded includes vehicle counts, angler counts, counts of each type of watercraft (canoes, kayaks, pontoons, fishing, stand up paddleboards, tubes), and day use/picnic area usage.*

#### *Step 2 - Visitor Use Questionnaire*

*A concise questionnaire focusing on visitor use and experience should be mailed to Trego Lake riparian landowners and fielded at the identified recreation sites when people are most likely to be*

*present. The survey should be conducted during various days during the survey period including weekdays and weekend as well as holidays. A review of past visitor data should be assessed to determine appropriateness or target survey dates with considerations for current season use patterns and any potential unexpected conditions taken into account. The questionnaire should be crafted to collect information from recreationists about recreation, activity participation, accessibility needs, areas visited, group size, user conflicts, perceived crowding, visitor profile, visual impressions, and satisfaction with or desire for recreational opportunities and facilities including levels and quality of interpretation and posted information in the project areas. The questionnaire should provide an opportunity for visitors to express any potential concerns over the current condition and future possibilities for recreation and recreation facilities in the project areas. Recommended questions for the questionnaire are provided at the end of the study request. The draft questionnaire should be shared with NPS and other interested stakeholders for comment.*

#### *Step 3 – Interviews with User Groups and Recreation Providers*

*Interviews should be conducted with a variety of identified regional and local recreation providers, user groups, and outdoor recreation tourism organizations associated with recreation in the project areas and in the project vicinity. Examples include Trego Lake District and the Chambers of Commerce and tourism organizations of local communities. These entities should be interviewed to gather additional information on current use, user preferences and needs, perceived regional uniqueness, and significance of recreation opportunities within the project areas, existing data, and observations in the project areas for both existing and potential future users.*

#### *Step 4 - Review of Research Publications and Existing Information*

*Recent relevant Wisconsin-based user preference surveys and other outdoor recreation surveys about recreation demand in the project areas should be gathered and reviewed. These include the most recent state and county recreational management plans identified in the PAD including the Wisconsin Statewide Comprehensive Outdoor Recreation Plans (SCORPs). The Applicant should also search for more current surveys that analyze the project and facility areas' outdoor recreation participation rates and growth needs in northern Wisconsin to help address how the project recreation facilities are helping to meet the demand of the greater area. This includes increasing population growth in the Twin Cities, Minnesota, Metropolitan statistical area, a two-hour drive, ecotourism and second home use trends. The newly created state Office of Outdoor Recreation in Wisconsin may provide contemporary information. Demand and user preference studies at various scales, covering Wisconsin, but especially those addressing northern sections of the state, should be reviewed for their applicability to the project areas. Recreation activity and participation trends information should be examined from the existing demand studies and reports.*

#### *Step 5 - Assessment of Regional Uniqueness and Significance of the Project Areas' Primary Recreation Opportunities*

*Regional uniqueness and significance of the project areas' primary recreation opportunities should be evaluated. Site-specific factors that contribute to the uniqueness of the project areas can inform the demand analysis and needs assessment. Where available, information should be gathered for sites including types of designation including water/canoe trail designation, types of*

*recreation opportunities available, visitation statistics (including information on visitor's origin), and general popularity for regional outdoor recreation areas.*

#### **Step 6 - Regional Demand Assessment**

*The recreation demand analysis should compare demand with the existing supply of recreation opportunities and use patterns. A gap analysis should be performed by comparing relative demand to supply, with consideration for trends and variations in user groups based on research and forecasts of population growth. By comparing this information to a detailed inventory of existing recreation opportunities and using information gathered in the observational surveys, visitor use questionnaires, structured interviews, and focus groups, it will be possible to determine whether there is a need for modifications to the existing facilities and/or for the development of additional facilities and recreation amenities.*

#### **Recreation Needs Assessment**

*A needs assessment is an analysis of all recreation-related study results. Consequently, the methods to complete the needs assessment consist of all the methods used to complete the elements of this Study Description as well as methods described in NPS study Request #3 Hydraulics, Sedimentation, and Channel Change Study (Trego).*

#### **Analysis**

*The information gathered by the recreation study will assess the suitability of facilities in terms of meeting the changing needs of recreation users in the project areas. The analysis will include developing existing and projected visitor-use estimates, along with existing and projected demand (including unmet demand) for recreational opportunities over the 40 to 50-year license term. The facility inventory assessment data collected should be analyzed to identify short and long-term improvement needs over the term of the new license. The recreation demand analysis should provide relevant information about user preferences and needs are related to recreation facilities provided by the project. The draft recreation report should include recommendations for monitoring every 6 years of recreation use, visitor demand evaluation, and facility condition over the life of the license. A courtesy copy of the Draft (should) be shared with NPS and other interested stakeholders for comment.*

#### **TLD Comment(s):**

*The recreation study proposed by NPS will set the stage for future improvements or enhancements of recreation opportunities on Trego Lake. TLD is happy to support and be involved in developing the picture this study creates. In the past, the recreation survey used by Xcel and its agents relied on a questionnaire at the Trego Town Landing. However, the study method was too narrow. The people using the lake most frequently, those living around it, were not methodically surveyed. Studying this crucial issue, as part of Xcel receiving a 40-year license to continue operating the dam, would ensure the entire lake formed by the dam is available for a range of recreational activities.*

**WDNR Comment(s):**

*Evaluate current recreational uses, including opportunities for low flow and high flow events, public access, natural scenic beauty, trails, water sports, and fishing with consideration of the different seasonal uses.*

*Methodology – Desktop assessment, including a review of the State of Wisconsin 2019-2023 Statewide Comprehensive Outdoor Recreation Plan (SCORP), released in March 2019, public surveys, and existing recreational sites. This includes assessment of current uses, level of use, evaluation for additional recreational features.*

**NSPW Response:**

NSPW is proposing to complete a recreation survey with four components: (1) facility inventory and condition assessment, (2) recreational facilities accessibility assessment, (3) a recreation use and demand analysis, and (4) a recreation needs assessment.

NSPW will conduct an inventory of recreation sites and facilities in the Hayward and Trego Project vicinity along with an assessment of each site's condition, accessibility, and amount of public recreational use. The surveys will include the following sites:

**Hayward Project**

- Canoe Portage Take-Out and Carry-In Access
- Canoe Portage Put-in
- Informal Bank Fishing Area
- City of Hayward Boat Landing
- City of Hayward Beach
- Bartz's Bay Informal Ice Fishing Access

**Trego Project**

- Town of Trego Park
- Town of Trego Boat Landing
- North Tailwater Access (Canoe Portage)
- South Tailwater Access

Visitor use questionnaires will be distributed to recreationists encountered during onsite surveys. In order to gather information from riparian owners, NSPW will provide the visitor use questionnaire to the Lake Hayward Property Owners Association (Hayward Project) and Trego Lake District (Trego Project) for distribution to their members. Questionnaires will also be distributed to the City of Hayward, Hayward Area Chamber of Commerce, and Sawyer County for the Hayward Project and the Town of Trego, Trego Lake District, and Washburn County for the Trego Project. The questionnaire will gather information on current recreational use, user preferences and needs, perceived regional uniqueness, significance of recreation opportunities within the Project areas, existing data, and observations from recreationists.

The Recreation Study Report will include a recreation needs assessment and analysis of data collected during the study. The study plan and study report will be distributed to interested stakeholders for comment. Stakeholder comments will be addressed in the final study plan and final study report. The recreation study will be completed in 2022.

**P. Sedimentation, Hydraulics and Channel Change Study at Trego Dam – NPS, TLD, WDNR**

**NPS Comment(s):**

*The NPS requests a study to evaluate the effects of Trego hydropower project operations on river hydraulics, sediment transport, and channel morphology. The primary goal of this study is determine whether the area proposed for removal from the Trego boundary in the vicinity of the US highway 53 bridge is influenced by project operations and is needed for project purposes such as public recreation, shoreline control, or protection of environmental resources...this proposal will characterize changes in channel planform and shoreline position; update the 1989 WI DNR Study, Evaluation of Sedimentation Processes and Management Alternatives in the Trego Flowage and bathymetry available from 1966; and build upon this existing data to determine the effects of continued hydropower project operations on sedimentation and flooding in the Namekagon River and Trego lake. Study results will also help inform recommendations related to potential flooding and ongoing management activities (e.g., dredging and vegetation management) that are used to mitigate sediment deposition, the growth of nuisance and invasive aquatic vegetation and related loss of recreation access particularly under changing climate scenarios.*

*Methodology*

*The NPS recommends conducting a study to update existing data on the effects of Trego hydropower project operations on river hydraulics, sediment transport, and channel morphology in the Namekagon River upstream of Trego Lake. The study consists of four components: (1) analysis of existing aerial imagery; (2) collection of bathymetric data; (3) hydraulic modeling; and (4) synthesis.*

*Specific tasks and proposed standard methods include the following:*

- 1. Channel and shoreline change analysis:*
  - a. Evaluate aerial imagery for the period of record, available from the University of Wisconsin map library, to evaluate change in the channel planform and shoreline position through time along the reservoir and upstream from the U.S. Highway 53 bridge. Channel margins and reservoir shoreline should be digitized using geographic information system (GIS) software and applying standard methods (Givear and Bryant, 2003).*
  - b. Quantify information on patterns in sediment deposition, bank/shoreline erosion, delta growth, and changes in aerial extent of aquatic vegetation through time.*
- 2. Bathymetric survey and analysis:*
  - a. Acquire a sufficiently detailed channel and lake bathymetry upstream from Trego dam to evaluate changes in bed elevation and support subsequent hydraulic modeling. Bathymetric data should be acquired using single-beam sonar integrated with GNSS positioning system and be integrated with existing Lidar to develop a high-resolution terrain model of the project area.*
  - b. Bathymetric transects should be compared to previous surveys to:*
    - i. Quantify volumes of sediment deposition and erosion that have occurred in the flowage since 1988 (WI, DNR 1989), and*

- ii. *Estimate average rate of reservoir sedimentation since 1988 and compare this rate to the rates reported previously by WI DRN for the period from dam construction to 1988.*
- 3. *Hydraulic modeling and analysis:*
  - a. *Using data obtained from the bathymetric survey, apply the US Corps of Engineers HEC-RAS model or similar to develop a one-dimensional hydraulic model extending a sufficient distance upstream from the US Highway 53 bridge to accurately model hydraulics through the project site including backwater effects due to the Trego hydropower project.*
  - b. *Evaluate the effect of the project on flood inundation under alternative climate scenarios. Methodologies to evaluate the impact of increasing precipitation and rainfall intensity are evolving and should be selected in consultation with NPS.*
- 4. *Synthesis – The final study report should address the following licensing issues:*
  - a. *Evaluate whether the upstream reach of the Namekagon River proposed for removal from the project boundary is impacted by the project and contributes to problems association with sediment deposition in the reservoir and/or channel; vegetation growth and loss of recreational access; and flood risk to existing infrastructure and public access areas.*
  - b. *Recommend updates to management plans and activities for sedimentation and vegetation (e.g., existing license Article 405; Barr Engineering, 1994; and WIDNR GP-NO-2019-66-03813) and identify alternate methods to mitigate the impact of sediment deposition on aquatic plant growth, recreation access, and flooding.*
  - c. *Evaluate the need for more detailed hydraulic and sediment transport modeling to quantify effects of sediment deposition on flood risk upstream from Trego dam.*

**TLD Comment(s):**

*An average of 2000 cubic yards of sediment accumulate in Trego Lake each year, as NPS notes in its study request. Sediment creates an enormous issue for Trego Lake users and land owners. The information gathered in the NPS study would be invaluable to identify issues and develop actions to mitigate sediment build-up, control growth of aquatic plants including aquatic invasive species (AIS) resulting from sedimentation buildup and prevent the loss of recreational opportunities for people visiting the lake or living on the lake.*

**WDNR Comment(s):**

*Assess sedimentation upstream of Trego Dam near where the boundary is proposed to be removed.*

**Methodology**

*Sediment accumulation should be assessed and measured downstream of Hwy 53 through the project area that is being proposed for removal. Assessments of sediment deposits and sediment depth measurements can be collected along multiple transects, including the bay areas, north and west of Leisch Road.*

**NSPW Response:**

An excerpt from the FERC Order Modifying and Approving Drawdown Needs Analysis issued October 31, 1995, stated:

*“In a study by the COE, it was reported that soil loss from the Trego Flowage watershed was minimal and that sediment carried by the system was primarily generated from natural processes upriver of the project. The study concluded that the Namekagon River is exhibiting normal streambed erosion and was undergoing a natural transition from a meandering system to a braided system. Timber cutting on sloped land near tributary channels, construction activities, and recreational activities were cited as contributing to the sediment load. Presently, the Namekagon River carries very low quantities of sediment compared to other, similar sized Wisconsin river systems...These very low concentrations are consistent with the nature of this well protected river system. The sediment that is carried by the system also appears to be generated from mostly natural processes. The Namekagon River above the flowage is undergoing a natural transition from a meandering to a braided river channel. The COE study found that an average of 6 feet (145,000 cubic yards) of coarse-grained sediment accumulated in the 15-acre inlet area from 1927 through 1988. If deposited at a uniform rate over the 70-year period, approximately 2,000 cubic yards were deposited annually. This infilling rate was reported to be low when compared to other Wisconsin impoundments.”*

Sediment deposition at the upper reaches of Trego Flowage is the result of natural processes upstream of the Project and is not attributed to Project operations (i.e., water level fluctuations). A similar process takes place where rivers enter a natural lake. Since the sedimentation is not caused by Project operations, the Licensee is not proposing to conduct a sediment study. The Cultural Resources Study, described in **Section F**, will identify eroding shoreline areas that may influence the amount of sediment within each Project boundary.

The Licensee will also gather information on aquatic and terrestrial vegetation, lakebed substrate, and water depths in conjunction with the ATIS Study described in **Section I**. Information collected will be utilized to develop updated vegetation and bathymetric maps of the reservoir. This information will be utilized to evaluate potential recreational impacts caused by excessive vegetation and/or low water depths as well as develop mitigation measures if needed.

NSPW is not proposing to conduct any hydraulic modeling of portions of the Namekagon River upstream of the maximum operational elevation of 1035.2 feet NGVD as identified in LiDAR mapping. The run-of-river operation does not have a noticeable effect on river hydraulics at elevations above the licensed operational range. Hydraulic effects are driven primarily by the volume of inflow, not the operation of the Project.

**Q. Shoreline Survey – NPS, TLD****NPS Comment(s):**

*The NPS proposes a comprehensive shoreline study that involves a detailed inventory of shoreline erosion, erosion controls, docks, and aquatic vegetation limiting recreational access to*

*the shoreline within the project boundaries. The objective of this study is to determine the existing shoreline conditions and to provide the basis for making recommendations for protecting and enhancing the project shorelines.*

*Study Method 1- The NPS recommends conducting a longitudinal survey of the river and its banks, using georeferenced photographic equipment (video or still). The High-definition Stream Survey (HDSS method (Trutta, 2019) is one method used in recent FERC hydropower licensing proceedings, which enables mapping and a visual record of stream and shoreline characteristics and data from a variety of sensors. The approach has been used to classify streambank condition, ranging from fully functional, functional, slightly impaired, and non-functional (Connell et. al, 2019) It has been used to classify unique manmade or natural features based on type, condition, and location similar to Yetman (2001) and could be used to identify sedimentation features such as in channel bars, vegetated islands, and in channel vegetation. In addition, the approach has also been used with side scan sonar to creation cross sectional bathymetric transects. Such an approach could also be integrated in the NPS requested sediment study.*

*Evaluate, quantify, photograph, and map shoreline conditions on the Hayward and Trego Project boundary shorelines including:*

- Streambank condition*
- Bank stabilization types and condition*
- Docks/piers*
- Public access locations*
- Presence/extent/type of aquatic vegetation (especially nuisance and invasive plants, but also highly valued wild rice)*

*Objectives include:*

- 1. Create georeferenced photographic database and map of shoreline conditions.*
- 2. Identify areas in need of management attention for shoreline erosion, cultural resource protection, vegetation management, and public access.*
- 3. Facilitate evaluation of change over time to ensure protection of visual/scenic/aesthetic, recreation, cultural, and natural resources.*
- 4. Facilitate communication between the licensee, NPS, shoreline property owners and local jurisdictions about shoreline protection practices and NPS Wild and Scenic River Act Requirements to review shoreline treatments and to protect and enhance river values.*

#### *Study Method Part 2*

*In addition, the NPS recommends that the licensee review its records to document changes in shoreline conditions on lands owned by the licensee within the project boundaries that have occurred over the life of the current licenses.*

*Objectives include:*

- 1. Compare existing shoreline conditions with past conditions available from the licensee's records.*
- 2. Create a list and brief description of shoreline stabilization and other construction projects conducted by the Licensee.*
- 3. Identify where consultation with the NPS was conducted for licensee activities.*

**TLD Comment(s):**

*The shoreline survey will identify erosion problem areas and aquatic vegetation on Trego Lake. As we note, sedimentation is a crucial issue, likely driven by erosion and resulting excessive aquatic vegetation. Studies will help us understand as we mitigate these issues.*

*TLD respectfully requests a more comprehensive look at sediment sources. Specifically, we ask you to extend the shoreline study to cover the Namekagon River between Hayward and Trego. This will help determine if the amount of sediment entering Trego Lake has increased and identify sources of sediment. This coupled with NPS study request #3 will provide a greater overall picture of sediment problems. With this information mitigation actions can be reviewed and developed to improve recreational opportunities for Trego Lake and the Namekagon River.*

**NSPW Response:**

In the Cultural Resources Study described in **Section F**, NSPW will monitor the Project shoreline for erosion. This study will also identify failing shoreline stabilization measures. Erosion sites and failing shoreline stabilization measures will be evaluated to determine if they are caused by project operations. This study will include all shorelines within either the current or proposed project boundaries which are also defined as the APE for each Project. No study of areas outside of the APE will occur because these areas are not influenced by project operations. Neither the Licensee nor FERC have the responsibility or authority to conduct mitigation in areas not affected by the Project operations.

NSPW owns a limited amount of land at each Project. Those lands owned by NSPW are primarily adjacent to the Project dams. The company-owned shorelines will be evaluated along with the rest of the Projects' shorelines when the Cultural Resources Study is conducted. No private docks are currently authorized on NSPW-owned shoreline at either Project. It is NSPW's policy that riparian owners may install docks on project shorelines following WDNR regulations. No permits or authorization from NSPW are required. Therefore, NSPW will not be collecting information regarding docks within the Project boundaries.

The condition of public access sites will be evaluated as part of the Recreation Study described in **Section O**. Information on aquatic vegetation will be collected in conjunction with the ATIS Study described in **Section I**.

The Hayward and Trego Projects are subject to Section 12 of the Federal Power Act regarding the safety of hydropower projects and project works. FERC is the lead federal agency which has oversight regarding dam safety and corresponding construction projects conducted over the term of the license. Since the NPS does not have authority over these projects, the Licensee is not required to consult with NPS regarding construction projects conducted under Part 12. Therefore, the Licensee will not be providing a list of construction projects conducted over the term of the current license and whether or not NPS was consulted on said projects. All construction projects at the Projects are completed in compliance of each Project's applicable Programmatic Agreement and/or Cultural Resources Management Plan.

NSPW believes that the information regarding shoreline erosion and failing shoreline stabilization measures described under the Cultural Resources Study described in **Section F** and the vegetation information to be collected under the ATIS Study described in **Section I**, along with the Recreation Study described in **Section O**, will provide sufficient information regarding the current condition of the shoreline at each Project. Therefore, the Licensee is not proposing a separate shoreline study as proposed by NPS and TLD.

## R. Water Quality Study – WDNR

### **WDNR Comment(s):**

The operation of the dam affects the water quality of the impoundment and downstream resources. The overall goal of the request is to further understand the current water quality conditions of the reservoir and river resources which will help inform management decisions in the future. Limited water quality data presented in the PAD is not representative of current or future water quality conditions.

Assess and monitor the following water quality parameters:

<i>Ammonia</i>	<i>Alkalinity</i>	<i>Bacteria</i>
<i>Chloride</i>	<i>Chlorophyll-a</i>	<i>Color</i>
<i>Conductivity</i>	<i>Cyanobacteria</i>	<i>Dissolved Oxygen</i>
<i>Dissolved Phosphorus</i>	<i>Iron, Manganese, and Sulfide</i>	<i>Methyl Mercury</i>
<i>Nitrate (plus Nitrite)</i>	<i>pH</i>	<i>Secchi Depth</i>
<i>Sediment Accumulation</i>	<i>Sulfate</i>	<i>Temperature</i>
<i>Total Mercury</i>	<i>Total Nitrogen</i>	<i>Total Phosphorus</i>
<i>Total Suspended Solids</i>		

*Methodology – The department classifies Hayward Lake as an impounded flowing water, where a water residence time is less than 14 days... The department classifies Trego Lake as an impounded flowing water, where a water residence time is less than 14 days... This means that river monitoring protocols should be applied instead of lake protocols upstream of the impounded area and downstream of the dam. Lake protocols should be applied within the deep hole of the impounded area.*

*River monitoring methods (including continuous monitoring) should be performed in at least three locations within the project area (or best appropriate location), including one location downstream of the dam, one location within the impounded area (within the deep area of the impoundment, typically near the dam), and one location upstream of the impounded area.*

*Data should be collected or analyzed using the DNR WISCALM Guidance, surface water grab sampling protocol. And the Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures 2020).*

### **NSPW Response:**

NSPW will complete the water quality monitoring for the parameters outlined by WDNR with the exception of methyl mercury. WDNR indicated that dam operations can influence the sulfur and

ultimately the mercury cycle where sulfate runoff can acidify the water and enhance methyl mercury concentrations in water and methyl mercury in fish. Since testing of total mercury levels in water will identify elevated mercury levels, no fish tissue sampling is being proposed by NSPW. The water sampling will be conducted according to WDNR WISCALM Guidance and surface grab sampling protocols. The following parameters will be monitored:

Upstream and Downstream Monitoring Locations (River Sampling Protocol)

- Ammonia, bacteria, chloride, dissolved phosphorus, nitrate (plus nitrite), sulfate-total mercury, total nitrogen, total phosphorus, and total suspended solids will be collected at each of the sampling sites monthly from May to October (6 total).
- Chlorophyll-a will be collected at each of the sites monthly from July through September (3 total).
- DO, temperature, conductivity, and pH will be collected at each of the sites hourly from July through September.

Impoundment (Deep Hole) Monitoring Location (Lake Sampling Protocol)

- Alkalinity, ammonia, bacteria, chloride, dissolved phosphorus, iron, manganese and sulfide, total phosphorus, secchi depth and total suspended solids will be collected at each of the sampling sites in May, July, August, and September (4 total).
- DO and temperature profiles at 1 m intervals will be collected at each sampling site in May, July, September, and October (4 total).
- Chlorophyll-a and cyanobacteria will be collected at each of the sites monthly from July to September (3 total).
- Ammonia, color, nitrate plus nitrite, and total nitrogen will be collected at each of the sites once between July and September (1 total).
- Sulfate and total mercury will be collected once in May (1 total).

The study plan and study report will be distributed to interested stakeholders for comment. Stakeholder comments will be addressed in the final study plan and final study report. Study implementation will be completed in 2022.

## **S. Wildlife Habitat Study – WDNR**

***WDNR Comment(s):***

*Document wildlife presence and diversity, habitat types, and general wildlife and vegetation abundance within the project area. The goal of this study is to evaluate the distribution and composition of vegetation, wildlife, and wildlife habitats, including wetlands, and the effects operations has on those habitats.*

*The department has concerns for otters, furbearers, and other wildlife if water levels are not managed similar to current operations. Turtles, frogs, and other herps would be negatively affected if water levels are drawn down after October 1<sup>st</sup>.*

*Methodology – Using a qualified biologist or ecologist knowledgeable in local vegetation, identify, classify, and delineate on a map major vegetation cover types within project area. Existing aerial*

*photography, on the ground surveys, or a combination of the two to identify and map the cover types may be used the biologist/ecologist will record all wildlife present. Ground-truth any remote-sensing mapping efforts and record all wildlife species detected (directly or indirectly) during survey efforts. Describe each cover type by species composition, successional state, and aerial extent (acreage) within the survey area, including invasive species. As an example, the methodology expressed the following reference could be used:*  
[https://www.fs.fed.us/research/publications/gtr/gtr\\_wo89/gtr\\_wo89.pdf](https://www.fs.fed.us/research/publications/gtr/gtr_wo89/gtr_wo89.pdf).

**NSPW Response:**

NSPW will determine the dominant cover type of lands within the Hayward and Trego Project boundaries via a combination of remote-sensing and ground truthing in the field. GIS mapping will be used to determine the areal extent of each cover type and an analysis of the differences in cover types between the lands within the existing and proposed boundaries will be completed. This information will be provided in the DLA.

NSPW is not proposing any changes to the operation of the Projects that would impact upland wildlife or upland wildlife habitat. No nexus between the Projects' operations and wildlife management has been established by the WDNR. Therefore, no wildlife observation surveys are being proposed by NSPW. A terrestrial vegetation component was incorporated into the ATIS Study discussed in **Section I**.

**T. Wood Turtle and Blanding's Turtle Studies – WDNR**

***WDNR Comment(s):***

*Wood Turtles*

*Wood turtles are listed as threatened in Wisconsin. In an effort to better understand the abundance and distribution of this species, several survey and management efforts are taking place across northern Wisconsin within a number of different river systems. Presence/absence surveys, population modeling and natural nest site surveys are three examples of existing work that is being done across the range of this species in Wisconsin, which is primarily the northern one-third of the state. The overall goal of this survey request is to determine whether any wood turtle nest sites occur within the Project boundary at either Hayward or Trego.*

*Methodology – Using a qualified biologist or ecologist, wood turtle nesting site surveys are requested following the protocol listed below.*

*Wood Turtle Nesting Site Surveys: Beginning in early to mid-June, and extending until approximately the first week in July, wood Turtle nesting activity can be surveyed by conducting daily searches for adult wood turtles and/or evidence of recent nesting activity in suitable nesting habitat. Suitable nesting habitat includes a sand or sand/gravel substrate that is either unvegetated or sparsely vegetated, receives sun exposure for most of the day late spring/summer and is within approximately 200 feet of the river's edge. Note that this can include gravel parking areas, roads, or shoulders of paved roads. Many portions of the project boundary can likely be eliminated from these nesting surveys due to a lack of suitable conditions.*

### Blanding's Turtles

#### *Goals and Objectives*

*Blanding's turtles are a Special Concern species in Wisconsin. In an effort to better understand the abundance and distribution of this species, we are requesting that Blanding's turtle surveys are conducted within the Hayward and Trego project boundaries. The overall goal of this survey request is to determine whether any Blanding's turtle nest sites occur within the project boundaries.*

#### *Methodology*

*Using a qualified biologist or ecologist, Blanding's turtle nesting site surveys are requested following the protocol listed below.*

*Blanding's turtle nesting site surveys: Beginning in early to mid-June, and extending until approximately the first week in July, Blanding's turtle nesting activity can be surveyed by conducting daily searches for adult Blanding's turtles and or evidence of recent nesting activity in suitable nesting habitat. Suitable nesting habitat includes a sand or sand/gravel substrate that is either unvegetated or sparsely vegetated, receives sun exposure for most of the day during late spring/summer and is within approximately 200 feet of the water's edge. Note that this can include gravel parking areas, roads, or shoulders of paved roads. Many portions of the project boundary can likely be eliminated from these nesting surveys due to lack of suitable conditions for turtle nesting.*

#### **NSPW Response:**

Wood and Blanding's turtles have been documented to be present within the Project vicinity. NSPW does not believe it is reasonable to conduct daily surveys for nesting turtles over the course of several weeks. Instead, NSPW proposes to conduct a survey to identify and map potential Wood and Blanding's turtle nesting habitat within each Project during the nesting season. The survey will be completed by traveling along the shoreline by boat or on foot (in areas where boating is not feasible) and on foot on Licensee owned lands with Project facilities (e.g., recreation sites, project structures, regularly maintained areas) where Project operations could impact nesting habitat. All areas with suitable nesting habitat will be identified and mapped. If any Wood or Blanding's turtles are identified during the surveys, their locations will be recorded via handheld GPS and a rare animal field report form will be completed and forwarded to WDNR. All specific turtle location information will be considered privileged and will not be publicly released. Once a map showing suitable Wood and Blanding's turtle nesting habitat within the Project is created, the Licensee will consult with WDNR to identify proposed mitigation measures to minimize or eliminate impacts. Information collected during the study and any proposed mitigation measures will be included in the DLA.

The study plan and study report will be distributed to interested stakeholders for comment. Stakeholder comments will be addressed in the final study plan and final study report. The Wood and Blanding's Turtle Nesting Habitat Study will take place in 2022.

**TABLE 1: Study Commitments and Timing**

<b>Commitment</b>	<b>Explanation</b>	<b>Time of Implementation</b>
Aquatic Plant Study (Completed as part of ATIS Study)	Will be completed as part of Aquatic and Terrestrial Invasive Species (ATIS) Study.	NA
Assessment of Current Dam Operations	Conduct assessment of current dam operations.	2022
	Include information in DLA.	2023
Assessment of Minimum Flow and Resource Impacts Downstream of the Tailwater	Not proposing to complete this study.	NA
Assessment of Riverine and Reservoir Habitat	Will be completed as part of ATIS Study.	NA
Assessment of Stream Flows, Channel Dimensions, and Linear Gradient	Not proposing to complete this study.	NA
Cultural/Historic Resources Study	Finalize study plan.	2021
	Conduct shoreline survey and provide study report to interested stakeholders for comment.	2022
	Finalize study report and include in DLA.	2023
Fisheries Study (Trego)	Not proposing to complete this study.	NA
Fish Entrainment and Fish Movement Study	Not proposing to complete this study.	NA
Invasive Study (Aquatic and Terrestrial)	Finalize study plan.	2021
	Complete study and provide study report to interested stakeholders for comment.	2022
	Finalize study report and include in DLA.	2023
Macroinvertebrate Study	Not proposing to complete this study.	NA
Mink Frog Study	Not proposing to complete this study.	NA
Mussel Study	Finalize study plan.	2021
	Complete study and provide study report for comment to interested stakeholders.	2022
	Finalize study report and include in DLA.	2023

<b>Commitment</b>	<b>Explanation</b>	<b>Time of Implementation</b>
Project Boundary Change Study	Analyze differences of lands in each proposed and existing Project boundary.	2022
	Include information in DLA.	2023
Rare and Endangered Species Study	Evaluate cover types within project to determine potential rare species impacts.	2022
	Include information in DLA.	2023
Recreation Study	Finalize study plan.	2021
	Conduct study and provide study report to interested stakeholders for comment.	2022
	Finalize study report and include in DLA.	2023
Sedimentation Hydraulics, and Channel Change Study at Trego	Components of this study request will be conducted in conjunction with the ATIS Study and Cultural Study. No stand-alone study is proposed.	NA
Shoreline Survey	Components of this study will be conducted in conjunction with the ATIS Study, Cultural Study, and Recreation Study. No stand-alone study is proposed.	NA
Water Quality Study	Finalize study plan.	2021
	Complete water quality monitoring.	2022
	Include information in DLA.	2023
Wildlife Habitat Study	Assess cover type information.	2022
	Include information in DLA.	2023
Wood and Blanding's Turtle Study	Finalize study plan.	2021
	Complete study and send report to interested stakeholders for comment.	2022
	Finalize study report and include in DLA.	2023

### **3. Literature Cited**

Federal Energy Regulatory Commission. 1995. Order Issuing Subsequent License (Minor Project) Northern States Power Company, Project No. 2417-001. Issued September 1, 1995.

Federal Energy Regulatory Commission. 1997. Northern States Power Company Project No. 2417-013, Order Approving Channel Restoration, Stabilization, and Maintenance Plan. Issued February 24, 1997.

Kleinschmidt, 2016. Chippewa River Fish Projection Study. Holcombe Project (FERC No. 1982), Cornell Project (FERC No. 2639), Jim falls Project (FERC No. 2491), Wisconsin Project (FERC No. 2567), Chippewa Falls Project (FERC No. 2440), Dells Project (FERC No. 2670). November 2016.

Northern State Power Company-Wisconsin. (1991). Application for a Subsequent License for a Minor Water Power Project. Hayward Hydroelectric Project, FERC Project No. 2417. December 1991.

## **Appendix 1. Study Request Letters**

# Appendix 1

## Comments on PAD and Study Requests



United States Department of the Interior  
NATIONAL PARK SERVICE

Interior Regions 3, 4, 5  
601 Riverfront Drive  
Omaha, NE 68102



April 27, 2021

Ms. Kimberly D. Bose, Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington DC. 20426

Electronic Filing

**Re: National Park Service Comments on the Preliminary Application Document and Study Requests for Hayward Hydroelectric Project (FERC Number P-2417) and Trego Hydroelectric Project (FERC Number P-2711)**

Dear Secretary Bose:

The National Park Service (NPS) respectfully submits the following comments on the Preliminary Application Document (PAD) for the Hayward Hydroelectric Project (FERC Number P-2417) and Trego Hydroelectric Project (FERC Number P-2711). The NPS is also submitting the following study requests: 1) Recreation Study (both projects), 2) Shoreline Survey (both projects), and 3) Hydraulics, Sedimentation, and Channel Change Study (Trego).

The NPS has authority to consult with the Federal Energy Regulatory Commission (FERC) and applicants concerning a project's effects on outdoor recreation resources under the Federal Power Act (18 CFR 4.38(a), 5.41(f)(4)-(6), and 16.8(a)); the Outdoor Recreation Act (Pub Law 88-29), and the NPS Organic Act (39 Stat. 535), and the National Wild and Scenic Rivers Act (Section 11(b)). The projects are located on the Namekagon River within the St. Croix National Scenic Riverway, a unit of the National Park System.

The St. Croix National Scenic Riverway (SACN) was established when the enabling legislation, the Wild and Scenic Rivers Act, was signed into law on October 2, 1968. The purpose of the St. Croix National Scenic Riverway is to preserve, protect, and enhance the values of the St. Croix and Namekagon rivers and their immediate environment for the benefit and enjoyment of present and future generations. The values for which the Riverway has been designated as a wild and scenic river are its free-flowing character, exceptional water quality, and the aquatic, riparian, recreational, cultural, geologic, and scenic-aesthetic values present in the rivers.

In addition to the NPS's responsibility to manage the SACN according to national wild and scenic river policies and best management practices, it is the policy of the NPS to represent the national interest regarding recreation to assure that hydroelectric projects subject to the FERC

licensing process incorporate the full potential for meeting present and future public outdoor recreation demands while maintaining and enhancing a quality environmental setting for those projects. Investigating opportunities to improve the recreation experience is consistent with NPS policy and FERC guidelines to identify potential future recreation needs.

We submit the following comments on the PAD and the three study requests, attached as appendices.

## **A. NPS COMMENTS ON THE PAD**

### **3.3.2 Trego Project Boundary (Proposed)**

The PAD states:

*The use of LiDAR data to review the current Project boundary identified that the upper extent of the existing Project boundary contains a portion of free-flowing Namekagon River that is not impounded at the maximum operating elevation of 1,035.2 feet and therefore is not necessary for project operations. Therefore, in developing the proposed Project boundary for this document, the unimpounded or free-flowing upstream reach has been removed from the proposed Project boundary.*

This characterization of the impacts of the project is misleading and is not technically correct. Although FERC regulations link impoundment boundaries to the maximum operating elevation, the regulations also recognize the potential need to include other areas for project purposes, such as public recreation, shoreline control, or protection of environmental resources. The effects of the project are related to velocity, gradient (or slope) and hydraulic head. Those effects extend well beyond the maximum operating elevation. The NPS is requesting a study to determine whether the upstream reach is impacted by the project and is needed for project purposes.

## **4.8 Recreation and Land Use**

The Applicant recently provided a 2021 “Draft Recreation Report” for each impoundment as required every six years throughout the 30-year license period. The applicant proposes to use information from these reports for relicensing purposes and proposes not to conduct a recreation study.

The 2020 Wisconsin Outdoor Recreation Economy Report found a 12% increase in outdoor recreation use and spending between 2012-2017 while overall state Gross Domestic Product grew by 7%. However, there is no *current* detailed user information for either impoundment in the Draft Recreation Report(s) that reflects this trend in increased recreation. While we agree that the Draft Recreation Reports adequately provided the *condition* of existing formal recreation facilities, the NPS finds the methodology used to determine *recreation use* in the 2021 reports insufficient for determining baseline information, mitigation and enhancement measures for the new 40-year license application.

We provided these comments regarding the 2021 reports in anticipation of relicensing activities:

We have concerns that the methodology used to determine recreation use in 2020 may not adequately reflect current user demand since annual recreation counts were based on information collected in 2013–2014 and extrapolated using population trends.

The 2013-2014 daytime recreational use information is an estimate “extrapolated from multiple sources including trail counters, estimates from outfitters, NPS usage numbers, and estimates from overnight facilities.” It is not clear how trail counters related to water-based impoundment recreation use; if outfitter estimates referred to impoundment and/or river use; and if NPS usage numbers referred to impoundment and/or river use. In addition, extrapolation for 2020 recreation estimates using population change estimates may not adequately reflect outdoor recreation trends over the period. Outdoor recreation use has increased significantly over the past decade in all regions of the state, likely outpacing population growth estimates for the three local counties for which the average population increase rates was used for extrapolation.

In addition to our prior comments, the report(s) lack important information such as opportunities to modify existing facilities to improve accessibility, dispersed/informal recreational use, and the closure of two access sites that may be within the undefined existing project boundary for Trego Lake. Please note that we use existing place names of “Trego Town Park” for the access site east of Highway 53 and “Trego Landing” for the access site midway on Trego Lake’s south side. We recommend including the following recreational components as part of relicensing:

- Recent closure of two paddle craft access points – the popular Wisconsin Department of Transportation site on the south side and the NPS site on the north - located in the upper impoundment area upstream/East of Highway 53 will likely divert recreational use to the Trego Park Landing, Trego Landing, or both. The impact of increased recreational pressure on the remaining two access sites has yet to be determined.
- On Hayward Lake, the popular winter recreation use of ice fishing and impacts of use on informal access were not evaluated in the report. The Hayward Recreation Report describes traffic congestion caused by parking on Chippewa Trail in winter when anglers seek to ice fish on Bartz’s Bay. The congestion was identified as problematic and a recommendation was made to consider providing designated parking areas.
- On Hayward Lake, reference to the put-in downstream of the dam was omitted from the PAD and should be included in the study and report.

Lastly, the proposed boundary change excludes Trego Town Park and its landing, the sole remaining access site out of three that provides access to the upper impoundment. It is unclear from the PAD maps if this park and landing are within the existing undefined project boundaries. We note that contemporary references (2021 Trego Recreation Report) and historic documents (described below) reference this site as important for recreational access *to the impoundment* as well as experiencing project impacts of sedimentation and flooding.

Historical reports on sediment deposition in the headwaters of Trego Lake document that these sediments impact access to existing boat launches at Trego Town Park and the resort and campground across the river, both located upstream of Highway 53:

“Although accessibility would generally be improved it is likely that in certain areas, such as that near immediately above the resort and at the site near the mouth of the bay area opposite the resort, additional sediment would have to be physically removed to achieve desired results” (Trego Flowage Study, Wisconsin Department of Natural Resources, 1989)

“It is doubtful that deposition in the lake is only a recent problem. The photographs seem to indicate that the Delta extends a good way downstream of Rowan’s Resort” (U.S. Army Corps of Engineers, Trego Flowage Study, WDNR 1989).

In response to the Applicant’s questionnaire, the Town of Trego representative stated that the boat landing is unusable due to aquatic vegetation and that flooding recently impacted the Trego Town Park. Consequently, we include the Trego Park Landing in our Recreation Study and Hydraulics, Sedimentation, and Channel Change Study (Trego) requests to evaluate project related impacts and inform proposed boundary change decisions.

#### **4.10 Historical and Cultural Resources**

The NPS St. Croix National Scenic Riverway staff requests to be a formal consulting party with the State Historic Preservation Officer on the Programmatic Agreement addressing Section 106 of the National Historic Preservation Act.

##### **5.1.2.2 Water Resources Trego Project**

The PAD attributes flooding concerns raised by the Town of Trego to occasional ice jams in the vicinity of the Highway 53 bridge. This perspective fails to address the effects of continued sedimentation caused by the project on local river hydraulics and flooding. Annual precipitation and heavy rain events are expected to increase in Wisconsin over the life of the new license (NOAA, 2017). The NPS is requesting a study to evaluate the effect of the project on flood inundation under alternative climate scenarios.

NOAA National Centers for Environmental Information, 2017. Accessed 4/11/2021  
<https://statesummaries.ncics.org/chapter/wi/>

#### **5.3 Mitigation Enhancement**

The Applicant proposes existing conditions of run-of-river operations, target elevations, minimum flows, and maintaining existing recreational access around their dams as mitigation and enhancement. We disagree with this definition because these measures are baseline standards: 1) run-of-river operation, target elevation, and minimum flows are required in the

State of Wisconsin's Clean Water Act Section 401 permit, and 2) the existing Commission Approved Project Recreational Facilities and surrounding area are included in the existing license articles.

The NPS will use study report results to inform development of mitigation and enhancement recommendations for inclusion in the new license articles.

### **Corrections**

Section 4.8.2.1: Correction on ownership of river landing. This site on the south side belongs to WisDOT and will be removed as part of Hwy 53/63 interchange project.

Figure 4.8.2.1-1: NPS River Access (South Side). Correct caption: This belongs to WisDOT.

Section 4.9.2.4: Correct the name of the visitor center to "Namekagon River Visitor Center"

Section 5.4: Include the St. Croix National Scenic Riverway General Management Plan (1998) as a Federal Comprehensive Waterway Plan; this plan was recently filed with FERC.

### **B. STUDY REQUESTS**

The NPS submits as appendices the following study requests: 1) Recreation Study (both projects), 2) Shoreline Survey (both projects), and 3) Hydraulics, Sedimentation, and Channel Change Study (Trego).

### **C. CONCLUSION**

The NPS appreciates the opportunity to provide comments on the PAD and request three studies for Hayward and Trego Hydroelectric Project relicensings. We look forward to working with the licensee, stakeholders, and FERC on this license application. For more information please contact Susan Rosebrough at [susan\\_rosebrough@nps.gov](mailto:susan_rosebrough@nps.gov) or (206) 220-4121 should you have questions.

Sincerely,

**RICHARD  
CLARK**

Richard A. Clark  
Deputy Regional Director

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CLARK  
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## **NPS STUDY REQUEST #1: RECREATION STUDY**

### **Criteria 1: Study Description and Objectives 18 CFR (§5.9(b)(1))**

The NPS proposes a multi-step focused recreation study; several aspects of these steps have already been completed as evidenced in the 2021 Recreation Report for each of the projects. In addition, the number of sites to be evaluated in this study is a subset of the total number of recreation facilities identified in the PAD and 2021 Recreation Reports.

The information from the comprehensive recreation study is necessary to determine potential future improvements to or new recreation facilities within the existing and proposed project boundaries. The objective of this recreation study is to determine the condition of certain existing recreational facilities, their capacity to address current and future user demand, user preferences, and to provide the basis for making recommendations for improving/enhancing recreation opportunities.

The first step involves a detailed inventory and assessment of targeted recreation facilities within the existing project boundaries to evaluate whether recreation needs are being met. These steps are followed by a demand analysis which contributes to the overall recreation study: comparing demand to the inventory and condition assessment and user preferences allows further evaluation of existing and projected recreation needs within the project areas. This recreation study will be comprised of the following elements for targeted sites:

- 1) Recreational Facility Inventory and Condition Assessment
- 2) Recreational Facilities Accessibility Assessment
- 3) Recreation Use and Demand Assessment
- 4) Recreation Needs Assessment

### **Criteria 2: Resource Management Goals 18 CFR (§5.9(b)(2))**

The NPS Organic Act; NPS General Authorities Act; Code of Federal Regulations, Title 36; Americans with Disabilities Act; Architectural Barriers Act; Rehabilitation Act; and NPS Management Policies 2006 (§1.4, 8.1) all address the importance of park units being available to all Americans to enjoy and experience.

The NPS administers the Namekagon River as part of the National Wild and Scenic Rivers System (NWSRS) and the National Park System and is included in the St. Croix National Scenic Riverway. The NPS is required by the Wild and Scenic Rivers Act to preserve the St. Croix River and the Namekagon tributary in a natural condition, to protect and enhance the exceptional natural, scenic, and cultural resources of the riverway and to provide high-quality recreational opportunities. River values identified in the hydropower project areas include aquatic resources, cultural resources, recreation, and scenic/aesthetic resources (NPS, 2017).

The presence of the hydropower projects is recognized as the baseline condition for the National Wild and Scenic River designation. However, continuing impacts on resource values must be identified so that protection and enhancement measures can be implemented.

In addition, it is the policy of the NPS to represent the national interest regarding recreation and to assure that hydroelectric projects subject to licensing recognize the full potential for meeting present and future public outdoor recreation demands while maintaining and enhancing a quality environmental setting for those projects. It is in the public interest to analyze impacts, provide mitigation to these impacts, and evaluate opportunities for recreation in the future. The FERC guidelines and the Federal Power Act also provide direction to give equal consideration to other non-hydropower resources including recreation. As federal agencies operating in the public interest, both NPS and FERC are charged with making resource management decisions based on sound information about public needs and interests including interests in recreation resources. (18 C.F.R. 4.61).

**Criteria 3: Resource Agency Status of Requestor and Relevant Public Interest 18 CFR (§5.9(b)(3))**

The National Park Service is a resource agency.

**Criteria 4: Existing Information and Need for Additional Information 18 CFR (§5.9(b)(4))**

The PAD for each project provides information on developed recreation facilities within the existing project boundary including Commission Approved Project Recreation Facilities owned and maintained by the Applicant as well as facilities owned and managed by others. In addition, the Applicant recently prepared a “2021 Recreation Report” for each project. The PAD and Report include recreation facility condition descriptions; the Report includes estimates on recreation demand and needs based on estimates made in 2013.

The methodology used to determine recreation use in 2020 for the 2021 Reports likely do not adequately reflect current user demand because annual recreation counts were based on information collected in 2013–2014 and extrapolated using population trends.

The 2013-2014 daytime recreational use information is an estimate “extrapolated from multiple sources including trail counters, estimates from outfitters, NPS usage numbers, and estimates from overnight facilities. Extrapolation for 2020 recreation using population change estimates likely do not adequately reflect outdoor recreation trends over the period. Outdoor recreation use has increased significantly over the past decade in all regions of the state, outpacing population growth estimates for the three local counties for which the average population increase rates was used for extrapolation. In addition, recreation use influence by ecotourism – the Twin Cities, Minnesota, are a two-hour drive from Trego Lake - and second home use are not reflected in the average population growth of the three surrounding counties.

“The Great Northwest Region has an abundance of natural resources such as Lake Superior, the Namekagon and St. Croix rivers, numerous inland lakes, and large forest blocks. Not surprisingly, tourism is a large and growing industry within the region. In addition to Wisconsin residents, visitors from the Twin Cities and surrounding suburban

areas, utilize the region's recreational resources. Seasonal home development, particularly along rivers and lakes, has increased dramatically within the region.” (Wisconsin Statewide Outdoor Recreation Plan 2019-2023)

The PAD does not include recreational use impacts of recent or imminent permanent closures of two access sites in the upper Trego impoundment east of U.S. Highway 53, leaving only one, which experiences limited water access due to sedimentation/vegetation, in the upper impoundment. The PAD does not include the informal access to Bartz's Bay, a popular ice fishing area in Lake Hayward.

In addition, while the PAD identifies that Americans with Disabilities Act (ADA) needs are accommodated on the Hayward impoundment it does not identify opportunities for the disabled to access its tailwaters, nor Trego Lake and its tailwaters. These opportunities need to be identified to understand current and future user accessibility needs.

#### **Criteria 5: Nexus to Project 18 CFR (§5.9(b)(5))**

A clear nexus exists between the project and recreational opportunities on the Hayward and Trego impoundments as the recreational facilities are located adjacent to the Project features and are used by visitors during their visit to the Project. Recreation is an important benefit of hydroelectric projects and FPA regulations require consideration for protection and enhancement of recreational opportunities. FERC's policies include ensuring that the ultimate development of recreation resources at licensed projects is consistent with area recreation needs and with the primary project purpose. To plan for future needs for recreation, data on existing recreation facilities and their needs and demands is necessary to make informed decisions about the development needs required through the term of the new FERC project license.

#### **Criteria 6: Study Methodology 18 CFR (§5.9(b)(6))**

An inventory of recreation opportunities and facilities; determining recreation demand using field observations, user surveys, and focus groups; and estimating recreation needs based on the data gathered is consistent with generally accepted practices employed during hydroelectric licensing proceedings. Evaluating outdoor recreation facilities per the Architectural Barriers Act Accessibility Guidelines is a common technique to establish the level of accessibility at outdoor recreation areas and recreation facilities.

The Applicant recently provided in the Recreation Reports (February 2021) for each project condition descriptions of Commission Approved Project Recreation Facilities as well as other facilities within the project boundaries. This study will identify additional information not provided in the Recreation Reports.

##### **a. Study Area**

The area of focus for the recreation facilities condition assessment and demand analysis consists of existing targeted formal and informal recreation areas within the existing project boundaries. The Applicant proposes to change the Trego Lake project boundaries therefor it is important to

include recreation facilities within the existing project boundaries in the evaluation of recreation needs and proposed project boundary changes.

b. Study Sites

The facilities and recreation sites to be inventoried for the Recreation Study should include targeted developed recreation sites and an informal access site. The inventory should identify current use, current conditions, and any impacts that the project might have on these. The study report should identify which Trego Lake recreation facilities would be omitted if the proposed project boundaries were approved.

Trego Lake: Recent permanent closures of two access sites east of U.S. Highway 53, one managed by the NPS and the other, Wisconsin Department of Transportation, leaves the Trego Town Park as the only public access site to the headwaters. The only other remaining Trego Lake access is Trego Landing located mid-impoundment, approximately 1.75 miles away. These Trego sites are recommended for study:

- Trego Town Park Landing
- Trego Landing
- Xcel's Trego Lake canoe access and nearby shoreline (possible angling)
- Xcel's tailwater fishing access (north and south)

These Hayward Lake sites are recommended for study:

- Commission approved project recreation facilities including the canoe portage, carry-in access on the impoundment, and informal shoreline fishing area
- Hayward Lake Bartz's Bay: undeveloped and informal ice fishing access site off Chippewa Trail

c. Study Methods

This recreation study has four components: (1) facility inventory and condition assessment, (2) recreational facilities accessibility assessment, (3) a recreation use and demand analysis, and (4) a recreation needs assessment.

1) Facility Inventory, Condition Assessment

The facility inventory and condition assessment portion of this recreation study consists of two steps: (1) site facility inventory and (2) field reconnaissance/condition assessment. The facility inventory and condition assessment inform the demand analysis and evaluates the condition of each of the facilities at the listed recreation sites. The inventories done in preparation for the 2021 Recreation Reports will form a base upon which to build more information.

Step 1 –Site Inventory

The existing facility inventory should include identification and location of parking spaces, picnic units, boat landings/ramps, bathrooms, and other facility components (e.g., informational

signage). Informally created user trails and sites (i.e., sites along shorelines frequented by recreation users but not identified as designated facilities) will also be identified and assessed.

## Step 2 – Field Reconnaissance/Condition Assessment

The field reconnaissance should include a physical condition inspection of existing recreation facilities and trails, as identified under Step 1. The reconnaissance should also identify observable use patterns and field verify if recreation amenities are constructed and in a condition that serves user needs. Informal user created sites should be identified for observable use and wear patterns.

The following steps should be taken to complete the facilities inventory:

1. Complete reconnaissance level field research: conduct fieldwork to create a detailed inventory on the conditions of existing recreation facilities and other user created sites within the study area
2. Assemble the results and create maps of data collected in the field.

The condition assessment will be qualitative based on a range of repair/replacement/maintenance needs to acceptable appearance and function to evaluate the condition of recreation facilities. Photos should be taken of facilities, all signs, trailheads, etc., and cataloged based on feature type or location. Other user created sites with observable wear patterns within the project areas should be cataloged for further evaluation within the recreation study.

## 2) Facility Accessibility Assessment

The inventory of targeted sites should identify features that do not meet current Americans with Disability Act (ADA) accessibility standards, Architectural Barriers Act (ABA), and Universal Design Principles as well as opportunities for modifications to improve accessibility.

## 3) Recreation Use and Demand Component

The Recreation Use and Demand Component of this Recreation Study consists of 6 steps: (1) observational survey; (2) visitor use questionnaire; (3) interviews with user/friend's groups and recreation providers; (4) review of research publications and existing information; (5) assessment of regional uniqueness and significance of the project areas' primary recreation opportunities; and (6) regional demand assessment. The steps are described in more detail below.

### Step 1 – Observational Survey

Observed recreation use occurring in the project area based on observational surveys should be used to estimate existing use. Observational surveys should be conducted during seasons of use for each location e.g., winter surveys for ice fishing at Bartz's Bay on Lake Hayward. Timing and sampling frequencies should be based on estimated use levels and the survey should be conducted at peak times during the day (e.g., peak angler time of day, dawn and dusk; water skiing, afternoon), on different types of days (weekday, weekend, holiday, or opening of fishing season). The observation data that should be recorded includes vehicle counts, angler counts,

counts of each type of watercraft (canoes, kayaks, pontoons, fishing, Stand Up Paddleboards, tubes), and day use/picnic area usage.

## Step 2 – Visitor Use Questionnaire

A concise questionnaire focusing on visitor use and experience should be mailed to Trego Lake riparian landowners and be fielded at the identified recreation sites when people are most likely to be present. The survey should be conducted during various days during the survey period including weekdays and weekend as well as holidays. A review of past visitor data should be assessed to determine appropriateness of target survey dates with considerations for current season use patterns and any potential unexpected conditions or events taken into account. The questionnaire should be crafted to collect information from recreationists about recreation, activity participation, accessibility needs, areas visited, user conflicts, perceived crowding and safety, visitor profile, visual impressions, and satisfaction with or desire for recreational opportunities and facilities including level and quality of interpretation and posted information in the project areas.

The questionnaire should provide an opportunity for visitors to express any potential concerns over the current condition of and future possibilities for recreation and recreation facilities in the project areas. Recommended questions for the questionnaire are provided at the end of the study request. The draft questionnaire should be shared with NPS and other interested stakeholders for comment.

## Step 3 – Interviews with User Groups and Recreation Providers

Interviews should be conducted with a variety of identified regional and local recreation providers, user groups, and outdoor recreation tourism organizations associated with recreation in the project areas and in the project vicinity. Examples include Trego Lake District and the Chambers of Commerce and tourism organizations of local communities. These entities should be interviewed to gather additional information on current use, user preferences and needs, perceived regional uniqueness and significance of recreation opportunities within the project areas, existing data, and observations in the project areas for both existing and potential future users.

## Step 4 – Review of Research Publications and Existing Information

Recent relevant Wisconsin-based user preference surveys and other outdoor recreation surveys about recreation demand in the project areas should be gathered and reviewed. These include the most recent state and county recreation management plans identified in the PAD including the Wisconsin Statewide Comprehensive Outdoor Recreation Plans (SCORPs). The Applicant should also search for more current surveys that analyze the project and facility areas' outdoor recreation participation rates and growth needs in northern Wisconsin to help address how the project recreation facilities are helping to meet demands of the greater area. This includes increasing population growth in the Twin Cities, Minnesota, Metropolitan Statistical Area, a two-hour drive, ecotourism and second home use trends. The newly created state Office of Outdoor Recreation in Wisconsin may provide contemporary information. Demand and user

preference studies at various scales covering Wisconsin, but especially those addressing northern sections of the state, should be reviewed for their applicability to the project areas. Recreation activity and participation trends information should be examined from the existing demand studies and reports.

#### **Step 5 – Assessment of Regional Uniqueness and Significance of the Project Areas’ Primary Recreation Opportunities**

Regional uniqueness and significance of the project areas’ primary recreation opportunities should be evaluated. Site-specific factors that contribute to the uniqueness of the project areas can inform the demand analysis and needs assessment. Where available, information should be gathered for sites including types of designation including water/canoe trail designation, types of recreation opportunities available, visitation statistics (including information on visitors’ origin), and general popularity for regional outdoor recreation areas.

#### **Step 6 – Regional Demand Assessment**

The recreation demand analysis should compare demand with the existing supply of recreation opportunities and use patterns. A gap analysis should be performed by comparing relative demand to supply, with consideration for trends and variations in user groups based on research and forecasts of population growth. By comparing this information to a detailed inventory of existing recreation opportunities and using information gathered in the observational surveys, visitor use questionnaires, structured interviews, and focus groups, it will be possible to determine whether there is a need for modifications to existing facilities and/or for the development of additional facilities and recreation amenities.

### **4) Recreation Needs Assessment**

A needs assessment is an analysis of all recreation-related study results. Consequently, the methods to complete the needs assessment consist of all the methods used to complete the elements of this Study Description as well as methods described in the NPS Study Request #3: Hydraulics, Sedimentation, and Channel Change Study (Trego).

#### **d. Analysis**

The information gathered by the recreation study will assess the suitability of targeted facilities in terms of meeting the changing needs of recreation users in the project areas. The analysis will include developing existing and projected visitor-use estimates, along with existing and projected demand (including unmet demand) for recreational opportunities over the 40 to 50-year license term. The facility inventory assessment data collected should be analyzed to identify short- and long-term improvement needs of the new license. The recreation demand analysis should provide relevant information about user preferences and needs as related to the targeted recreation facilities provided by the Project. The Draft Recreation Report should include recommendations for monitoring every 6 years of recreation use, visitor demand evaluation, and facility condition over the life of the license. A courtesy copy of the Draft be shared with NPS and other interested stakeholders for comment.

### Criteria 7: Level of Effort and Cost 18 CFR (§5.9(b)(7))

The cost would be contingent on Applicant staff availability and/or the billing rate arrangement with the Applicant's consultants (rate is not known).

In summary, this recreation study would provide necessary information regarding the project-related recreation facilities, visitor use and demographics, demand and needs at targeted recreation facilities.

This study requests additional visitor counts and survey collection to adequately address existing use in the Project Vicinity and ensure that the results for each Recreation Area can be characterized. An alternative study on recreation has not been proposed.

### Requested Survey Questionnaire

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#### SECTION 1 - YOUR TRIP CHARACTERISTICS

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1. On the enclosed map, please place an X on the location where you received this survey.
2. Below is a list of activities available. Please indicate:  
(A) Which of these activities have you participated in **on your current visit** to the (area name)  
(B) Which **ONE** of these activities is your **PRIMARY ACTIVITY** on this trip to the area?

ACTIVITY	(A) Participated in <b><u>ON THIS TRIP</u></b> (Check <u>all</u> that apply)	(B) PRIMARY ACTIVITY (Check <u>only one</u> )
Shoreline/tailwater fishing		
Fishing from a boat		
Motorized boating		
Non-motorized boating		
Swimming		
Picnicking		
Wildlife Viewing		
Other (specify)		

3. (A): Were there any activities that you and your group wanted to do on this visit to (area name) that you were not able to?

☐ NO

☐ YES

(B) If YES: What was it? \_\_\_\_\_ (open-ended)

(C) Which of the following reasons, if any, explain why you did not engage in the activity?

☐ Rules or regulations did not allow for activity

☐ Area was temporarily closed to the public

☐ Not enough time

☐ Safety concerns

☐ Not enough information about the activity

☐ Too crowded

☐ Difficult road or trail access

☐ No road or trail access

☐ Unsatisfactory conditions of facilities

☐ Resource damage due to overuse

☐ No facilities or services

☐ Bad weather

☐ Flooding or other natural hazard

☐ Other (please specify)

4. Does anyone in your personal group have a physical condition or personal limitation that made it difficult to access or participate in [site] activities or services?

☐ Yes

☐ No

If YES, on this visit what activities or services did the person(s) have difficulty accessing or participating in? (Please describe): \_\_\_\_\_

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## SECTION 2 - EXISTING CONDITIONS

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5. (A) How crowded did you feel while recreating at these locations today at this recreation facility/reservoir? [Select one number for each or indicate it was not applicable to your visit.]

### LOCATION/AREA

1) Not at all crowded   2) Slightly crowded   3) Moderately crowded   4) Very crowded  
5) Extremely crowded (check box) Not applicable to the place you received this survey

	1	2	3	4	5	<input type="checkbox"/>
In parking areas						<input type="checkbox"/>
On the trails						<input type="checkbox"/>
At a developed campground						<input type="checkbox"/>
At a boat-in campsite						<input type="checkbox"/>
While fishing from the shoreline						<input type="checkbox"/>
While boating/fishing from a boat						<input type="checkbox"/>

(B) If you felt crowded, did you modify your recreation plans because you felt crowded?  
☐ YES   ☐ NO

(C) If YES, what did you do?

- ☐ Moved to a new location   ☐ Chose not to recreate  
☐ Changed the time of day   ☐ Continued with current plans  
☐ Changed your activity   ☐ Other: \_\_\_\_\_

6. During the planning process for your visit, how did the possibility of crowds affect your trip plans? (Please select one response)

- ☐ It did not affect my plans  
☐ I visited at a time of day I thought would be less crowded  
☐ I visited on a day of the week I thought would be less crowded

- ☐ I avoided places here I thought would be crowded today
- ☐ Other (please specify)

7 Did the actions or behavior of any other group or individual interfere with your enjoyment on this trip?

☐ NO ☐ YES. If YES, what type of group or person interfered with your enjoyment on this trip?

Group/Person	Reason(s)		
	Proximity	Loudness	Other (specify)
Motorized boaters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Non-motorized watercraft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Vehicles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____

8. How satisfied were you with the following **amenities** at this recreation facility/reservoir today.

***Important:*** Please only circle a number for the items ***that you used during your current visit*** to this specific recreation facility/reservoir. Also, please ***check*** the "Did Not Use" box, if you did not use the item or it does not exist at the specific recreation facility.

		Very Satisfied	Satisfied	Neither	Dissatisfied	Very Dissatisfied	Did Not Use	If you were dissatisfied for any reason, please explain why:
		1	2	3	4	5	<input type="checkbox"/>	
FACILITIES AND	Restroom	1	2	3	4	5	<input type="checkbox"/>	
		1	2	3	4	5	<input type="checkbox"/>	
	Picnic sites	1	2	3	4	5	<input type="checkbox"/>	
		1	2	3	4	5	<input type="checkbox"/>	
		1	2	3	4	5	<input type="checkbox"/>	
	Trash receptacles	1	2	3	4	5	<input type="checkbox"/>	

	Very Satisfied	Satisfied	Neither	Dissatisfied	Very Dissatisfied	Did Not Use	If you were dissatisfied for any reason, please explain why:
	1	2	3	4	5		
Vehicle parking areas	1	2	3	4	5	<input type="checkbox"/>	
Boat launch parking area	1	2	3	4	5	<input type="checkbox"/>	
Boat launch	1	2	3	4	5	<input type="checkbox"/>	
Boat dock	1	2	3	4	5	<input type="checkbox"/>	
Other: _____	1	2	3	4	5	<input type="checkbox"/>	
Roads to the facility	1	2	3	4	5	<input type="checkbox"/>	
Trails	1	2	3	4	5	<input type="checkbox"/>	
Signage to the facility	1	2	3	4	5	<input type="checkbox"/>	
Signage within the facility	1	2	3	4	5	<input type="checkbox"/>	
Other: _____	1	2	3	4	5	<input type="checkbox"/>	

**9. How did you obtain information to plan your current trip? (Please select all that apply)**

- |  |   |
|--|---|
| <input type="checkbox"/> Federal or State website          | <input type="checkbox"/> Previous visits                              |
| <input type="checkbox"/>                                   |   |
| <input type="checkbox"/> City, local, or municipal website | <input type="checkbox"/> Word of mouth                                |
| <input type="checkbox"/> Xcel website                      | <input type="checkbox"/> Social media (e.g., Facebook, Twitter, etc.) |
| <input type="checkbox"/> Other websites                    | <input type="checkbox"/> Travel guides and tour books                 |
| <input type="checkbox"/>                                   | <input type="checkbox"/> Newspaper/magazine article                   |
| <input type="checkbox"/> Maps, brochures, pamphlets        | <input type="checkbox"/> Radio/TV broadcasts                          |
| <input type="checkbox"/> Visitor bureaus/centers           | <input type="checkbox"/> Other (specify): _____                       |

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### SECTION 3 - ABOUT YOU

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10. What is the ZIP code where you live or country if not in the United States?  
ZIP code: \_\_\_\_\_ or, country (if not the United States): \_\_\_\_\_
11. What is your Age: \_\_\_\_\_.
12. What is your Gender? ☐ Male ☐ Female ☐ Non-binary
13. Which of these categories best indicates your race and ethnicity? Answer only for yourself. Please select **one or more**.
- |  |   |                                     |
|--|---|-------------------------------------|
| <input type="checkbox"/> American Indian/Alaskan       | <input type="checkbox"/> Asian              | <input type="checkbox"/> White      |
| <input type="checkbox"/> Native Hawaiian/other Pacific | <input type="checkbox"/> Hispanic or Latino | <input type="checkbox"/> Don't know |
| <input type="checkbox"/> Black/African-American        | <input type="checkbox"/> Not Hispanic or    |                                     |
14. Please let us know if you have any additional comments regarding your recreation experience during your visit: (contact information)

## **NPS STUDY REQUEST #2: SHORELINE SURVEY**

### **Criteria 1: Study Description and Objectives 18 CFR (§5.9(b)(1))**

The NPS proposes a comprehensive shoreline study that involves a detailed inventory of shoreline erosion, erosion controls, docks, and aquatic vegetation limiting recreational access to the shoreline within the project boundaries. The objective of this study is to determine the existing shoreline conditions and to provide the basis for making recommendations for protecting and enhancing the project shorelines.

### **Criteria 2: Resource Management Goals 18 CFR (§5.9(b)(2))**

The NPS administers the Namekagon River as part of the National Wild and Scenic Rivers System (NWSRS) and the National Park System; the river is part of the St. Croix National Scenic Riverway. Resource management goals are to protect and enhance free flow, water quality and outstandingly remarkable river values (values) that led to the designation of the river into the NWSRS in 1968. Values identified in the hydropower project areas include aquatic resources, cultural resources, recreation, and scenic/aesthetic resources (NPS 2017).

The presence of the hydropower projects is recognized in the baseline condition for the National Wild and Scenic River designation. However, continuing impacts on resource values should be identified so that protection and enhancement measures can be implemented. In addition, the FERC guidelines and the Federal Power Act provide direction to give equal consideration to non-hydropower resources including scenic, recreational, and other environmental values of the project. As federal agencies operating in the public interest, both NPS and FERC are charged with making resource management decisions based on sound information about public needs and interests.

The NPS is responsible for reviewing shoreline protection measures that require Federal authorization to ensure that standards under Section 7 of the Wild and Scenic Rivers Act are satisfied. The applicable standard is that the project would not have a direct and adverse effect on the values for which the river was designated.

### **Criteria 3: Resource Agency Status of Requestor 18 CFR (§5.9(b)(3))**

The NPS is a resource agency.

### **Criteria 4: Existing Information and Need for Additional Information 18 CFR (§518 CFR.9(b)(4))**

The PAD description of aesthetic resources/visual character is very broad and does not provide detail about the visual experience for recreational users, boating or fishing on the reservoirs. The PAD provides very general information about the current land use, vegetative cover, and amount of development of the shoreline. There is no specific mention of bank stabilization measures on the impoundments although photos of project facilities included in the PAD show rock rip rap on the dams and embankments including around the Hayward canoe access.

It appears there has been significant growth in the number of structures along the Trego impoundment within a limited area causing an increase in structure density. Cumulatively, these developments may change the scenic values for which the impounded segments of the Namekagon are managed:

- DNR, 1989 – Identifies approximately 120 homes, cottages, and resorts adjacent to the Trego flowage with development comprising 25% of the shoreline.
- C. Peterson, Trego Lake District, pers. Comm. March 26, 2021 – 240 residences on the lake; there are relatively few bank stabilization measures, including some ‘walls’.

Aquatic vegetation management has been a continuing activity under the current license. There is no evidence of detailed mapping to document changes over time, although the PAD identifies additional species of aquatic invasive plants that were addressed in the current license and an increase in the presence of highly valued wild rice. Maps included in the required annual ‘Purple Loosestrife’ Monitoring Reports for Article 410 of the Hayward project are very general, using the 1964 bathymetric map as a base; these are insufficient to determining changes over time.

Shoreline surveys by qualified archeologists are planned in accordance with Historic Properties Programmatic Agreements for the Trego and Hayward projects. To date, periodic surveys have not identified erosion concerns. Including inventory of other shoreline resources as part of these periodic assessments may enhance efficiencies.

The NPS needs more detailed information on shoreline condition and changes to coordinate with the licensee, local jurisdictions, and landowners to address management needs within the Park, including the specific requirements associated with review of water resources projects on a Wild and Scenic River.

#### **Criteria 5: Nexus to Project 18 CFR (§5.9(b)(5))**

The current licenses for Hayward and Trego include standard articles for the use and occupancy of project lands and waters. This gives the licensee authority to authorize measures such as riprap and small boat docks without approval by the FERC. However, such authorization must be consistent with the purposes of protecting and enhancing the scenic, recreational, and environmental values of the project (FERC, 2012). Although the project boundary does not include a shoreline buffer, the resources to be studied extend into the water and thus have a clear nexus to project operations.

The requested study would provide current information on the status of the shoreline and identify problem areas and the need for potential management attention. It would provide a baseline for monitoring conditions and change over the life of the license.

Review of shoreline protection measures implemented by the licensee, such as the use of riprap and other construction as part of their robust program for dam safety in collaboration with the FERC Dam Safety Office, have not routinely included consultation with the NPS. The NPS has responsibility to review such water resources projects under Section 7 of the Wild and Scenic Rivers Act.

## **Criteria 6: Study Methodology 18 CFR (§5.9(b)(6))**

Study Method Part 1 – The NPS recommends conducting a longitudinal survey of the river and its banks, using georeferenced photographic equipment (video or still). The High-Definition Stream Survey (HDSS) method (Trutta, 2019) is one method used in recent FERC hydropower licensing proceedings, which enables mapping and a visual record of stream and shoreline characteristics and data from a variety of sensors. The approach has been used to classify streambank condition, ranging from fully functional, functional, slightly impaired, and non-functional (Connell et. al. 2019). It has been used to classify streambank modification in terms of native/unmodified, modified, and highly modified. It also has been used to classify unique manmade or natural features based on type, condition, and location similar to Yetman (2001) and could be used to identify sedimentation features such as in-channel bars, vegetated islands, and in-channel vegetation. In addition, the approach has also been used with side-scan sonar to create cross-sectional bathymetric transects. Such an approach could also be integrated in the NPS requested sediment study.

Evaluate, quantify, photograph and map shoreline conditions on the Hayward and Trego project boundary shorelines, including:

- Streambank condition
- Bank stabilization types and condition
- Docks/piers
- Public access locations
- Presence/extent/type of aquatic vegetation (especially nuisance and invasive plants, but also highly valued wild rice)

Objectives include:

1. Create georeferenced photographic database and map of shoreline conditions.
2. Identify areas in need of management attention for shoreline erosion, cultural resource protection, vegetation management, and public access.
3. Facilitate evaluation of change over time to ensure protection of visual/scenic/aesthetic, recreation, cultural, and natural resources.
4. Facilitate communication between the licensee, NPS, shoreline property owners, and local jurisdictions about shoreline protection practices and NPS Wild and Scenic River Act requirements to review shoreline treatments and to protect and enhance river values.

Study Method Part 2 – In addition, the NPS recommends that the licensee review its records to document changes in shoreline conditions on lands owned by the licensee within the project boundaries that have occurred over the life of the current licenses.

Objectives include:

1. Compare existing shoreline conditions with past conditions available from the licensee's records.
2. Create a list and brief description of shoreline stabilization and other construction projects conducted by the licensee.
3. Identify whether consultation with the NPS was conducted for licensee activities.

#### **Criteria 7: Level of Effort and Cost 18 CFR (§5.9(b)(7))**

Study Method Part 1 - The complete cost for field work, video production, classification and reporting can range from approximately \$2,000 to \$4,000/mile. The longer the segment surveyed decreases overall per mile costs, while the overall number of different classifications requested increases the per mile cost. An alternative study incorporating a comprehensive shoreline review and assessment has not been proposed.

Study Method Part 2 – This would likely require a few hours of staff time by the licensee.

#### References:

Connell, B. A., Ayers, P., Ludwig, A., Neff, K., & Parham, J. E. (2019). Georeferenced Video Mapping to Classify Streambank Erosion Susceptibility. *Journal of Spatial Hydrology*, 15(2).

FERC, Guidance for Shoreline Management Planning at Hydropower Projects, July 2012. Last accessed 3/31/2021 <https://www.ferc.gov/sites/default/files/2020-04/smpbook.pdf>

NPS St. Croix National Scenic Riverway, *Foundation Document*, 2017. Accessed 4/5/2021 <https://www.nps.gov/sacn/learn/management/foundation-document.htm>

Trutta Environmental Solutions, *Tallapoosa River High Definition Stream Survey Final Report*, December 2019, included in Alabama Power filing, draft Erosion and Sedimentation Study Report for the R.L. Harris Project under P-2628-065, December 2020. Last accessed 3/31/2021: [https://elibrary.ferc.gov/eLibrary/filelist?document\\_id=14850582&accessionnumber=20200410-5091](https://elibrary.ferc.gov/eLibrary/filelist?document_id=14850582&accessionnumber=20200410-5091)

WI DNR, *Evaluation of Sedimentation Processes and Management Alternatives in the Trego Flowage*, May 1989. Accessed 3/27/2021 [https://elibrary.ferc.gov/eLibrary/docinfo?document\\_id=13774147](https://elibrary.ferc.gov/eLibrary/docinfo?document_id=13774147)

Yetman, K.T. 2001. Stream Corridor Assessment Survey. Watershed Restoration Division Chesapeake & Coastal Watershed Services Maryland Dept. of Natural Resources Annapolis, MD.

## **NPS STUDY REQUEST #3: HYDRAULICS, SEDIMENTATION, AND CHANNEL CHANGE**

### **Criteria 1: Study Description and Objectives 18 CFR (§5.9(b)(1))**

The NPS requests a study to evaluate the effects of Trego hydropower project operations on river hydraulics, sediment transport, and channel morphology. The primary goal of this study is to determine whether the area proposed for removal from the Trego boundary in the vicinity of the U.S. Highway 53 bridge is influenced by project operations and is needed for project purposes such as public recreation, shoreline control, or protection of environmental resources as described in FERC regulations ([18 CFR 4.41\(h\)\(2\)](#); [18 CFR 4.51\(h\)\(2\)](#); [18 CFR 4.61\(f\)](#)). This proposal will characterize changes in channel planform and shoreline position; update the 1989 WI DNR study, *Evaluation of Sedimentation Processes and Management Alternatives in the Trego Flowage* and bathymetry available from 1966; and build upon this existing data to determine the effects of continued hydropower project operations on sedimentation and flooding in the Namekagon River and Trego Lake. Study results will also help inform recommendations related to potential flooding and ongoing management activities (e.g., dredging and vegetation management) that are used to mitigate sediment deposition, the growth of nuisance and invasive aquatic vegetation and the related loss of recreation access particularly under changing climate scenarios.

### **Criteria 2: Resource Management Goals 18 CFR (§5.9(b)(2))**

The NPS administers the Namekagon River as part of the National Wild and Scenic Rivers System (NWSRS) and of the National Park System and is included in the St. Croix National Scenic Riverway. The NPS is required by the Wild and Scenic Rivers Act to preserve the St. Croix River and the Namekagon tributary in a natural condition, to protect and enhance the exceptional natural, scenic, and cultural resources of the riverway and to provide high-quality recreational opportunities. River values identified in the hydropower project areas include aquatic resources, cultural resources, recreation, and scenic/aesthetic resources (NPS, 2017).

The presence of the hydro projects is recognized as the baseline condition for the National Wild and Scenic River designation. However, continuing impacts on resource values must be identified so that protection and enhancement measures can be implemented.

### **Criteria 3: Resource Agency Status of Requestor and Relevant Public Interest 18 CFR (§5.9(b)(3))**

Requestor is a resource agency.

#### **Criteria 4: Existing Information and Need for Additional Information 18 CFR (§5.9(b)(4))**

The PAD presents information about prior studies identifying sediment sources and references studies that the sediment load is small compared with other WI rivers. However, the upper end of Trego Lake has experienced sedimentation issues and aquatic plant problems since at least the 1980s (US Corps of Engineers, as referenced by WI DNR, 1989). A 1989 evaluation of the sedimentation processes for the Trego flowage was conducted by the Wisconsin Department of Natural Resources. The 1989 study noted that without further action sedimentation problems in the inlet area, increased nuisance aquatic vegetation, and loss of recreational access would continue. The PAD includes comments from the Town of Trego and others stating that aquatic vegetation limits access to the Trego Town Park Landing upstream of U.S. Highway 53.

The PAD presents recent topographic data to justify proposed boundary changes. This raises questions about whether the upstream extent of the maximum operating elevation of the project has changed since the boundary was originally surveyed (either through reservoir sedimentation or floodplain deposition).

The PAD attributes flooding concerns raised by the Town of Trego to occasional ice jams in the vicinity of the Highway 53 bridge. This perspective fails to address the effects of continued sedimentation caused by the project on local river hydraulics and flooding. Annual precipitation and heavy rain events are expected to increase in Wisconsin over the life of the new license (NOAA, 2017).

Available information about sediment dynamics and bathymetry dates from the late 1980s and 1960s, respectively. Given continuing issues related to sediment deposition, the proposed boundary change, and changing climate conditions, updated bathymetric data and analysis is needed to evaluate the ongoing impacts of the hydropower project and provide the basis for making recommendations about hydraulic and sediment-related issues.

#### **Criteria 5: Nexus to Project 18 CFR (§5.9(b)(5))**

Reservoir sedimentation is a complex process that varies with watershed sediment production and mode of deposition. The impoundment of water associated with hydropower operations can lead to reduced flow velocities, alter sediment transport and deposition, and cause the formation of deltas at the upstream end of reservoirs. Formation of deltas may cause aggradation of sediment further upstream, elevate channel bed levels and increase flood risks. In addition, sedimentation in the reservoir can result in the establishment of nuisance aquatic vegetation and cause negative effects on recreational opportunities and access. Sedimentation and aquatic vegetation encroachment at the head of the reservoir above Trego dam have been an ongoing issue for more than 30 years. The licensee has worked cooperatively with all stakeholders under the current license to address these issues. The continuing need to address sediment-related issues under the new license requires thorough investigation.

Hydraulic and sedimentation studies can be used to answer questions pertaining to many aspects of a hydropower project including the effects on upstream and downstream geomorphic and ecological systems. Results will help determine whether or not the boundary change proposed in the PAD is justified and evaluate the need to update management plans and practices used to mitigate for ongoing impacts associated with sedimentation, such as growth of aquatic vegetation, loss of recreation access, and potential flooding.

#### **Criteria 6: Study Methodology 18 CFR (§5.9(b)(6))**

The NPS recommends conducting a study to update existing data on the effects of Trego hydropower project operations on river hydraulics, sediment transport, and channel morphology in the Namekagon River upstream of Trego Lake. The study consists of four components: (1) analysis of existing aerial imagery; (2) collection of bathymetric data; (3) hydraulic modeling; and (4) synthesis.

Specific tasks and proposed standard methods include the following:

1. Channel and shoreline change analysis:
  - a. Analyze aerial imagery for the period of record, available from the University of Wisconsin map library, to evaluate change in channel planform and shoreline position through time along the reservoir and upstream from the U.S. Highway 53 bridge. Channel margins and reservoir shoreline should be digitized using geographic information system (GIS) software and applying standard methods (Gilvear and Bryant, 2003).
  - b. Quantify information on patterns in sediment deposition, bank/shoreline erosion, delta growth, and changes in aerial extent of aquatic vegetation through time.
2. Bathymetric survey and analysis:
  - a. Acquire a sufficiently detailed channel and lake bathymetry upstream from Trego dam to evaluate changes in bed elevation and support subsequent hydraulic modeling. Bathymetric data should be acquired using single-beam sonar integrated with GNSS positioning system and can be integrated with existing LiDAR to develop a high-resolution terrain model of the project area.
  - b. Bathymetric transects should be compared to previous surveys to:
    - i. Quantify volumes of sediment deposition and erosion that have occurred in the flowage since 1988 (WI DNR, 1989), and
    - ii. Estimate average rate of reservoir sedimentation since 1988 and compare this rate to the rates reported previously by WI DNR for the period from dam construction to 1988.
3. Hydraulic modeling and analysis:
  - a. Using data obtained from the bathymetric survey, apply the US Corps of Engineers HEC-RAS model (or similar) to develop a one-dimensional hydraulic

model extending a sufficient distance upstream from the U.S. Highway 53 bridge to accurately model hydraulics through the project site including backwater effects due to Trego hydropower project.

- b. Evaluate the effect of the project on flood inundation under alternative climate scenarios. Methodologies to evaluate the impact of increasing precipitation and rainfall intensity are evolving and should be selected in consultation with the NPS.
4. Synthesis - The final study report should address the following licensing issues:
- a. Evaluate whether the upstream reach of the Namekagon River proposed for removal from the project boundary is impacted by the project and contributes to problems associated with sediment deposition in the reservoir and/or channel; vegetation growth and loss of recreation access; and flood risk to existing infrastructure and public access areas.
  - b. Recommend updates to management plans and activities for sedimentation and vegetation (e.g., existing license Article 405; Barr Engineering, 1994; and WI DNR, GP-NO-2019-66-03813), and identify alternate methods to mitigate the impact of sediment deposition on aquatic plant growth, recreation access, and flooding.
  - c. Evaluate the need for more detailed hydraulic and sediment transport modeling to quantify effects of sediment deposition on flood risk upstream from Trego dam.

#### **Criteria 7: Level of Effort and Cost 18 CFR (§5.9(b)(7))**

Although costs and level of effort depend on who would be conducting the work, a rough estimate is presented here:

- Channel and shoreline change analysis: \$5,000
- Bathymetric surveys and analysis: \$20,000 (this cost could potentially be reduced if combined with the longitudinal survey of the river and its banks, requested as part of the NPS Shoreline Survey.)
- Hydraulic modeling: \$10,000
- Synthesis/Final report: 1-2 weeks of staff time.

An alternative study on channel changes and sedimentation has not been proposed. The NPS is potentially interested in partnering with the licensee and other stakeholders for a more comprehensive evaluation of hydropower power operations on river hydraulics, sediment transport, and channel processes, and the impacts on flooding, recreations uses and access, and the aquatic and riparian ecosystem.

#### **References:**

Barr Engineering, *Trego Flowage Macrophyte Survey and Vegetation Plan*, November 1994. Accessed 3/27/2021 <https://tregolakedistrict.com/wp-content/uploads/2019/04/1994-Trego-Flowage-Lake-Plan.pdf>

Gilvear, D. and Bryant, R., 2003, *Analysis of Aerial Photography and Other Remotely Sensed Data*, in Kondolf, F.M., and Piegay, H., *Tools in Fluvial Geomorphology*, John Wiley & Sons, Ltd. pp. 133-168.

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WI DNR, *Trego Lake - Washburn County, Wisconsin DNR Lake Map, Jun 1966*. Accessed 3/27/2021 <https://dnr.wi.gov/lakes/maps/DNR/2712000a.pdf>



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May 6, 2021

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Secretary Federal Energy Regulatory Commission  
888 First Street, NE  
Washington DC. 20426

Electronic Filing

**Re: Support of National Park Service Comments on the Preliminary Application Document and Study Requests for Hayward Hydroelectric Project (FERC Number P-2417) and Trego Hydroelectric Project (FERC Number P-2711)**

Dear Secretary Bose,

The Trego Lake District Board of Commissioners supports the request for studies and comments by the National Park Service (NPS) regarding the Preliminary Application Document (PAD) for the Trego Hydroelectric Project (FERC Number P-2711). Trego Lake District encourages the completion of the three studies outlined in the NPS study requests: 1) Recreation Study (both projects), 2) Shoreline Survey (both projects), and 3) Hydraulics, Sedimentation, and Channel Change Study (Trego). See TLD Resolution attached.

Our comments on the proposed NPS studies will focus on their impact to Trego Lake and Trego Lake riparian owners who make up the membership of the Trego Lake District. Trego Lake District respectfully requests to be included in any future discussions regarding the finalizing of study plans.

Trego Lake is a 383-acre lake in Northwest Wisconsin created by the Trego Dam operated by Xcel Energy. Trego Lake offers a variety of activities to the general public including boating, canoeing/kayaking, fishing, swimming and other recreational activities. Trego Lake District (TLD) was first formed as an association in the 1980s but quickly was incorporated into a Lake District in 1989 for the protection and rehabilitation of Trego Lake. TLD is a local unit of government committed to improving and enhancing the lake and recreation by protecting fish, maintaining water quality, marking navigation channels, controlling weeds and aquatic invasive species, and reducing sedimentation buildup. TLD works to enhance the lake for the general public and riparian landowners. Trego Lake District includes the riparian landowners on Trego Lake from the Trego dam to U. S. Highway 53. We will review the NPS Study Requests in reverse order based on their importance to TLD.

### **Support of NPS Study Request #3: Hydraulics, Sedimentation, and Channel Change Study**

An average of 2000 cubic yards of sediment accumulate in Trego Lake each year, as NPS notes in its study request<sup>1</sup>. Sediment creates an enormous issue for Trego Lake users and land owners. The information gathered in the NPS study would be invaluable to identify issues and develop actions to mitigate sediment

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<sup>1</sup> WI DNR, *Evaluation of Sedimentation Processes and Management Alternatives in the Trego Flowage*, May 1989.

build-up, control growth of aquatic plants including aquatic invasive species (AIS) resulting from sedimentation buildup, and prevent the loss of recreational opportunities for people visiting the lake or living on the lake.

Since its creation, TLD has worked to address the sedimentation build-up and its impact on the lake. The sediment build-up creates recreational challenges for boating, making it impossible to access certain areas of the lake. Additionally, it has led to an increase in aquatic plant growth including AIS: curly leaf pond weed and hybrid/Eurasian water milfoil. Since a 1995 Federal Energy Regulatory Commission (FERC) modification of the Trego Dam license, Xcel Energy (in 1995 Northern States Power, NSP) and TLD have worked in partnership to improve recreation by harvesting aquatic vegetation that reduces the recreation opportunities of the lake for all and particularly impedes residents from fully utilizing the value of Trego Lake. TLD organizes the harvesting and Xcel pays for one harvest per year. The cost varies: \$2500 in 2020 to \$8000 in 2019, depending on service availability and time of harvest.

For over 35 years, TLD has been addressing sediment build up in the lake. Management of sediment and aquatic vegetation is an ongoing problem that was considered as part of the current license for Trego Dam and should be considered in its relicensing. A variety of options have been discussed including drawdowns, sediment traps, and dredging. In 2016, after a number of years developing a workable proposal, TLD was able to dredge channels to allow for a variety of power boat traffic. During this process, TLD worked with and received permits and/or approval from the various oversight agencies including: Wisconsin Department of Natural Resources (WDNR), Army Corps of Engineers, NPS, tribes and others. Landowners in the area and others recreating on Trego Lake were able to easily access the full lake. After a significant rain event 2 years later, the channels filled in creating problems accessing the lake. The TLD has recently purchased a small suction dredge to spot-dredge problematic areas within designated channels (permitted by the WDNR, and authorized by the Army Corps of Engineers) to allow for minimal power boat traffic. This summer will be our initial effort. Nearly a quarter of the landowners on the lake (roughly 60 properties) are impacted by the sediment buildup making some areas impassable.

### **Support for NPS Study Request #2: Shoreline Survey**

The shoreline survey will identify erosion problem areas and aquatic vegetation on Trego Lake. As we note, sedimentation is a crucial issue, likely driven by erosion and resulting in excessive aquatic vegetation. Studies will help us understand and mitigate these issues.

TLD respectfully requests a more comprehensive look at sediment sources. Specifically, we ask you to extend the shoreline study to cover the Namekagon River between Hayward and Trego. This will help determine if the amount of sediment entering Trego Lake has increased and identify sources of sediment. This, coupled with NPS Study Request #3 will provide a greater overall picture of sediment problems. With this information, mitigation actions can be reviewed and developed to improve recreational opportunities for Trego Lake and the Namekagon River.

### **Support for NPS Study Request #1: Recreation Study**

The recreation study proposed by NPS will set the stage for future improvements or enhancements of recreation opportunities on Trego Lake. TLD is happy to support and be involved in developing the picture this study creates. In the past, the recreation survey used by Xcel and its agents relied on a questionnaire at the Trego Town Landing. However, the study method was too narrow. The people using the lake most frequently, those living around it, were not methodically surveyed. Studying this crucial issue, as part of Xcel receiving a 40-year license to continue operating the dam, would ensure the entire lake formed by the dam is available for a range of recreational activities.

The recreation study proposed by NPS would offer a more complete picture of recreation on the lake. It includes a mailed survey to each riparian landowner on Trego Lake. Gathering this information provides more complete input to determine the needs and opportunities for recreating on Trego Lake. If TLD can assist in this survey process in any way, we would be happy to do so.

#### **Support for certain NPS comments regarding the PAD.**

As NPS has noted, TLD questions the reasoning behind Xcel's proposed change in the Trego Project Boundary as part of this 40-year relicensure. TLD is concerned about this proposed change because it could impact the sedimentation issue. Could a change in the project boundary permit Xcel to avoid its obligation to address sedimentation?

#### **Additional input on NPS comments regarding the PAD.**

As noted by NPS in their comments, a concern is the closing of the Wisconsin Department of Transportation access site on the Namekagon River in Trego because of the re-routing of the intersection of U. S. Highways 63 and 53. TLD is also concerned about these closures. The loss of this access point may divert recreators to the Trego Town Park landing which is congested with sediment and aquatic plants. In addition to the closed landings being used by those coming down the Namekagon River, it was also used by Trego riparian landowner canoeist, kayakers, and tubers to access the upper portions of Trego Lake. We think the three studies proposed by NPS are likely to document a need for improved access with the potential for modifications at the Trego Town Park landing.

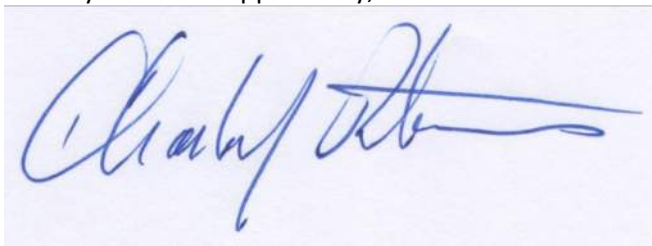
#### **Conclusion**

The TLD appreciates the opportunity to provide input on the relicensing of the dam and to support the study requests of NPS. TLD and Xcel Energy are currently in partnership to improve recreation on the lake by harvesting aquatic plants that impede boat travel and reduce the use of the lake to the general public and residents on the lake. With the discovery of AIS in the area, this effort is even more critical today.

Additionally, TLD is thankful for the work of NPS in responding to the PAD and its subsequent study requests. Their effort has been invaluable as we work to protect and rehabilitate Trego Lake. As noted earlier, TLD requests to be included in any future discussions regarding the finalizing and/or conducting of these studies.

Finally, if TLD can be of any assistance in these studies, we would be happy to do so. TLD has a website that includes current and historic documents about the lake: <https://tregolakedistrict.com>  
If you have any question or comments, please do not hesitate to contact the district at: [tld@trego.net](mailto:tld@trego.net)

Thank you for this opportunity,



For the Board. . .  
Charlie Petersen  
TLD Board Chair

## **Attachment**

### **Resolution Authorizing Trego Lake District Board of Commissioners to Support and Provide Information on National Park Service Study Requests Regarding the Relicensing of Trego Dam April 2021**

WHEREAS, the Trego Lake District (TLD) is interested in the relicensing of Xcel Energy's hydroelectric dam creating Trego Lake.

WHEREAS, the process has begun for re-licensure of the dam and part of the Federal Energy Regulatory Commission's (FERC) process for re-licensure includes a request for possible areas to study that the dam project may affect.

WHEREAS, the National Park Service (NPS) has drafted three study proposals that identify key issues relating to Trego Lake and TLD concerns. The studies include: 1) Recreation Study, 2) Shoreline Survey, and 3) Hydraulics, Sedimentation, and Channel Change Study.

NOW, THEREFORE, BE IT RESOLVED, that the Trego Lake District Board of Commissioners is authorized to act in support of these study requests and submit a letter to FERC as testimony to this support. Additionally, the TLD will participate with NPS, and other interested parties, in providing information on these study areas to NPS and FERC as needed and/or requested.

Adopted this 17<sup>th</sup> day of April 2021.



May 7, 2021

Federal Energy Regulatory Commission  
Kimberly D. Bose, Secretary  
888 First Street, N.E.  
Washington, DC 20426

Matthew J. Miller  
Hydro License Compliance Consultant  
Northern States Power Company-Wisconsin, Xcel Energy  
1414 W Hamilton Avenue, PO Box 8  
Eau Claire, Wisconsin 54702-0008

**RE: Wisconsin Department of Natural Resources Comments on Preliminary Application Document for the Hayward Hydroelectric Project P-2417 and Trego Hydroelectric Project P-2711**

Dear Mr. Miller:

The Wisconsin Department of Natural Resources (department) appreciates the opportunity to participate in the process to relicense the Hayward and Trego hydroelectric dams as proposed in the Preliminary Application Document (PAD). These dams are licensed by Xcel Energy (Xcel), under projects P-2417 and P-2711.

The Hayward Project is located in the City of Hayward, Sawyer County, Wisconsin. The Trego Project is located in the Town of Trego, Washburn County, Wisconsin.

The department has limited information regarding natural resource information associated with the hydroelectric dams and their project areas. Studies associated with Hayward and Trego relicensing have different purposes, from a short term, long term, and cumulative impact. The department has carefully considered our responsibilities under the Clean Water Act and Navigable Waters Public Trust Doctrine for the proposed relicensing of Hayward and Trego.

We are providing comments to the PAD and are recommending that the following studies be completed. Each study is presented as appropriate for the various alternatives that could be evaluated as part of the comprehensive review and assessment of the project area. Our requests for information and studies focus on the continued operation of the Hayward and Trego dams.

As Xcel Energy begins to evaluate the array of study requests and determine their study proposal and next steps, the department will continue to provide guidance and recommendations. The licensee should continue to work with the department to collect resource information and develop study plans and protocols. If new information becomes available through the relicensing process, we reserve the rights to require additional studies to gather appropriate information.

To save time and costs, the department recommends that studies be combined, and that the licensee meet with the stakeholders who have requested studies to explore their options and still achieve desired data collection. We also recommend exploring the use of citizen monitoring groups and organizations.

Please be aware that Scientific Collectors Permits may be required to complete various surveys. Please work with the department to obtain appropriate permits and approvals prior to the collection of data.

Please note that the department cannot guarantee the accuracy of the information related to FERC project monitoring that is stored in the department's Surface Water Integrated Monitoring System (SWIMS), its repository lakes pages, and other associated department websites. Please contact the statewide FERC coordinator for the most current and accurate information on FERC projects.

The department will provide additional outreach to the tribes, as appropriate.

Please direct all inquiries to the Project Manager, Cheryl Laatsch, Statewide FERC Coordinator.

If you have any questions or comments regarding our recommendations, please contact me at 920-387-7869, or Cheryl.Laatsch@wisconsin.gov. We look forward to working with you.

Regards,



Cheryl Laatsch  
Statewide FERC Coordinator  
Wisconsin Department of Natural Resources

## Comments on Pre-Application Document (PAD)

### Relicensing of Hayward (P-2417) and Trego (P-2711) Projects

#### General:

Throughout the PAD, Xcel references data that is greater than 10 years old (for example, 3.2.1.1 references NSPW data from 1991). Additionally, some of the department websites that were referenced do not provide publishing or revision dates for the collected data and summaries (for example, 3.2.1.6 bathymetry data is actually from a 1964 map, 4.1.7 WDNR 2020a is data from 2010), and the department cannot verify if this data is still applicable to present day conditions at the Projects.

Please verify that the PAD reflects current project conditions.

#### 3.2.1.1 Hayward Dam

*A mixture of sand and bentonite material was placed over the apron in locations where holes have historically been seen. The downstream apron is a concrete slab located over rock-filled timber cribbing with thicknesses varying from 1 to 3 feet. The voids in the timber cribbing beneath the apron are grouted.*

- Provide details on how the repairs have held up.
- Provide details on if there are ongoing monitoring of the voids and apron deficiencies.
- Provide details on the last time these voids and apron deficiencies were inspected.

#### 3.2.2 Hayward Project Boundary

*The current and proposed Project boundaries are depicted in Figure 3.2.2-1 on the following page and in the existing Exhibit G included as Appendix 3.2.2-1. The Licensee is proposing to increase the acreage within the Project boundary an additional 2.8 acres. The increase includes a portion of the reservoir currently occupied by the Project, but not currently included in the Project boundary (Mead & Hunt, 2020).*

- It is difficult to clearly understand the proposed project boundary on Figure 3.2.2-1. Please provide an updated map or additional side-by-side boundary comparisons.
- Provide details if flowage easements are in place for the new project boundary area.

#### 3.3.2 Trego Project Boundary

*The use of LiDAR data to review the current Project boundary identified that the upper extent of the existing Project boundary contains a portion of free-flowing Namekagon River that is not impounded at the maximum operating elevation of 1,035.2 feet and therefore is not necessary for project operations. Therefore, in developing the proposed Project boundary for this document, the unimpounded or free-flowing upstream reach has been removed from the proposed Project boundary. This results in an overall decrease of acreage within the Project boundary of 29.1 (submerged) acres.*

- Please clarify why LiDAR data was not applied to the Hayward project. The department requests consistent approaches between the projects.

### 3.4.1.1 Current Operation (Hayward)

*Under normal operating conditions, the Licensee is required to maintain the reservoir at a target elevation of 1,187.4 feet but can fluctuate around the target elevation such that the reservoir is maintained between 1,187.0 feet (minimum) and 1,187.5 feet (maximum).*

- Provide details on why the target elevation of the reservoir is 1,187.4 feet, when the maximum reservoir elevation is 1,187.5 feet. This target elevations only leaves a margin of 0.1 feet.
- Provide details on why the specific reservoir elevation license requirements for Hayward are different than Trego's reservoir target elevations fluctuations (the Licensee maintains the Project reservoir at a target elevation of 1034.9 feet, with fluctuations limited to +/- 0.3 feet around the target elevation).

*The plant is manually operated with controls installed for automatic shutdown in case of operational emergencies. Whenever a plant shutdown occurs or high or low headwater levels are detected, staff at the Licensee's Wisconsin Hydroelectric Project control center are automatically notified.*

- Define the terms "high" and "low" for headwater levels.

*Tailwater is monitored manually via a staff gage downstream of the powerhouse.*

- Provide details on the location of the staff gage and the frequency of monitoring and calibration.

*Flows in excess of the 8 cfs minimum flow are primarily passed through the powerhouse. Flows in excess of the Project's hydraulic capacity are passed through the overflow spillway.*

- Clarify how this is meeting run-of-river operations. This does not appear to be equal inflow/outflow, as excess flows will go downstream.
- Clarify why excess flows are not passed through the overflow spillway.

### 3.4.2.1 Current Operation

*The Project currently operates in a run-of-river mode where discharge measured immediately downstream of the Project tailrace approximates the sum of inflows to the Project reservoir*

- Provide more information on how sum of inflow is calculated.
- Provide details on water usage for the spillway and powerhouse and the amount of water flowing into these areas versus flowing out of these areas.

*Headwater and tailwater elevations are continuously monitored electronically and manually confirmed with staff gages mounted on the Project headworks and tailwater.*

- Provide the locations of where elevations are being electronically and manually collected.

## 4.1 General Description of the Project Area (18 CFR § 5.6(d)(3)(xiii))

*There are two FERC-licensed hydroelectric projects and three state-regulated dams on the Namekagon River; all are listed from upstream to downstream in **Table 4.1-1** and are shown in **Figure 4.1-1**. The FERC-regulated*

*dams include the Hayward and Trego Projects. The state-regulated facilities do not generate power and are regulated by the State of Wisconsin.*

- Provide details on how these state-regulated facilities impact or effect the Hayward and Trego projects.
  - Department database shows that Phipps and Pac-Wa-Wong are owned by the U.S. Department of Interior. The most recent files we have are from 1995 for Phipps Dam.
  - Namekagon is State regulated and located 27 miles upstream of Hayward Project. This is a run of river dam with 17-ft fixed crest weir and two 4-ft stoplog bays. The dam was designed to pass the Q1000-yr event with 2.4 feet of freeboard before overtopping.

#### **4.2.3.1 Hayward Project, 4.2.3.2 Trego Project**

*The combination of NSPW shoreline ownership, minimization of reservoir fluctuation, existing native riparian vegetation buffers, local shoreland regulations, and Upper St. Croix and Namekagon River Management Plan provide adequate protection from wide-spread shoreline erosion and over development in the vicinity of the Hayward Project.*

- Provide a map and table of Xcel ownership, public lands, and private ownership within the Hayward and Trego FERC boundaries.

#### **4.3.2 Streamflow, Gage Data, and Flow Statistics**

- Provide a map showing all gauge locations for the Hayward and Trego projects.

*Monthly flow duration curves for the Trego Project were developed based on discharge information collected by the Licensee. While there is a USGS gage in the vicinity of the Trego Project, it does not record daily flow data needed to develop flow duration curves and the USGS gage at Leonards is not located close enough to provide statistically accurate flow information*

- Provide greater detail on these two gauging stations and why these gauges cannot provide relevant flow data.

#### **4.3.2.2 Trego Project**

*There is a drainage area of 488 square miles at the Trego Project. Based on the data for the analyzed period, the average annual calendar year flow at Trego Project was 540 cfs, the maximum annual average calendar year flow was 579 cfs in 2019, and the minimum annual average calendar year flow was 469 cfs in 2015.*

- Provide the relevancy and significance of the years 2015 and 2019.
- The department requests flow data from the past 20 years for the Hayward and Trego projects. This includes duration curves, low flows, high flows, spring run-off, dry years, wet years, etc.

#### **4.3.4 Instream flow**

- Discuss and evaluate current instream flow data for the Hayward and Trego projects.

#### 4.3.7.1 River Water Quality Standards

- The upper confidence bound for Hayward Lake residence time is 6 days, therefore, Hayward Lake is considered an impounded flowing water.
- The upper confidence bound for Trego Lake residence time is 11 days, therefore, Trego Lake is considered an impounded flowing water.
- Verify if state standards are being met at the Hayward and Trego project.
- Trego Lake is considered an impaired water and is 303(d) listed for the Recreation designated use, due to high chlorophyll-a concentrations, and will be addressed as part of the St. Croix Nutrient TMDL expiring in 2025.
- Trego Project should be subject to the Warm-Large temperature criteria (see table below from Chapter NR 102.2 – Water Quality Standards for Wisconsin Surface Waters)
- Hayward Project should be subject to Coldwater temperature criteria (see table below from Chapter NR 102.2 – Water Quality Standards for Wisconsin Surface Waters)

Month	Cold <sup>4</sup>			Warm — Large <sup>5</sup>			Warm — Small <sup>6</sup>			LFF <sup>7</sup>		
	Ta <sup>1</sup>	SL <sup>2</sup>	A <sup>3</sup>	Ta	SL	A	Ta	SL	A	Ta	SL	A
JAN	35	47	68	33	49	76	33	49	76	37	54	78
FEB	36	47	68	33	50	76	34	50	76	39	54	79
MAR	39	51	69	36	52	76	38	52	77	43	57	80
APR	47	57	70	46	55	79	48	55	79	50	63	81
MAY	56	63	72	60	65	82	58	65	82	59	70	84
JUN	62	67	72	71	75	85	66	76	84	64	77	85
JUL	64	67	73	75	80	86	69	81	85	69	81	86
AUG	63	65	73	74	79	86	67	81	84	68	79	86
SEP	57	60	72	65	72	84	60	73	82	63	73	85
OCT	49	53	70	52	61	80	50	61	80	55	63	83
NOV	41	48	69	39	50	77	40	49	77	46	54	80
DEC	37	47	69	33	49	76	35	49	76	40	54	79

<sup>1</sup> Ta = ambient temperature  
<sup>2</sup> SL = sub-lethal criteria  
<sup>3</sup> A = acute criteria  
<sup>4</sup> Cold = waters with a fish and aquatic life use designation of “cold water community”  
<sup>5</sup> Warm – Large = waters with a fish and aquatic life use designation of “warm water sport fish community” or “warm water forage fish community” and unidirectional 7Q10 flows ≥ 200 cfs (129 mgd)  
<sup>6</sup> Warm – Small = waters with a fish and aquatic life use designation of “warm sport fish community” or “warm water forage fish community” and unidirectional 7Q10 flows < 200 cfs (129 mgd)  
<sup>7</sup> LFF = waters with a fish and aquatic life use designation of “limited forage fish community”

#### 4.4.1.1 Fish Stocking Data

- Describe the purpose of fish stocking at these projects, including information on frequency, methods, and timelines of stocking events.

#### 4.4.1.2 Mussels

- Data provided by the department included the year of observation, but this is not included in table 4.4.1.2-1

#### 4.4.3.1 Hayward Project

*The WDNR further acknowledged that Hayward Lake did not provide good walleye habitat, and even in the absence of fish entrainment, the original goal of 3 walleye per/acre would not be possible to achieve. The WDNR also concluded there was no compelling resource-based reason to plan for drawdowns*

- This information should be updated since the FERC 2012 statement.
- Provide current status of walleye and walleye habitat at the Hayward Project.

#### 4.5.1 Botanical Species

- Boreal Forest was not a forest type in the NW Sands Ecological Landscape historically.

#### 4.5.2. Wildlife

- Acknowledge which species have NHC-listed status.
- Identify species that are state or federally listed under 4.7 Rare, Threatened and Endangered Species.
- There is an inconsistency of the 4.5 list of species and the list in 4.7 (for example, the Northern Long-Eared Bat is listed in 4.5.2, however, 4.7.2.3 states that the species is not found within the vicinity of the projects).
- Marten and white tailed jackrabbit do not occur in the vicinity of these project boundaries.

#### 4.5.3 Invasive Species

- Please update the references and reference lists for consistency.
- *Selected Regulated AIS* in WI may have been updated since 2016, and this flyer should only serve as a reference.

#### 4.8.1.6 Hayward Project Informal Shoreline Fishing Area

*The unimproved shoreline areas downstream of the spillway and powerhouse, which are owned by the Licensee, are often used as informal fishing areas*

- Xcel should work with local municipality to maintain and enhance recreational opportunities, especially in areas that are known to have active use.

#### 4.8.2.3 Town of Trego Park Landing

- Photo 4.8.2.3-1 shows presence of active erosion at the boat landing and will need repair.

## Study Requests

### Relicensing of Hayward (P-2417) and Trego (P-2711) Projects

(Study requests to be applied to both Hayward and Trego Projects, unless otherwise noted)

#### ASSESSMENT OF CURRENT DAM OPERATIONS

- Goals and Objectives: Determine if the Project is meeting the requirements of minimum flows and run-of-river operations; including documenting how downstream river flows are managed appropriately to limit water level fluctuations.
- Relevant DNR Management Goals: Review the current operations relative to maintaining consistent reservoir elevations and downstream flows that mimic background hydrology, as achieved by run-of-river operations.
- Existing Information: For the Hayward Project, a minimum flow of 8 cfs or inflow, whichever is less, is released at all times into the bypass reach, as stated in the current license. The Trego Project does not have minimum flow requirements.
- Operation nexus to resource and how informs license: Ensure Project operates within limits of hydrologic modification through run-of-river, and not causing divergence in flows that harm the downstream aquatic ecosystem.
- Methodology: Desktop review of existing inflow and outflow data, including an evaluation report of run-of-river and operations requirements.
- Level of Effort and Cost: Staff time is expected to be 20-40 hours at \$125 per hour equaling \$2,500-\$5,000 for data analysis and report.

#### ASSESSMENT OF MINIMUM FLOW, DRAWDOWNS, AND RESOURCE IMPACTS DOWNSTREAM OF THE TAILWATER

- Goals and Objectives: Provide an assessment of the average range of flows, including minimums and maximums and their relevance, associated with run-of-river operations and facility capacity. Determine if the project minimum flow of 8 cfs at the Hayward Project and target reservoir elevations of the Trego Project are providing sufficient flows and environment for aquatic resources.
- Relevant DNR Management Goals: Evaluate the current minimum flow and ensure that the minimum flow does not have an adverse impact on the aquatic resources within the Project boundary and downstream of the Project. Ensure that the aquatic environment is maintained in a healthy state, which includes protection of rare and listed species. Consideration for impacts to wildlife that will be hibernating would be adversely affected by drawdowns. Sediment loading impacts from frequent drawdowns and loss of recreational opportunities, due to limited access, are affected by drawdowns. If a drawdown or refill is performed too quickly, turbid water can flow down river, depending on the water flow rate. Sediment can also settle out at the base of the dam, creating water quality and habitat issues.
- Existing Information:
 

**Hayward**: For the Hayward Project, a minimum flow of 8 cfs or inflow, whichever is less, is released at all times into the bypass reach, as stated in the current license.

**Trego:** The Trego Project does not have minimum flow requirements and does not have a bypassed reach.

The department has concerns for otters, furbearers, and other wildlife if water levels are not managed similar to current operations. Turtles, frogs, and other herps would be negatively affected if water levels are drawdown after October 1<sup>st</sup>.

- Operation nexus to resource and how informs license: Ensure Project is meeting the intent of run-of-river, and not causing divergence in flows that harm the downstream aquatic ecosystem.
- Methodology: In-stream flow study, which includes a description of current habitat conditions within the bypass channel under current operation and flows to determine if the current minimum flows are impacting available habitat, fish, and macroinvertebrate communities. Assess various flow regimes to determine what is appropriate to minimize and avoid adverse impact on the cold-water resource.
- Level of Effort and Cost: Staff time is expected to be 20-40 hours of field work at \$125 per hour, plus costs for equipment.

## **ASSESSMENT OF STREAM FLOWS, CHANNEL DIMENSIONS, AND LINEAR GRADIENT**

- Goals & Objective: Determine impacts the Project has on the existing stream flows, channel dimensions and linear gradient of Namekagon River downstream of the Project.
- Relevant DNR Management Goals: The proposed study would investigate the impacts the Project would have on the existing stream flows, channel dimensions, and linear gradient of the Namekagon River. The impacts that the Project may cause on the existing stream flows, channel dimensions and linear gradient may alter resources and recreational and developmental management plans for the future.
- Existing Information: Data is limited relating to flow, channel dimensions, and linear gradient impacts within the Project boundary.
- Operation nexus to resource and how informs license: The relicensing of Hayward and Trego has the potential to have short term and long-term impacts on the aquatic community downstream of the impoundment. These impacts include, but are not limited to, dewatering and limiting available aquatic habitat in the downstream river channel depending on stream discharge and dam operation. These impacts can vary by season as well as daily. Proper management of the resource will help ensure that adequate flows are available to aquatic life at the proper time and thermal regime.
- Methodology: Conduct a flow study to determine stream morphology downstream of the Project at various flows, including width, depth, wetted perimeter and substrate composition. The study should identify any wetlands that are flooded. This should include available aquatic habitat under current operation through flood flow conditions. Quantitative Habitat Assessment Methodology should be used to document habitat conditions. Refer to existing management efforts (recreational, resource, habitat) to investigate the impacts the proposed Project would have.
- Level of Effort and Costs: 40 hours of fieldwork and 40 hours of report writing at \$125 per hour, plus equipment costs.

## ASSESSMENT OF WATER QUALITY

- **Goals & Objectives:** The department is requesting at least one year of water quality data collection. Depending on the first year of data, a second year of water quality studies may be requested. Assess and monitor the following water quality parameters:

Total Phosphorus	Sulfate, Total Mercury	Total Suspended Solids
Chlorophyll-a	Methyl Mercury	Sediment Accumulation
Dissolved Oxygen (DO)	Dissolved Phosphorus	Alkalinity
Temperature	Nitrate (plus nitrite)	Secchi Depth
Conductivity	Ammonia	Color
pH	Chloride	Iron, Manganese, and/or Sulfide
Total Nitrogen	Bacteria	Cyanobacteria

- **Relevant DNR Management Goals:**

Total Phosphorus: One of the primary causes of eutrophication and most widespread pollutant in waterbodies statewide and nationally. Impoundments are unlikely to raise the concentration of phosphorus in the downstream river but play a role in the transformation, such as the ratio of dissolved phosphorus to total phosphorus. Dam operation might influence internal phosphorus loading to the impoundment by affecting the mixing regime as water levels change.

Chlorophyll-a: A measurement of the amount of algae in a waterbody, one of the primary manifestations of eutrophication. As impoundments increase surface area, slow and warm water are likely to produce more chlorophyll-a, per unit phosphorus/nitrogen, than the upstream or downstream river. Impoundments may produce chlorophyll-a in the lake environment that is then passed to the downstream river.

Dissolved Oxygen: Dissolved oxygen is critical for the health and survival of aquatic organisms. Deep impoundments may stratify and become oxygen depleted in deep water. Impoundments may then cause a decrease in dissolved oxygen in the downstream river, especially if there is bottom withdrawal of a eutrophic impoundment, or an impoundment that stratifies. Additionally, eutrophic impoundments may transform nutrients into organic matter (mainly algae) that then flows into the river, decomposes and reduces oxygen.

Temperature: Temperature regime of a waterbody structures community composition of fish, invertebrates, plants, etc. Temperature also effects rates of chemical reactions, ecosystem productivity and the ability for gasses to dissolve in water. Impoundments can increase water temperatures by slowing water velocity and increasing surface area to absorb solar radiation. Additionally, deep impoundments may cause deep water temperatures to decrease if there is stratification. Dam operations can influence downstream temperature by changing/mixing withdrawal location, top versus bottom draw (among others).

Conductivity: High concentrations of dissolved ions, measured as conductivity, can impair the osmoregulation of organisms with gills and other semipermeable membranes. Sources of elevated conductivity are likely from nonpoint and certain point source discharges. However, conductivity is important for classifying the impoundment and stream and is therefore needed as background information.

pH: pH can control the biologic availability, solubility and speciation of chemicals in water. Although wild rice does well in slightly acidic waters (pH 5.9 – 6.2), even moderately acidic water may irritate the gills of aquatic fish and insects or reduce the hatching success of fish eggs. Eutrophication increases swings in pH during the algal growth and die-off phases. Highly eutrophic impoundments may release high or low pH to the river downstream. In addition, fluctuating water levels can acidify the impoundment by exposing the waterbody bed to air and then flushing sulfate into the water when lake levels rise again or when it rains. Dam operation probably has very little opportunity to mitigate dramatic pH swings at short timescales, but operations that cause sufficient changes in water levels may affect pH at a seasonal or interannual time scale.

Total Nitrogen: An oversupply of nitrogen is one of the primary causes of eutrophication. A lack of nitrogen limits wild rice development. Impoundments are unlikely to raise the concentration of nitrogen in the downstream river. Although some planktonic algae can fix atmospheric nitrogen, this amount is likely overwhelmed by the amount of nitrogen coming in from the watershed via tributary streams. Impoundments do play a role in the transformation, such as the ratio of dissolved inorganic nitrogen to organic nitrogen.

Sulfate, Total Mercury, Methyl Mercury: Dam operations can influence the sulfur and ultimately the mercury cycle. In short, long-term drawdowns can eventually lead to increased sulfate runoff when it rains. This acidifies the water and can then enhance methyl mercury concentrations in water and methyl mercury in fish. Sulfate can also be converted to toxic sulfide which affects the mitochondria of plants. When sulfate is high, sulfides are also usually high and therefore toxic to wild rice and other plants. This process has been demonstrated in formation of new reservoirs and in the regulation of existing reservoirs. Impoundments can cause this process to happen. Water levels will need to be managed to prevent increased total mercury and high sulfate levels.

Dissolved Phosphorus: An oversupply of phosphorus is one of the primary causes of eutrophication and most widespread pollutant in waterbodies, statewide and nationally. Low phosphorus levels limit wild rice seedling success and development. Impoundments are unlikely to raise the concentration of phosphorus in the downstream river, but play a role in the transformation, such as the ratio of dissolved phosphorus to total phosphorus. Dam operation might influence internal phosphorus loading to the impoundment by affecting the mixing regime as water levels change.

Nitrate (plus nitrite): One of the bioavailable forms of nitrogen, a primary cause of eutrophication. Impoundments are unlikely to raise the concentration of nitrate in the downstream river. Although some planktonic algae can fix atmospheric nitrogen, this amount is likely overwhelmed by the amount of nitrate coming in from the watershed via tributary streams.

Ammonia: One of the bioavailable forms of nitrogen, a primary cause of eutrophication. Impoundments are unlikely to raise the concentration of ammonia in the downstream river.

Chloride: Chloride, at elevated levels is toxic to fish, invertebrates and amphibians. At lower levels, it can negatively affect diversity, productivity, and increase the density of water. Chloride is increasing statewide and nationally in waterbodies that have even small percentages of their watershed in urbanized land use. The impoundment is unlikely to transform or change chloride levels from the incoming tributaries (assuming long-term stable water levels). The major exception being if the shore is heavily developed and there are major applications of road salt or point sources with high chlorides.

Bacteria: Bacterial indicators, such as E. coli, are used to detect the presence of fecal contamination in waterbodies to protect recreational uses. Impoundments are unlikely to increase E. coli in downstream

ivers, unless there is heavy recreation (campgrounds, beaches, non-sewered sanitation) on the impoundment.

Total Suspended Solids (TSS): High concentrations of TSS can inhibit visibility for predators, damage gill structure of fishes, and lead to high rates of sedimentation in streams and alter benthic habitat. Impoundments are likely to lower TSS concentrations in the downstream river. In extreme cases where sediment build-up behind a dam structure is high, there may be some chance of increased concentrations of TSS. Dam operation is unlikely to influence TSS unless there is a catastrophic event, drawdown or using ash cinders as a sealant.

Sediment Accumulation Behind Dam: Dams trap sediments upstream. Ecological concerns include increasing turbidity upstream and smothering spawning beds in the reservoir and upstream. Sediment build up can also threaten the longevity of the dam itself.

Alkalinity: Alkalinity itself is not regulated, but it is important for determining sensitivity to acidification and the biological communities that can live there. Alkalinity does not have criteria or thresholds; it is used to help understand lake characteristics. Alkalinity can be measured in concert with conductivity and pH with a single water sample.

Secchi Depth: Secchi depth measures water clarity and is a general indicator of lake health. The impoundment could affect Secchi depth through its effects on eutrophication and suspended sediments. Dam operations can influence internal nutrient loading and chlorophyll *a* (see above), and thus, also water clarity.

Color: Color refers to how much colored organic matter is in the water, staining it brown. Water color is important for understanding the ecology of the lake. Highly stained waters reduce water clarity and in turn, can affect algal and plant growth and even fish growth. The impoundment is unlikely to affect color, but color will be important for understanding the ecology of the impoundment. Color does not have criteria or thresholds; it is used to help understand lake characteristics.

Iron, Manganese, and/or Sulfide: These are reducing substances that can have high concentrations in the hypolimnion of reservoirs under anoxic conditions. They use oxygen through their own chemical transformations and can further increase oxygen demand. In addition, iron binds phosphorus under oxic conditions, but releases phosphorus under anoxic conditions. Therefore, reservoirs with high iron could be prone to internal phosphorus loading if they go anoxic in the hypolimnion. May be necessary to manage impoundments that stratify and become anoxic. May be necessary to manage impoundments that stratify and become anoxic. Dam operations can impact stratification and mixing, and thus, the concentration of these substances and internal nutrient loading. The department does not have criteria or thresholds for these substances; they would be used to help understand cycling of nutrients, mercury, etc., and oxygen dynamics within a lake

Cyanobacteria cell counts and cyanotoxins: Harmful Algal Blooms are of concern for human health, recreation, and fish and aquatic life. High concentrations of chlorophyll *a* are often correlated with high concentrations of cyanobacteria and cyanotoxins, but not in all cases. These indicators need to be measured independently for evaluation. As impoundments increase surface area, slow and warm water they likely to produce more chl *a* per unit phosphorus/nitrogen, than the upstream or downstream river. This could also include more cyanobacteria and cyanotoxins as well. Recent studies of dams across wide geographic areas show that cyanobacterial blooms are more prevalent when dams are drawn down. Temperatures increase along with water residence times and nutrient concentrations, all of which favor

cyanobacteria. Dam operations can influence the likelihood of cyanobacterial blooms. The department recommends following EPA's recommended cyanobacteria thresholds. The department's standard operating procedures and assessment methodology should be followed for monitoring, reporting and review. Highly recommended in reservoirs/impoundments that are known to suffer from harmful algal blooms. In addition to routine monitoring, samples may be taken in response to reports of algal blooms/sickness. Not necessary where chlorophyll concentrations are low and there are no reports of algal blooms.

• Existing Information:

**Hayward:** Water quality monitoring is not required in the current license. Water clarity data was collected at the Hayward Project 2010-2017. Hayward Lake is a designated Area of Special Natural Resources Interest (ASNRI) as an Outstanding and Exceptional Area, a Priority Navigable Waterway (PNW) Musky Area, and a PNW Walleye Area. The Namekagon River that flows through the Hayward Project is an ASNRI Wild and Scenic River, ASNRI Trout Stream, and a PNW Musky Area.

**Trego:** Water quality monitoring is not required in the current license. Water quality parameters were collected at the Trego Project 2010-2014 and 2016-2020. Satellite water clarity was collected at the Trego Project in 2015. Trego Lake is an ASNRI Outstanding and Exceptional Area and ASNRI Wild Rice Area. The Namekagon River that flows through the Trego Project is a PNW Musky Area.

• Operation nexus to resource and how informs license: Ensure compliance of state water quality standards and how operations are meeting those standards. The operation of the dam affects the water quality of the impoundment and downstream resources. The overall goal of the request is to further understand the current water quality conditions of the reservoir and river resources which will help inform management decisions in the future. Limited water quality data presented in the PAD is not representative of current or future water quality conditions.

• Methodology: The department classifies Hayward Lake as an impounded flowing water, where a water residence time is less than 14 days. According to current department information, the upper confidence limit for water residence time for Hayward Lake is 6 days. This means that river monitoring protocols should be applied instead of lake protocols upstream of the impounded area and downstream of the dam. Lake protocols should be applied within the deep hole of the impounded area.

The department classifies Trego Lake as an impounded flowing water, where a water residence time is less than 14 days. According to current department information, the upper confidence limit for water residence time for Trego Lake is 11 days. This means that river monitoring protocols should be applied instead of lake protocols upstream of the impounded area and downstream of the dam. Lake protocols should be applied within the deep hole of the impounded area.

River monitoring methods (including continuous monitoring) should be performed in at least three locations within the project area (or best appropriate location), including one location downstream of the dam, one location within the impounded area (within the deep area of the impoundment, typically near the dam), and one location upstream of the impounded area.

Data should be collected or analyzed using the DNR WISCALM Guidance, surface water grab sampling protocols, and the Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures, 2020). A list of standard operating procedures can be found in the appendix of the most current department Wisconsin Consolidated Assessment and Listing Methodology (WisCALM,

<https://dnr.wisconsin.gov/topic/SurfaceWater/WisCALM.html>), in addition to protocols listed in the table below:

One (1) sample location upstream of the impounded area and one (1) sample location downstream of the dam			
Parameter	Method	Frequency – At least one year of studies requested	DNR Protocols
<b>Total phosphorus</b>	Grab samples	Monthly, May – Oct <b>6 total</b>	Nutrient Grab Sample Protocol
<b>Chlorophyll <i>a</i></b>	Grab samples	Monthly, July 15 – September 15 <b>3 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures, 2020)
<b>Dissolved Oxygen</b>	Field measurement	Continuous, July – September	Use instruction manual from manufacturer
<b>Temperature</b>	Field measurement	Continuous, year-round	Use instruction manual from manufacturer
<b>Conductivity</b>	Field measurement	Continuous, July – September	Use instruction manual from manufacturer
<b>pH</b>	Field measurement	Continuous, July – September	Use instruction manual from manufacturer
<b>Dissolved Phosphorus</b>	Grab samples	Monthly, May – Oct <b>6 total</b>	Nutrient Grab Sample Protocol
<b>Total Nitrogen</b>	Grab samples	Monthly, May – Oct <b>6 total</b>	Nutrient Grab Sample Protocol
<b>Sulfate, Total Mercury</b>	Grab samples	Possibly 1x in spring	Nutrient Grab Sample Protocol
<b>Methyl Mercury</b>	Fish Tissue Samples	Possibly 1x in spring	Contact DNR Fisheries Biologist
<b>TSS</b>	Grab samples	Monthly, May – Oct <b>6 total</b>	Nutrient Grab Sample Protocol
<b>Nitrate (plus nitrite)</b>	Grab samples	Monthly, May – Oct <b>6 total</b>	Nutrient Grab Sample Protocol
<b>Ammonia</b>	Grab samples	Monthly, May – Oct <b>6 total</b>	Nutrient Grab Sample Protocol
<b>Chloride</b>	Grab samples	Monthly, May – Oct <b>6 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Bacteria</b>	Grab samples	Monthly, May – Oct <b>6 total</b>	Citizens Monitoring Bacteria: A training manual for monitoring E. coli <a href="http://dnr.wi.gov/lakes/forms/ecoli_may162005.pdf">http://dnr.wi.gov/lakes/forms/ecoli_may162005.pdf</a>
Nutrient Grab Sample Protocol: <a href="https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=114118765">https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=114118765</a>			
Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures, Revised 2020): <a href="https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/CLMN/ChemistryMan.pdf">https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/CLMN/ChemistryMan.pdf</a>			

One (1) sample location within the impounded area (deep hole)			
Parameter	Method	Frequency – At least one year of studies requested	DNR Protocols
<b>Total Phosphorus (TP)</b>	Field fixed, persulfate digestion	Spring turnover + 3x July 15 - Sep 15 <b>4 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Chlorophyll <i>a</i></b>	Water filtered in facility's lab or mail to SLH	3x July 15 - Sep 15 <b>3 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Dissolved Oxygen</b>	Field, Profile at 1 m intervals	Spring turnover + 3x July 15 - Sep 15 <b>4 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Temperature</b>	Field, Profile at 1 m intervals	Spring turnover + 3x July 15 - Sep 15 <b>4 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Conductivity &amp; pH (optional)</b>	Profile at 1 m intervals	Spring turnover + 3x July 15 - Sep 15 <b>4 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Conductivity, pH, Alkalinity</b>	Field collected, then sent to lab	1x during July 15 - Sep 15 <b>1 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Dissolved Phosphorus</b>	Field collected, then sent to lab	Spring turnover + 3x July 15 - Sep 15 <b>4 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Clarity (Secchi)</b>	Field	Spring turnover + 3x July 15 - Sep 15 <b>4 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Secchi Disk Procedures)
<b>Color</b>	Field collected, then sent to lab	1x during July 15 - Sep 15 – <b>1 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Total Nitrogen</b>	Field fixed (sulfuric acid)	1x during July 15 - Sep 15 <b>1 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Sulfate, Total Mercury</b>	Field collected, then sent to lab	Possibly 1x in spring	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Methyl Mercury</b>	Fish tissue. See appendix for explanation.	Possibly 1x in spring	Contact DNR Fisheries Biologist
<b>Nitrate (plus nitrite)</b>	Field fixed (sulfuric acid)	1x during July 15 - Sep 15 – <b>1 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)

<b>Ammonia</b>	Field collected, then sent to lab	Probably 1x July 15 - Sep 15 – <b>1 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Chloride</b>	Field collected, then sent to lab	Spring turnover + 3x July 15 - Sep 15 <b>4 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Iron, Manganese, and/or Sulfide</b>	Field collected, then sent to lab	Spring turnover + 3x July 15 - Sep 15 <b>4 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Total suspended solids (TSS)</b>	Field collected, then sent to lab	Spring turnover + 3x July 15 - Sep 15 <b>4 total</b>	Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)
<b>Cyanobacteria/ cyanotoxins</b>	Contact DNR Water Quality Biologist		
<b>Bacteria</b>	Field collected, then sent to lab	Dependent on system & tied to public beaches – Contact Water Quality Biologist	Citizens Monitoring Bacteria: A training manual for monitoring E. coli <a href="http://dnr.wi.gov/lakes/forms/ecoli_may162005.pdf">http://dnr.wi.gov/lakes/forms/ecoli_may162005.pdf</a>
<b>Wisconsin Citizen Lake Monitoring Training Manual (Secchi Disk Procedures, Revised 2020):</b> <a href="https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/CLMN/SecchiMan.pdf">https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/CLMN/SecchiMan.pdf</a>			
<b>Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures, Revised 2020):</b> <a href="https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/CLMN/ChemistryMan.pdf">https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/CLMN/ChemistryMan.pdf</a>			

For the analytes without state standards, they should be analyzed by mean and median values and reported in a table by date and time annually.

Sediment accumulation should be assessed and mapped behind the dam. This includes estimated depth and volume of sediment held within the impoundment.

**Sampling Locations:** Apply river monitoring methods in the river in the impounded area, downstream of the dam, and upstream of the impounded area.

- **In the Impounded Area:** One or more stations within the main impounded area. At least one station should be located in the deep area of the impoundment, which would typically be near the dam. However, it must be located outside of the hazard zone demarcated by buoys. For large impoundments an additional station or two may be required in the middle and upper reaches of the impounded area, along the thalweg, to characterize water quality throughout the impoundment. For those with a more complex system of tributary arms or large bays, additional monitoring stations may be recommended to characterize those areas.
- **Downstream of the dam:** One station. In cases where some of a river's flow is diverted through the dam and another portion of the flow is not, the station should be located below the mixing zone (see the DNR's "Guidance for Mixing Zones, Zones of Initial Dilution, and Rapid Mixing"). It should also be placed in an area that is safe to access (some areas may be too swift-flowing) and if possible where vandalism of equipment is less likely.
  - In certain cases, a second station immediately below the dam may be required if low DO is expected to be an issue due to bottom draw releases and/or low DO in the impounded area.
- **Upstream of the impounded area:** Monitoring inflows can provide a point of comparison with waters in the impoundment and downstream and help identify pollution sources. One river station upstream of the impounded area may be required if:
  - There is not another station upstream of the facility's impounded area that is being monitored by another facility upstream (in areas with several consecutive dams).
  - There is a water quality problem identified downstream or in the impounded area which needs additional upstream data to determine the cause of the issue.

• **Level of Effort and Costs:** Six field days plus with two people \$125 per hour plus costs for equipment. Estimated 40 hours for report writing and chemical analysis. Additional field work may be required to monitor/maintain continuous monitoring sensors.

## ASSESSMENT OF SEDIMENTATION AT TREGO DAM

- **Goals & Objectives:** Assess sedimentation upstream of Trego Dam near where the boundary is proposed to be removed.
- **Relevant DNR Management Goals:** Dams trap sediments upstream. Ecological concerns include increasing turbidity upstream and smothering spawning beds in the reservoir and upstream. Sediment build up can also threaten the longevity of the dam itself.
- **Existing Information:** During the JAM presentation, the local Trego Lake association shared concerns with sedimentation at the Trego dam, as well as where the proposed FERC boundary is being removed. The lake association also has concerns of flooding in this portion of the project boundary.

- Operation nexus to resource and how informs license: Ensure compliance of state water quality standards and how operations are meeting those standards. The operation of the dam affects the water quality of the impoundment and downstream resources. The overall goal of the request is to further understand the current water quality and sedimentation conditions of the reservoir and river resources which will help inform management decisions in the future.
- Methodology: Sediment accumulation should be assessed and measured downstream of HWY 53 through the project area that is being proposed for removal. Assessments of sediment deposits and sediment depth measurements can be collected along multiple transects, including the bay areas north and west of Leisch Road.
- Level of Effort and Costs: 40 hours of desktop review, and data summary at an estimated \$125 per hour, plus equipment costs.

## ASSESSMENT OF WILDLIFE AND WILDLIFE HABITAT

- Goals & Objectives: Document wildlife presence and diversity, habitat types, and general wildlife and vegetation abundance within the Project area. The goal of this study is to evaluate the distribution and composition of vegetation, wildlife, and wildlife habitats, including wetlands, and the effects operations of those
- Relevant DNR Management Goals: The department has responsibility to manage wildlife, including listed species. This information will be beneficial to understanding the current environment, and potential needs for resource management associated with the Project.
- Existing Information: Limited or no wildlife surveys or data have been collected within the Project boundary. Additionally, the PAD does not include any field assessment or surveys of wildlife habitat or use.

**Trego:** The department does not own land so we do not have any wildlife or fishery area management plans for this area of land. The only survey conducted in this area was the bear snare survey (which showed an abundance of bears).

The department has concerns for otters, furbearers, and other wildlife if water levels are not managed similar to current operations. Turtles, frogs, and other herps would be negatively affected if water levels are drawn down after October 1<sup>st</sup>.

**Hayward:** From a game species standpoint, wildlife impacts are presumed to be low. The game “species” that would see the largest direct impact would be waterfowl and furbearers. The Waterfowl Management Plan was approved by the department and Wisconsin Natural Resources Board as of January 2020 and lays out the goals for Wisconsin’s waterfowl.

Water dwelling or using furbearers could also be impacted in water conditions changes from its current state. Like the waterfowl plan, the department Beaver Management Plan can be used for reference.

There is bald eagle territory on Lake Hayward, with two nests by the Lumberjack Bowl and a newer nest just north of Hwy 77.

Waterfowl Management Plan (2020): <https://p.widencdn.net/uffph8/WisconsinWaterfowlPlan>

Beaver Management Plan (2015): <https://p.widencdn.net/axlcfq/WM0610>

- Operation nexus to resource and how informs license: The relicensing of the Project has the potential to have short term and long-term impacts on habitat and wildlife use of affected habitats. Proper management of the resource will help to minimize any adverse impacts associated with the removal, restoration, and relicensing activities.

- Methodology: Using a qualified biologist or ecologist knowledgeable in local vegetation, identify, classify, and delineate on a map major vegetation cover types within project area. Existing aerial photography, on the ground surveys, or a combination of the two to identify and map the cover types may be used. The biologist/ecologist will record all wildlife present.

During the summer and fall (migration), ground-truth any remote-sensing mapping efforts, record all wildlife observed (directly or indirectly) and document any terrestrial invasive species detected during survey efforts. Describe each cover type by species composition, successional stage, and aerial extent (acreage) within the survey area, including invasive species. As an example, the methodology expressed in the following reference could be used: [https://www.fs.fed.us/research/publications/gtr/gtr\\_wo89/gtr\\_wo89.pdf](https://www.fs.fed.us/research/publications/gtr/gtr_wo89/gtr_wo89.pdf)

- Level of Effort and Costs: 80 hours of desktop review, field work, and data summary at an estimated \$125 per hour, plus equipment costs.

## ASSESSMENT OF FISHERIES AT TREGO PROJECT

- Goals & Objectives: Define the diversity and abundance of the fish community within the Trego Project.
- Relevant DNR Management Goal: Understand the existing environment. The department manages public water for recreational use, such as fishing, protection and management of species, and the overall health of the fishery of the state.
- Existing Information: The PAD states that department data was provided for upstream of Trego Lake, downstream of Trego Lake, and within Trego Lake for 2003-2019. Trego Lake is an ASNRI Outstanding and Exceptional Area and ASNRI Wild Rice Area. The Namekagon River that flows through the Trego Project is a PNW Musky Area.

The department has concerns on Lake Sturgeon entrainment at the Trego Dam. Lake Sturgeon are currently stocked by the department in the Namekagon River (above Trego Lake) and within Trego Lake in hopes of re-establishing this population, however, with entrainment, larger adult sturgeon can leave the lake but cannot return.

- Operation nexus to resource and how informs license: Having current fish survey information will help department staff make informed management decisions regarding the fishery.

- Methodology:

Seasonal catch per unit effort (CPUE) surveys in the spring, summer, and fall to quantify fish population relative abundance and summary report to document the species available to recreational fishers and general fish community composition.

**Early Spring Fyke Netting**: Three to five fyke nets (front frame 4'x6'), set the week of ice out.

**Early Spring Electroshocking**: Maxi boom to survey the entire shoreline with two dippers, when water temps are between 45-55 degrees

**Late Spring Electroshocking**: Maxi boom to survey the entire shoreline with two dippers, when water temps are between 60 – 70 degrees.

**Summer Fyke netting (June-early August):** Three to five fyke nets (front frame 4'x6'), set when water temps are approaching 70 degrees.

**Fall Electroshocking:** Maxi boom to survey the entire shoreline with two dippers, when water temps are between 55-65 degrees

- Level of Effort and Costs: Estimated \$125 per hour, plus equipment costs.

**Early Spring Fyke Netting:** Nets would be checked for 3 - 5 days, approximately 2 - 4 hours a day to set, check, move and workup the fish.

**Early Spring Electroshocking:** Approximately 1-2 nights of electrofishing (depending on 2 or 4 boats), approximately 6 hours per boat/night, 8 2-mile stations.

**Late Spring Electroshocking:** Approximately 2-4 nights of electrofishing (depending on 1 or 2 boats), approximately 4 hours per night

**Summer Fyke Netting:** Approximately 2 to 4 hours a day to set, check, move and workup the fish. The nets would be deployed for 3 to 4 net nights, usually set on a Monday, checked daily and removed Thursday or Friday of that same week.

**Fall Electroshocking:** Approximately 2-4 nights of electrofishing (depending on 1 or 2 boats), approximately 4 hours per night, 4 stations

## ASSESSMENT OF FISH ENTRAINMENT AND FISH MOVEMENT

- Goals & Objectives: The department has concerns on Lake Sturgeon entrainment at Trego dam. Assess fish entrainment at the Trego Project and Hayward Project and better understand fish movement from above to below the dams. The department has concerns with Lake Sturgeon entra

- Relevant DNR Management Goals: Understand the existing environment. The department manages public water for recreational use, such as fishing, protection and management of species, and the overall health of the fishery of the state.

- Existing Information:

**Trego:** The department has documented at least seven lake sturgeon that have entrained the dam (from Trego Lake to Namekagon River below) and survived to be recaptured below Trego Dam. There are likely many more sturgeon and other fish species that are entraining below Trego Dam and surviving. The department suspects that muskellunge are also doing this but haven't been able to document that through our fish surveys.

This dam is a major block to fish passage and migration for the Namekagon River, the most notable species that is impacted are lake sturgeon. Lake Sturgeon are currently stocked by the department in the Namekagon River (above Trego Lake) and Trego Lake in hopes of re-establishing this population. However, with entrainment, larger adult sturgeon can leave the lake but cannot return.

Trego Project has 1.5" spacing for both trash racks (one for each turbine), with a 1.2 feet/second intake velocity at maximum flow.

**Hayward:** Department fisheries biologists are interested in the fishery below the Hayward dam, and some of the most popular fish species are species coming from Hayward Lake upstream.

Hayward Project has 1.5” trash rack spacing with a 1.5 feet/second intake velocity at full gate.

- Operation nexus to resource and how informs license: Having current fish movement information (e.g. when fish are passing the dam, how many fish are passing the dam) and survival information will help department staff make informed management decisions regarding the fishery.
- Methodology: Model a tagging study after existing research to look at entrainment of sturgeon, muskie, and walleye. This research could use radio tagging or hydroacoustic telemetry.
- Level of Effort and Costs: Fieldwork and data reporting at \$125 per hour, plus equipment costs

## MACROINVERTEBRATE SURVEY

- Goals & Objectives: Assess the water quality using macroinvertebrate bio-indicators downstream of the impoundment.
- Relevant DNR Management Goals: The department is charged with managing the water quality of the waters of the state and meeting designated criteria under the Clean Water Act.
- Existing Information: Macroinvertebrate data is not available for the Hayward and Trego Projects.
- Operation nexus to resource and how informs license: Macroinvertebrates are likely impacted by segmentation of the river, and impoundments can impact communities due to changing thermal and/or flow regimes. These bio-indicators are used to assess the health of the resource.
- Methodology: Collect a wadable macroinvertebrate sample, if possible, downstream of the flowage using the department’s Guidelines for Collecting Macroinvertebrate Samples from Wadable Streams (2017). If the stream is not wadeable, a large river macroinvertebrate sample should be collected. Data should be analyzed using the current department WISCALM Guidance. Wisconsin DNR Guidelines for Collecting Macroinvertebrate Samples from Wadable Streams (2017) and Large River Macroinvertebrate Sampling (2015), as appropriate. Data should be analyzed using the current department WISCALM Guidance. Macroinvertebrates should be collected upstream of the reservoir in the riverine reach, in the bypass channel and downstream of the powerhouse in the fully mixed zone.

Large River Macroinvertebrate Sampling (2015)

<https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=120273145>

Wadable Streams Macroinvertebrate Sampling (2017)

<http://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=150708168>

- Level of Effort and Costs: One day of field work with an estimated 20 hours of field and data analysis at \$125 per hour equals \$2,500. Lab analysis at state certified lab estimated to cost \$1,000. Mobilization, travel, and equipment is estimated at \$2,000.

## AQUATIC AND TERRESTRIAL INVASIVE SPECIES SURVEY

- **Goals & Objectives:** Evaluate the presence/absence of invasive species listed in NR40, including habitat preferences, within the Project area.
- **Relevant DNR Management Goal:** Minimize the transport and establishment of existing invasive species and establish management practices to reduce new invasive species. Compliance with NR40.
- **Existing Information:** Chinese mystery snail, curly-leaf pondweed, Eurasian water milfoil, and hybrid Eurasian/northern water milfoil have been observed at the Hayward Project. Zebra mussel eDNA, qPCR analysis was conducted in 2019; results were negative. Chinese mystery snails, curly-leaf pondweed, Eurasian water milfoil, and Japanese mystery snails have been observed at the Trego Project. Early Detection Monitoring was conducted at the Trego Project in 2017. Purple loosestrife is monitored annually and is observed at Hayward Project. Purple loosestrife is not monitored in the current license for Trego Project.
- **Operation nexus to resource and how informs license:** The Project may influence invasive species that have the potential to directly or indirectly cause economic or environmental harm or harm to human health, including harm to native species, biodiversity, natural scenic beauty and natural ecosystem structure, function or sustainability; harm to the long-term genetic integrity of native species; harm to recreational, commercial, industrial and other uses of natural resources in the state; and harm to the safety or wellbeing of humans, including vulnerable or sensitive individuals. – per NR40.
- **Methodology:** Use department Early Detection Early Response Protocols. Additional methodology may be needed for terrestrial species, and other methodologies such as point-intercept may be appropriate if combining this study with other studies.
- **Level of Effort and Costs:** 40 hours of field work and reporting at \$125 per hour equals \$5,000. Mobilization, equipment, and supplies are estimated at \$10,000.

## AQUATIC PLANT SURVEY

- **Goals & Objectives:** The goal of the aquatic plant study is to provide baseline data on the condition of the aquatic plant community in the Project.
- **Relevant DNR Management Goals:** The proposed aquatic plant study will provide baseline aquatic plant information to determine if management practices would be needed to enhance the existing aquatic plant community, and overall health of the Project reservoir as a bio indicator. Water levels can influence aquatic vegetation.
- **Existing Information:** In-water plant community data is limited within the Project boundary.
- **Operation nexus to resource and how informs license:** The study results will provide baseline aquatic plant data. The data informs the Department of the effects on the surface water resource and would be used to formulate management options. Plant density and diversity of aquatic and native species are important for establishing various management plans and protecting the resource.
- **Methodology:** The information collected from this study includes an assessment of the density and diversity of macrophytes, which includes frequencies of occurrence of different plant species, as well as estimates of species richness, abundance, and maximum depth of plant colonization. The aquatic invasive species study should be conducted according to the department's Recommended Baseline Monitoring of Aquatic Plants in Wisconsin.

- Level of Effort and Costs: 40 hours of fieldwork and 40 hours of reporting at \$125 per hour, plus equipment costs.

## MUSSEL STUDY

- Goals & Objectives: Determine the effects of barriers to mussel distribution and diversity within the Project area and Namekagon River. Determine freshwater mussel density and diversity, including characterizing mussel habitat within the Project area. The study would provide information on freshwater mussel species present, their diversity, density, and a better understanding of baseline conditions and associated management needs for the Project area.
- Relevant DNR Management Goals: This information will help the resource agencies determine if any best management practices are needed to protect listed species, as well as any management measures to protect or enhancement the existing freshwater mussel population.
- Existing Information: No federally or state threatened/endangered or special concern mussel species are known to occur in the impounded sections of the reservoirs, however listed species may occur downstream from the dams or further upstream from the impounded reaches of the reservoirs.
- Operation nexus to resource and how informs license: The operations of the Project could influence the freshwater mussel species located within the Project boundary. The results of the survey will provide essential information to determine if any protection measures, restoration, or enhancements would be necessary as a management requirement associated with the relicensing of the dam.
- Methodology: A qualitative and quantitative survey for freshwater mussels should be conducted within the Project area and downstream of the dam structure, on the Namekagon River. Some methods that can be used are the department's Guidelines for Sampling Freshwater Mussels in Wadable Streams and the department's Quantitative Habitat Assessment Methodology. Methodology should be discussed with the department for quantitative surveys. A Mussel Survey Plan should be submitted to the department for review at least 2 weeks (1 month preferred) prior to implementation.

Mussel sampling should be conducted when water temperatures exceed 50°F to minimize thermal stress to the resource. This period will allow mussels disturbed during sampling to re-establish themselves into the substrate.

Qualitative timed searches should first be conducted to assess habitat suitability and presence of freshwater mussels. Sites will be located below each barrier within the study area, plus one site upstream of the Project area. Starting locations should be representative of available habitat within the sampling reach. As a minimum, timed searches will be 4 per/hrs or a total search distance of 200 m in riverine sections of the project area and up to 8 per/hrs within reservoirs.

Based on results of qualitative surveys, quantitative surveys may be required. Quantitative sampling using quadrat samples will be used to determine population density, community composition, age and total length distributions, living/dead and sex ratios. One quantitative site will be located on the Project area where mussel habitat is determined suitable and where past sampling has occurred. The sampling unit will consist of a 30m transect with 10 equally spaced 1/4m<sup>2</sup> quadrats every three meters along the unit. Each transect extends perpendicular from shore. Up to 300 1/4 m<sup>2</sup> quadrats are sampled, collecting all living bivalves and empty shells. Mussels are brought to the surface in a 3 mm mesh-sized bag where they are identified to species, aged, and shell measurements recorded. All live mussels are then returned along the same transect they were collected.

- Level of Effort and Cost: An estimate of 80 hours of field work and 40 hours to analyze data and draft a report at an estimated \$125 per hour, plus equipment costs.

## ASSESSMENT OF RARE AND ENDANGERED SPECIES

- Goals & Objectives: Rare plants and animals have been found within, adjacent to, and in habitats similar to the study area. It would be recommended to complete plant and animal surveys for these species to determine if they occur within the study area and to further our understanding of their populations within this area. This will also inform the licensee as to where these plant and animal locations are.
- Relevant DNR Management Goals: The department has responsibility to manage plants and animals, including listed species. This information will be beneficial to understanding the current environment, and potential needs for resource management associated with the Project. The licensee is also required to follow state Endangered Species laws.
- Existing Information: An Endangered Resources Review has been performed for current Hayward and Trego Project boundaries, but will need to be updated with proposed project boundary changes that are presented within the PAD.
- Operation nexus to resource and how informs license: The relicensing of the Project has the potential to have short term and long-term impacts on vegetation and animals-- in particular, wood turtles and their habitat. Proper management of the resource will help to minimize any adverse impacts associated with the removal, restoration, and relicensing activities.
- Methodology: Using a qualified botanist knowledgeable in area vegetation and specific species, identify, classify, and delineate on a map rare, threatened, or endangered plant species within the Project area. Using a qualified biologist or ecologist, conduct presence/absence surveys for specific rare, threatened, or endangered animal species.
- Level of Effort and Cost: 40 hours of desktop review and 40 hours of fieldwork, plus equipment costs.

## WOOD TURTLE SURVEYS

- Goals & Objectives: Wood turtles are listed as Threatened in Wisconsin. In an effort to better understand the abundance and distribution of this species, several survey and management efforts are taking place across northern Wisconsin within a number of different river systems. Presence/absence surveys, population modelling and natural nest site surveys are three examples of existing work that is being done across the range of this species in Wisconsin, which is primarily the northern one-third of the state. The main goal of this study request is to determine whether any wood turtle nest sites occur within the Project boundary at either Hayward or Trego.
- Relevant DNR Management Goals: The department has responsibility to manage wildlife, which includes the wood turtle. This study will be beneficial to understanding the current environment and potential needs for resource management associated within both Project boundaries. Two of the main threats to wood turtles across their range are: 1. Adult mortality due to vehicle collisions 2. Predation of eggs and hatchlings at nest sites, resulting in poor recruitment in many river systems. Wood turtles are particularly susceptible to nest predation due to their tendency to nest colonially and nest in the same location every year, providing a pattern that is recognizable by nest predators, such as raccoon and fox. In an effort to improve recruitment, the department has employed several strategies to protect existing nest sites and create protected artificial nest sites. If any

natural nest sites are found within the Project boundaries at Hayward or Trego, the department will work with the licensee to protect these nest sites from predation as well as from negative human-related impacts.

- Existing Information: Wood turtles are known to be present near this Project boundary, however, survey data is limited.
- Operation nexus to resource and how informs license: The relicensing of these Projects has the potential to have short term and long-term impacts on wood turtles and habitat use. Proper management of the resources will help to minimize any adverse impacts associated with the restoration and relicensing activities. Examples of possible impacts to wood turtles are related to seasonal water level fluctuations during vulnerable life history stages, both upstream and downstream. If nest sites are present downstream of the dam, increasing downstream water levels during the period following egg laying in June until hatchling emergence in August/September could cause nest failure if nests become submerged for extended periods of time. Depending on timing, winter drawdowns could have impacts on wood turtles upstream of the dam if the water level is lowered to a point where overwintering turtles are exposed to the elements due to low water levels where they are hibernating.
- Methodology: Using a qualified biologist or ecologist, wood turtle nesting site surveys are requested, following the protocol listed below.

Wood turtle nesting site surveys: Beginning in early to mid-June, and extending until approximately the first week in July, wood turtle nesting activity can be surveyed by conducting daily searches for adult wood turtles and/or evidence of recent nesting activity in suitable nesting habitat. Suitable nesting habitat includes a sand or sand/gravel substrate that is either unvegetated or sparsely vegetated, receives sun exposure for most of the day during late spring/summer and is within approximately 200 feet of the river's edge. Note that this can include gravel parking areas, roads or shoulders of paved roads. Many portions of the project boundary can likely be eliminated from these nesting surveys due to a lack of suitable conditions for turtle nesting.

- Level of Effort and Costs: 40-60 hours at \$125 per hour, plus equipment costs.
  1. Wood turtle nesting site surveys: Assess nest site suitability within the project boundary, focusing on free-flowing river stretches. Desktop review followed by ground truthing.
  2. Wood turtle nesting site surveys, Spring/Summer: Daily surveys of suitable nesting sites (if any are found) for four weeks (Assume 1 hour per survey).

## **BLANDING'S TURTLE SURVEYS AT HAYWARD PROJECT**

- Goals & Objectives: Blanding's turtles are a Special Concern species in Wisconsin. In an effort to better understand the abundance and distribution of this species, we are requesting that Blanding's turtle surveys are conducted within the Hayward and Trego project boundaries. The overall goal of this survey request is to determine whether any Blanding's turtle nest sites occur within the Project boundaries.
- Relevant DNR Management Goals: The department has responsibility to manage wildlife, which includes the Blanding's turtle. This study will be beneficial to understanding the current environment and potential needs for resource management associated within the Project boundary. Two of the main threats to Blanding's turtles across their range are: 1. Adult mortality due to vehicle collisions 2. Predation of eggs and hatchlings at nest sites, resulting in poor recruitment in many systems. If any natural nest sites are found within the current or proposed Project boundary, the department will work with the licensee to protect these nest sites from predation as well as from negative human-related impacts.

- Existing Information: Blanding's turtles are known to be present near these Project boundaries, however, survey data is limited.
- Operation nexus to resource and how informs license: The relicensing of these Projects has the potential to have short term and long-term impacts on Blanding's turtles and habitat use. Proper management of the resources will help to minimize any adverse impacts associated with the restoration and relicensing activities. Examples of possible impacts to Blanding's turtles are related to seasonal water level fluctuations during vulnerable life history stages. If nest sites are present downstream of the dam, increasing downstream water levels during the period following egg laying in June until hatchling emergence in August/September could cause nest failure if nests become submerged for extended periods of time. Depending on timing, winter drawdowns could have impacts on Blanding's turtles upstream of the dam if the water level is lowered to a point where overwintering turtles are exposed to the elements due to low water levels where they are hibernating.
- Methodology: Using a qualified biologist or ecologist, Blanding's turtle nesting site surveys are requested, following the protocol listed below.

1. Blanding's turtle nesting site surveys: Beginning in early to mid-June, and extending until approximately the first week in July, Blanding's turtle nesting activity can be surveyed by conducting daily searches for adult Blanding's turtles and/or evidence of recent nesting activity in suitable nesting habitat. Suitable nesting habitat includes a sand or sand/gravel substrate that is either unvegetated or sparsely vegetated, receives sun exposure for most of the day during late spring/summer and is within approximately 200 feet of the water's edge. Note that this can include gravel parking areas, roads or shoulders of paved roads. Many portions of the project boundary can likely be eliminated from these nesting surveys due to a lack of suitable conditions for turtle nesting.

- Level of Effort and Costs: 40-60 hours at \$125 per hour, plus equipment costs.

1. Blanding's turtle nesting site surveys: Assess nest site suitability within the project boundary. Desktop review followed by ground truthing.
2. Blanding's turtle nesting site surveys, Spring/Summer: Daily surveys of suitable nesting sites (if any are found) for four weeks (Assume 1 hour per survey).

## **MINK FROG SURVEYS AT HAYWARD PROJECT**

- Goals & Objectives: Mink Frogs are listed as a species of Special Concern in Wisconsin. In an effort to better understand the abundance and distribution of this species, several survey and management efforts are taking place across northern Wisconsin within a number of different river systems. Presence/absence surveys are an example of existing work that is being done across the range of this species in Wisconsin, which is primarily the northern one-third of the state. The overall goal of this survey request is to further our knowledge of the distribution of Mink Frogs within the watershed more broadly. The main objectives of this study request are to determine if Mink Frogs are present within the Project boundary of the dam.
- Relevant DNR Management Goals: The department has responsibility to manage wildlife, which includes the Mink Frog. This survey study will be beneficial to understanding the current environment and potential needs for resource management associated within the Project boundary.
- Existing Information: Mink Frogs are known to be present within this Project boundary, however, survey data is limited.

- Operation nexus to resource and how informs license: The relicensing of the Project has the potential to have short term and long-term impacts on Mink Frogs and habitat use. Proper management of the resources will help to minimize any adverse impacts associated with the restoration and relicensing activities. Examples of possible impacts to Mink Frogs are related to seasonal water level fluctuations during vulnerable life history stages, both upstream and downstream.

- Methodology: Using a qualified biologist or ecologist, conduct calling (presence/absence) surveys for Mink Frogs.

1. Calling or presence/absence surveys for Mink Frogs: Follow the Mink Frog Survey Protocols where suitable habitat is present:

<https://wiatri.net/inventory/frogtoadsurvey/Volunteer/Mink/MinkFrogSurveyProtocols.pdf>.

- Level of Effort and Costs: 20 hours at \$125 per hour, plus equipment costs.

1. Presence/absence surveys for Mink Frogs, June 6 – July 15, 2021: Two surveys per week for four weeks (assume 2 hours per survey). These surveys should focus on free-flowing river stretches where adjacent bog habitat is present.

## ASSESSMENT OF RIVERINE AND RESERVOIR HABITAT

- Goals & Objectives: Define, measure, and assess the stream habitat conditions upstream and downstream of the hydropower facilities at current and proposed elevations. Define, measure, and assess the reservoir habitat, including upstream and downstream of the reservoir at current and proposed elevations. Determine if degradation is occurring and if resources are affected.

- Relevant DNR Management Goals: Obtaining recent habitat assessment information is critical for future management actions and establishing baseline data. Water level fluctuations due to drawdowns may affect aquatic habitat; impacts of drawdowns on the resource should be assessed. Obtaining information on how/if new water levels will cause shoreline erosion as a new ordinary high water mark is established

- Existing Information: The PAD states that “the Lake Hayward shoreline was surveyed for archaeological evidence in 1998 and 2003. The surveys concluded the reservoir shoreline was very stable and well vegetated with little or no erosion.” The PAD states that “the Trego Lake shoreline was surveyed for archaeological evidence in 1998 and 2003. The surveys concluded the reservoir shoreline was very stable and well vegetated with little or no erosion.” The PAD states that “riparian habitat is heavily developed on Hayward Lake and moderately developed on Trego Lake.”

- Operation nexus to resource and how informs license: Having updated habitat assessment information is critical for evaluating the effects of the project on the reservoir and downstream ecosystem. It will provide baseline data to current conditions and assist with management recommendations of any current or future needs. The data can be used to help guide water resource management associated with the Project.

- Methodology: The riverine habitat within the project area downstream from the dam should be evaluated with the department Quantitative Habitat Assessment methodology in the wadable stretches of the Project at the time of each fish survey, as well as in the wadeable stretches of the Namekagon River at various flows or estimates. For the reservoir, department shoreland habitat protocol should be used. Newly impounded areas and any wetlands that could be affected by the new water level should be mapped. Please work with the department to determine which protocol should be used for different locations.

- Level of Effort and Costs: 80 hours of field work and 40 hours of data analysis and reporting at \$125 per hour, plus equipment costs.

## ASSESSMENT OF RECREATION

- Goals & Objectives: Evaluate current recreational uses, including opportunities for low flow and high flow events, public access, natural scenic beauty, trails, water sports, and fishing, with consideration for the different seasonal uses.
- Relevant DNR Management Goals: The Department supports a wide array of recreational use. We support the need for recreational use surveys that consider a broad array of users. A quantitative recreational use survey completed within the Project boundary will evaluate potential changes associated with any modifications to water levels and operations. Information needs to be gathered in order to understand the current use, and potential future uses.
- Existing Information:

**Hayward Project:** Hayward Lake is an ASNRI Outstanding and Exceptional Stream designation. Below the dam is a PNW Musky water. The ASNRI designation also points to the Wild and Scenic River status for the Namekagon River, that is protected by federal law. Hayward Lake has a boat ramp 0.3 miles upstream from the dam, just east of the Highway 27 crossing. Hayward Lake also has a recreational fishing pier approximately ½ mile upstream from the dam.

**Trego:** Trego Lake, on the Namekagon River has designated ASRNI status as an Outstanding and Exceptional area. It also has Wild Rice present and retains the designation for that reason as well. Tribal consultation will be necessary to determine any changes to this waterbody and how it might impact wild rice.

Just downstream from the Trego dam is a canoe landing popular with non-motorized watercraft that use the riverway. This area being national scenic riverway, this reach is managed for paddlers and camping where several primitive water-only access campsites are available. Trego Lake has two boat ramps for motorized boats, and a canoe/kayak launch on the east side of Trego. This area is extremely popular with non-motorized boats and tubes, with a large rental business on the east side of Trego.

- Operation nexus to resource and how informs license: Hydro operations, management of impoundments, water level changes, and sufficient public access can have a significant impact on recreational value. Adequate information is necessary to determine what impacts may be occurring from the hydro operations, and what recreational opportunities may be enhanced.
- Methodology: Desktop assessment, including review of the State of Wisconsin 2019 to 2023 Statewide Comprehensive Outdoor Recreation Plan (SCORP), released in March 2019, public surveys, and existing recreational sites. This includes assessment of current uses, level of use, evaluation for additional recreational features.
- Level of Effort and Cost: 40 hours of desktop review and fieldwork at \$125 per hour, plus equipment costs.

## ASSESSMENT OF PROPOSED PROJECT BOUNDARY

- Goals & Objectives: Quantitative assessment of acres of wildlife habitat and surface water that would be modified with a proposed change in Project boundary. This includes impacts to public access and recreational activities.
- Relevant DNR Management Goals: Protection of natural resources and providing public recreational opportunities are part of the Department's mission.
- Existing Information: The PAD states for the Hayward Project that "the Licensee is proposing to increase the acreage within the Project boundary an additional 2.8 acres. The increase includes a portion of the reservoir currently occupied by the Project, but not currently included in the Project boundary." The PAD states for the Trego Project that "The use of LiDAR data to review the current Project boundary identified that the upper extent of the existing Project boundary contains a portion of free-flowing Namekagon River that is not impounded at the maximum operating elevation of 1,035.2 feet and therefore is not necessary for project operations. Therefore, in developing the proposed Project boundary for this document, the unimpounded or free-flowing upstream reach has been removed from the proposed Project boundary. This results in an overall decrease of acreage within the Project boundary of 29.1 (submerged) acres."
- Operation nexus to resource and how informs license: The riparian areas are critical in protecting water quality and fish and wildlife habitat in the Namekagon system. Recreation and public access, along with natural resource protection are all part of the Public Trust Doctrine in Wisconsin.
- Methodology: Desktop evaluation of wetland and riparian habitat. Identify changes in acreage in wetland and habitat, as well as changes in acreage and use in reactional features. Additionally, identify if any of the areas proposed to be exclude from the Project boundary provide habitat for listed species.
- Level of Effort and Cost: 40 hours of desktop review at \$125 per hour.



PO Box 184 TREGO WISCONSIN 54888

August 27, 2021

Darrin Johnson  
FERC Compliance and Licensing, Water  
Mead and Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: TLD comments to Section P, Proposed Study Summary for Hayward and Trego Hydroelectric Project relicensing

Mr. Johnson,

The Trego Lake District (TLD) would like to thank the consultant for Xcel Energy, Mead and Hunt, for supporting studies on recreation, aquatic plants, and aquatic invasive species. Additionally, TLD is pleased with the study focusing on water quality. However, TLD strongly recommends conducting the sedimentation studies suggested by NPS and WDNR in the relicensing of Trego Dam. The 1995 FERC Order states: “. . . the licensee is responsible for providing the recreating public access to the upper portion of the reservoir, . . .”<sup>1</sup> To provide this access, the licensee (Xcel Energy), must study and address the sedimentation issue which directly affects the growth of aquatic plants, aquatic invasive species, and recreation.

TLD believes sedimentation study is necessary because of differing responses on sediment build up from FERC during the licensing process in the 1990s; Xcel’s proposal to remove areas from the project area that were impacted by the accumulation of sediment over the past 60 years (1962 to current); and Xcel’s acceptance of provisions in the 1990s relicensing intended to mitigate excessive aquatic plant growth, likely caused by increased sedimentation.

In reviewing documents regarding the relicensing of the Trego dam in the 1990s, FERC draws different conclusions to the data. A February 27, 1992 FERC Environmental Assessment states:

*“Since the project’s construction in 1927, considerable (emphasis added) sediment deposition has occurred, creating wetlands in inlets of the Trego impoundment, particularly the upstream end where the Namekagon River enters. In this area, 3 to 8*

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<sup>1</sup> <https://drive.google.com/file/d/1RRwJ02Wx3S0YnmseAQdqQ-nAACbRmDdQ/view>

*feet of sediment has been deposited (an estimated 145,000 cubic yards). Estimates show that 2000 cubic yards of sediment per year continue to settle in the upper reaches of the impoundment (WDNR, 1989). As a result of the shallow conditions, aquatic plants invade such areas, especially in the 15-acre Namekagon River inlet area.”<sup>2</sup>*

The FERC Environmental Assessment cited highlights the significant impact of the estimated sediment rate, not just the amount of deposit. Additionally, the 1992 Environmental Assessment goes on to recommend developing a management plan to assess an option to address sedimentation and plant growth (a rejected drawdown plan, then supported by TLD). It recommends that “the issue be reevaluated on a recurring basis every four years because of the high value of project impoundment for recreational activity as part of a National Wild and Scenic River.” This points out the complex and confusing roles sedimentation plays in Trego Lake and the need for sufficient data, critical analysis, and action plans on mitigating its impact.

To illustrate the issue for Trego Lake using the data provided in the 1988 COE study, it would be as if 14,500<sup>3</sup> dump trucks dropped sediment into the lake west of the Highway 53 bridge and east of the mouth of Potato Creek over the 61-year period. While this may be a “minimal” amount as identified in the consultant’s document, it is a significant amount to Trego Lake and the members of TLD located in that area. A 1962 Wisconsin Department of Natural Resources (WDNR) contour map<sup>4</sup> shows the area measuring roughly 3 feet in depth. The addition of 6 feet of sediment over the next 60 years – the time from COE 1988 study plus the shortest of licensing timeframes (30 year) – would overwhelm this area and/or push sediment further into Trego Lake. Trego Lake has already gone 32 years without significant study on the impact of sedimentation and an additional 30 plus years without study would be contrary to Xcel’s legal obligations to address recreation and subsequent environmental impacts on the project area.

Further, Xcel Energy wants to reduce the footprint of the project at this very point in the lake. Their reasoning is that it is “not impounded at the maximum operating elevation of 1,035.2 feet.” If you compare back to the 1962 WDNR contour map, this area has filled in from sediment and now Xcel Energy wants to exclude the area, and issue, from the project area. This action seems highly suspect. In addition to questioning the boundary reduction, TLD supports the WDNR’s current request for study: “Sediment accumulation should be assessed and measured downstream of Hwy 53 through the project area that is being proposed for removal. Assessments of sediment deposits and sediment depth measurements can be collected along multiple transects, including the bay areas, north and west of Leisch Road.” Plus, TLD supports sedimentation study east of the Highway 53 bridge to the boundary of the current project area.

Finally, the FERC Order Modifying and Approving Drawdown Needs Analysis issued October 31, 1995 states:

*Sedimentation and macrophyte growth make the upper one-third of the lake difficult to access for recreational purposes in the spring and summer months. The licensee recommends a localized macrophyte management plan which involved harvesting,*

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<sup>2</sup> <https://tregolakedistrict.com/wp-content/uploads/2021/03/Environmental-Assessment-for-Dam-License-Februar-27-1992.pdf>

<sup>3</sup> <https://www.google.com/search?client=safari&rls=en&q=how+many+cubic+yards+of+sand+in+one+dump+truck&ie=UTF-8&oe=UTF-8>

<sup>4</sup> <https://dnr.wi.gov/lakes/maps/DNR/2712000a.pdf>

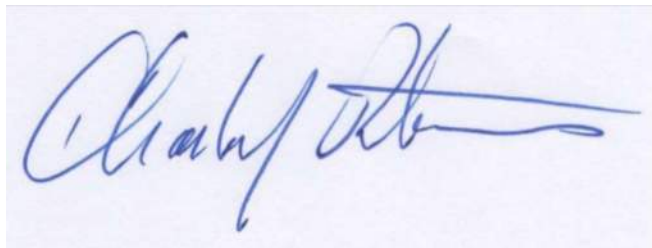
*chemical control, hand raking, or a combination of these options to clear paths to enable boats to reach open water and to clear areas in front of residences for swimming and wading purposes.*<sup>5</sup>

The language in this Order and subsequent “Vegetation Management Plan”<sup>6</sup> provided a basis for Xcel Energy and TLD to work together to address the impact of sedimentation on excessive aquatic plant growth in the lake. The plant growth is a result of shallow waters caused by sedimentation buildup in Trego Lake. With this language and action, Xcel Energy has recognized that sedimentation has an impact on Trego Lake.

TLD has been working since its inception in 1989<sup>7</sup> “to support and encourage the preservation of the natural beauty, peacefulness, safety, and recreational value of the shoreline and waters of Trego Lake, and to coordinate with the various public and private organizations involved in these efforts”<sup>8</sup> and has assumed the responsibility for TLD members to have full access to the lake as noted in the FERC order.

We urge you to include the sedimentation studies as part of the relicensing process for Xcel.

The TLD appreciates the opportunity to provide comments here and for all detailed study plans regarding Hayward and Trego Hydroelectric Project relicensing. We look forward to working with the licensee, stakeholders, and FERC on the licensing process for these projects. Should you have any questions regarding these comments, please contact me at 612-803-8765 or [cjpetersen@msn.com](mailto:cjpetersen@msn.com)



For the Board. . .  
Charlie Petersen  
Trego Lake District Board Chair

Cc: FERC

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<sup>5</sup><https://drive.google.com/file/d/1RRwJ02Wx3S0YnmseAQdqO-nAACbRmDdQ/view>

<sup>6</sup> [https://drive.google.com/file/d/1WI4\\_hkXZ8SFnRV3wj9oGgITnLXpNrezm/view](https://drive.google.com/file/d/1WI4_hkXZ8SFnRV3wj9oGgITnLXpNrezm/view)

<sup>7</sup> <https://drive.google.com/file/d/1i-E9Gj-Q5bteZPh1WpFcpAjuBiF2Jupt/view>

<sup>8</sup> Trego Lake District mission statement



# United States Department of the Interior

NATIONAL PARK SERVICE  
St. Croix National Scenic Riverway  
401 North Hamilton Street  
Saint Croix Falls, WI 54024

In Reply, Refer To:  
I.A.I. (SACN)

August 31, 2021

Darrin Johnson  
[Darrin.Johnson@meadhunt.com](mailto:Darrin.Johnson@meadhunt.com)  
FERC Compliance and Licensing, Water  
Mead & Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: Summary of Study Comments and Responses for Hayward (p-2417) and Trego (p-2711)

Dear Mr. Johnson,

The National Park Service (NPS) appreciates the opportunity to provide comments on the *Summary of Study Comments and Responses* prepared by Mead & Hunt for Xcel Energy for the Hayward and Trego hydroelectric projects on the Namekagon River, within the St. Croix National Scenic Riverway administered by the NPS. We received this proposed study summary by email dated August 2, 2021. We understand that you will address any comments received within 30 days prior to the submission to FERC.

The NPS requests to be included as an interested stakeholder and have an opportunity to review and comment on all detailed study plans. We understand that individual detailed study plans will be sent out for review and comment at some time in 2021 as part of the Stage 1 Consultation Process. More details on this schedule will help the NPS respond to these consultation opportunities.

Based on the Summary, of the three studies requested by the NPS, the licensee proposes:

- O. Recreation Study – including all four components recommended by the NPS;
- P. Sedimentation, Hydraulics, and Channel Change Study at Trego – integrate some components of this request into the Aquatic and Terrestrial Invasives Study (ATIS) and the Cultural/Historic Resources Study; and
- Q. Shoreline Survey - integrate some components of this request into the Aquatic and Terrestrial Invasives Study (ATIS), the Cultural/Historic Resources Study, and the Recreation Study.

The NPS offers the following comments on our requested studies and the plan to integrate some components into other studies.

## **O. Recreation Study**

### **1) Comments on NSPW response**

- a) We are encouraged by NSPW's plans to conduct the four-part comprehensive recreation study as proposed by NPS. We encourage NSPW to use the detailed methodology described and recreation survey template provided in our study request and look forward to reviewing NSPW's draft detailed recreation study plan later this year.

### **2) We have the following suggested edits:**

- a) Table of Contents "O. Recreation Study" should state NPS rather than WDNR
- b) "O. Recreation Study":
  - i) the section header should state NPS rather than WDNR
  - ii) under "NPS Comments(s)" remove the first paragraph since it constitutes WDNR's study request rather than the NPS study request
  - iii) under "NSPW Response," correct in the first paragraph the third component (3) to "a recreation use and demand assessment" per our study request, replacing "a recreation use and demand analysis"
  - iv) under the listing of recreation sites and facilities correct the first bullet under Trego Project sites to state "Town of Trego Park Landing" rather than "Town of Trego Park"

## **P. Sedimentation, Hydraulics and Channel Change Study at Trego Dam**

### **1) Comments on NSPW response**

- a) NSPW references the Corps of Engineers Study cited in current license documents. The study concluded that the sediment load and deposition is low compared to other Wisconsin rivers.
  - i) NPS agrees that the amount of sediment supplied by the upstream watershed may be small relative to other Wisconsin river systems, but it is well documented in the Trego licensing record that sedimentation and vegetation growth in the upper reaches of Trego Flowage are a continuing problem. These issues have been addressed in the current license and we expect that protection, mitigation, and enhancement measures will be included in the subsequent license.
- b) NSPW asserts that sediment is not caused by project operations, and thus is not proposing to conduct a sediment study.
  - i) The NPS considers that the Trego dam is a key component of the project and associated operations. The NPS requested this study to evaluate the extent that the existence of the Trego Dam is responsible for sediment deposition at the upper reaches of the Trego Flowage. The Trego Flowage is not a natural lake - it is a man-made reservoir. Thus, although production and transport of sediment from the

upstream watershed are natural processes, the sedimentation occurring in the Trego flowage is associated with the ongoing impact of the project dam. The May 1989 WDNR Evaluation Report cited in our study requests notes that between three and eight feet of sediment accumulated in the upper most 15 acre inlet area between 1927 and 1988, though it is not specific about where this area is located.

- c) NSPW notes that updated vegetation and bathymetric maps of the reservoir will be developed as part of the ATIS study.
    - i) The point measurements described as part of the ATIS study will not be adequate to evaluate changes in bathymetry resulting from continued sedimentation in the project area. The NPS suggests that a bathymetric survey of sufficient density and data quality be conducted to develop an accurate updated bathymetric map of the reservoir.
  - d) NSPW is not including the NPS proposed hydraulic modeling because it asserts that hydraulic effects are driven primarily by the volume of inflow, not the operation of the Project.
    - i) Again, the NPS requested the study to understand the extent that the hydraulic effects are associated with backwater effects of the Trego Dam and that this information is needed to understand sediment deposition and upstream flood risk. This information is critical for understanding whether the proposed boundary change is appropriate, given the importance of this area for recreation access and its influence on sedimentation and plant growth further downstream.
  - e) The Study summary does not address the following components of the NPS study request: Channel and shoreline change analysis; Bathymetric survey and analysis comparison to previous surveys; Synthesis – proposed boundary change issues associated with flood risk to existing infrastructure and public access areas.
    - i) Although the licensee plans to provide some updated bathymetric data as part of the ATIS study, the NPS suggests that the detailed study plan should include analysis of change from previous surveys. The NPS assumes that issues related to sediment deposition, aquatic plant growth, and recreation access (including flooding) will be addressed as part of the ATIS and Recreation studies, and lead to protection, mitigation, and enhancement measures in the subsequent license.
- 2) NPS recommendations
- a) Please reconsider the need for a more detailed sediment, hydraulic and channel change study. The NPS study request would update the analysis by the Corps of Engineers used as the basis for understanding sediment dynamics in the current license. It would also clarify the role of the Trego Dam and associated operations in sediment, aquatic vegetation, flooding, and recreation; help identify approaches for addressing ongoing impacts; and inform response to the proposed boundary change.
  - b) Any mapping (e.g., shoreline condition, vegetation, substrate) should be completed using geospatial platforms to facilitate analysis of change over time. Techniques proposed in the NPS shoreline study should be considered.

## Q. Shoreline Survey

### 1) Comments on NSPW response

- a) NSPW plans to monitor the Project shoreline for erosion and identify failing shoreline stabilization measures as part of the Cultural Resources Study. NSPW will not collect information about docks within the Project boundary because it relies on WDNR to regulate docks on the project shoreline. NSPW will provide information about public access locations as part of the recreation study. NSPW will provide information about aquatic vegetation, including Wild Rice, as part of the ATIS study.
  - i) The NPS looks forward to receiving the detailed study plan and encourages the use of the NPS recommended study methodology to create a georeferenced photographic database and map of shoreline conditions. This approach would provide additional baseline information on the type and condition of shoreline stabilization measures, and not merely an indication of whether it is failing. It would also facilitate identification of areas in need of management attention and other objectives identified in the NPS shoreline study request. It would provide the basis for making recommendations for protecting and enhancing the project shorelines.
- b) NSPW rejected the NPS study request to document changes in shoreline conditions on lands owned by the licensee because it asserts that the NPS does not have authority over these projects and the licensee is not required to consult with NPS on construction projects conducted under Part 12 of the Federal Power Act.
  - i) The NPS does have authority over water resources construction projects to assure that construction does not have adverse impacts on the Namekagon. Although the FERC is the lead Federal agency with oversight for dam safety construction, no department or agency of the United States is authorized to assist in the construction of any water resources project on or directly affecting a component of the national wild and scenic rivers system that has a direct and adverse effect on the values for which it was designated, as determined by the Secretary charged with its administration, under Section 7 of the Wild and Scenic Rivers Act (16 U.S.C. §§1271 et seq.). The NPS administers the Namekagon River as part of the St. Croix National Scenic Riverway, a National Wild and Scenic River. Thus prior to Federal agency approval of construction activities (e.g., FERC, U.S. Army Corps of Engineers), NPS review is necessary.
  - ii) Although, the licensee does not have an explicit requirement to consult with the NPS under Part 12 of the Federal Power Act and the FERC has administrative and supervisory responsibilities over dam safety modifications, the licensee is responsible for using sound and prudent engineering practices in any actions relating to the design, construction, operation, maintenance, use, repair, or modification of a water power project or project works. By requesting this study, the NPS seeks to document baseline conditions and improve its coordination with the licensee to ensure that dam safety construction is consistent with river values over the term of the next license. Early coordination can help ensure that projects are designed to protect river values (such as scenic and recreational resources) and meet the standards of the Wild and Scenic Rivers Act.

In addition, the NPS offers the following comments on other proposed studies:

**C. Assessment of Minimum Flow and Resource Impacts Downstream of the Tailwater – WDNR**

- The NPS supports the WDNR proposed assessment. It is appropriate to evaluate whether habitat improvements made under Article 406 of the current Hayward license will continue to achieve desired results under a subsequent license.

**F. Cultural /Historical Resources Study – NSPW**

- Any mapping (e.g., shoreline condition, vegetation, substrate) should be completed using geospatial platforms to facilitate analysis of change over time. Techniques proposed in the NPS shoreline study should be considered.

**I. Aquatic and Terrestrial Invasive Species (ATIS) Study – WDNR**

- The shoreline boat survey could also be used to identify shoreline stabilization and condition.
- The NPS supports the inclusion of Wild Rice in this study, as described in the NSPW response on the Rare and Endangered Species Study.

Thank you for your consideration of these additional comments as you continue to develop and refine your study plan. The NPS looks forward to the opportunity to continue to collaborate on the continued operation of the Hayward and Trego projects. If you have any questions about our response, please contact Susan Rosebrough at [susan\\_rosebrough@nps.gov](mailto:susan_rosebrough@nps.gov) or (206) 220-4121.

Sincerely,

JULIET

GALONSKA

Digitally signed by  
JULIET GALONSKA  
Date: 2021.08.31  
08:27:56 -05'00'

Juliet L. Galonska  
Superintendent

Document Content(s)

FinalNPSProposed Study SummaryTregoHayward.pdf .....1

## Recreation Study Plan Consultation

## Darrin Johnson

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**From:** Shawn Puzen  
**Sent:** Friday, November 5, 2021 8:07 AM  
**To:** angietornes@gmail.com; cheryl.laatsch@wisconsin.gov  
**Cc:** Darrin Johnson; Miller, Matthew J; Crotty, Scott A; Maurer, Brey J; Shawn Puzen  
**Subject:** Draft Hayward-Trego Recreation Study Plan for your Review  
**Attachments:** 20211104 Draft Hayward-Trego Recreation Use Study Plan Complete.pdf

Good Morning,

Attached for your review is the proposed Recreation Study Plan.

We are sending this study plan for your review right now because it requires the surveys to begin in January of 2022. Therefore, we need to move this plan through the review ahead of the other plans.

Please provide your comments as soon as possible, but no later than December 5, 2021.

Please do not hesitate to contact me if you have any questions.

Thanks,

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### SHAWN PUZEN

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt  
Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
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**Hayward and Trego  
Hydroelectric Projects  
FERC Nos. 2417 and 2711**

**Draft Study Plan**

**Recreation Study**

**Prepared for**



**Prepared by**



**November 2021**

## 1. Introduction

Northern States Power Company – Wisconsin (NSPW or Licensee), d/b/a Xcel Energy, currently holds licenses issued by the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the Hayward and Trego Hydroelectric Projects (Projects). The Projects are owned, operated, and maintained by the Licensee. The current licenses, which designate the Projects as FERC Nos. 2417 (Hayward) and 2711 (Trego), expire on November 30, 2025. To obtain subsequent licenses, the Licensee must submit final license applications to FERC no later than November 30, 2023. The final license applications, in part, must include an evaluation of the existing recreational facilities associated with each Project along with proposed recreation enhancements.

On March 11, 2021, the Licensee held a Joint Agency Meeting to present information about the Projects. At the meeting, and during the 60-day comment period immediately following, the Licensee received comments and study requests from several entities. The National Park Service (NPS) and Wisconsin Department of Natural Resources (WDNR) requested a study of recreation facilities and an investigation of recreation enhancements as part of the relicensing process.

NPS requested that the Licensee conduct an inventory of recreation opportunities and facilities including determining recreation demand using field observations, user surveys, and focus groups and estimating recreation needs based on the data gathered.

WDNR requested that the Licensee evaluate current recreational uses, including opportunities for low flow and high flow events, public access, natural scenic beauty, trails, water sports, and fishing, with consideration for the different seasonal uses.

This study plan is consistent with the NPS and WDNR requests.

## 2. Study Plan Elements

### 2.1 Study Goals and Objectives

The objective of this study is to provide a subjective assessment of existing recreation facility conditions as well as recommended enhancements. The study will also determine the capacity of existing facilities to help assess current and future user demand, produce sufficient information to evaluate such impacts, and provide the rationale for recommended recreation enhancements.

### 2.2 Background and Existing Information

Recreation in the vicinity of the Projects is dominated by activity near the Projects' facilities. The existing recreational facilities within the Projects will be evaluated for recreational use and improvements.

The last recreation studies for the Projects were completed in 2020 and filed with FERC on February 24, 2021. The Hayward report indicated that "...the Lake Hayward area offers a sufficient amount of recreational opportunities for both land and water-based activities. The recreational facilities, while limited in number, are in good condition and receive regular maintenance and upgrades when required.

The number and size/capacity of the facilities appear sufficient to accommodate the current amount of use on all but the busiest of days” (NSPW, 2021).

The Trego report indicated that “...the Trego Flowage area offers reasonable opportunities for both water and land-based recreational activities, including opportunities for overnight recreation (i.e., camping, night fishing, etc.). Although the number of recreational facilities is limited, most are in good condition and receive routine maintenance. The number and capacity of the facilities appear sufficient to accommodate current recreational use on all but the busiest days, despite the apparent observed increase in recreational activity related to COVID-19.”

In March 2019, the State of Wisconsin published its Statewide Comprehensive Outdoor Recreation Plan (SCORP) for 2019-2023. The SCORP did not identify any specific recreation needs in the immediate vicinity of the Projects.

The SCORP places an emphasis on nature-based recreational opportunities including hiking, fishing, and boating. For both Projects, the Licensee currently provides a carry-in access on the reservoir, a tailrace fishing area downstream of the powerhouse, and a canoe portage that helps fulfill recreation needs. These recreational opportunities are consistent with the SCORP.

## 2.3 Nexus between Project Operations and Effects on Resources

Hydro operations, including fluctuations in reservoir elevation, and insufficient public access can limit recreational opportunities. Adequate information is necessary to determine what impacts may be occurring from hydro operations as well as which recreational opportunities may be enhanced.

## 2.4 Study Area

Since it is believed no additional recreation sites are necessary, the inventory and recreational use study will incorporate the recreation sites listed below in Table 2.4-1.

**Table 2.4-1. Recreation Sites to be Inventoried and Surveyed for Existing Use**

Hayward Canoe Portage Take-Out and Carry-In Reservoir Access
Hayward Canoe Portage Trail and Put-In
Hayward Informal Tailwater Bank Fishing Area
Hayward City Boat Landing
Hayward City Beach & Barrier-Free Fishing Pier
Hayward Bartz’s Bay Informal Ice Fishing Access <sup>1</sup>
Town of Trego Park Boat Landing
Town of Trego Boat Landing
Trego North Tailwater Access (Canoe Portage)
Trego South Tailwater Access

<sup>1</sup> Bartz’s Bay Informal Ice Fishing Access will only be surveyed during the January and February survey periods.

## 2.5 Methodology<sup>2</sup>

### 2.5.1 Recreation Inventory

Each of the recreation sites listed in Table 2.4-1 will be inventoried during the summer using the forms attached as Appendix 1 to collect information on recreation amenities and capacity. The following types of information will be recorded:

- 1) The primary type(s) of recreation provided at the site.
- 2) Existing sanitation facilities (if any).
- 3) Type of vehicle access and parking capacity (if any).
- 4) The presence and type (if any) of barrier-free facilities.
- 5) The GPS location of the facility.
- 6) Photographs of the recreation site, amenities, signage, and entryways to the site from the main road(s), including photographs of any adverse impacts the site may have on environmental resources including shoreline erosion.

### 2.5.2 Facility Condition Assessment

During at least one visit to each of the recreation sites listed in Table 2.4-1, the condition of each amenity or feature (including recreational wayfinding signs and interpretive signs) and its immediate vicinity will be assessed. A rating for each site will be made according to the following scale:

- 1) Not Usable and Needs Replacement
- 2) Needs Repair
- 3) Needs Maintenance or cleaning
- 4) Good Working Condition (does not need any attention)
- 5) Facility Lacking; need to install facility or otherwise add enhancement (identify item).

If a rating is assigned indicating that additional attention is required, the specific item that needs additional attention will be noted on the form.

### 2.5.3 Recreation Use Survey

Recreation use surveys will be conducted during visits to each of the recreation sites listed in Table 2.4-1. The surveys will last at least one hour per site between the hours of 7:00 a.m. and 7:00 p.m. Surveying will be completed on a rotating schedule to avoid surveys from repeatedly being conducted at the same time of day and will also account for time-of-day use patterns. The recreation use survey form included in Appendix 2 will be administered to users to gather their opinion about the existing recreation facilities and opportunities. The survey will record the number of people in a party, their primary reason for visiting the site, their perception of level of use, and their opinions regarding the amount and types of recreation opportunities offered within

<sup>2</sup> Please note: The methodology does not include regional demand assessment or recreation needs assessment. These analyses will be completed as part of the License Application.

the proposed Project vicinity. The recreation use surveys will be conducted according to the following schedule in Table 2.5.3-1

**Table 2.5.3-1. Recreation Use Survey Schedule**

<b>Survey Month</b>	<b>Recurrence Interval</b>
January	One randomly selected weekend day.
February	One randomly selected weekend day.
April	One randomly selected weekend day.
May	One randomly selected weekend day. One day during Memorial Day weekend.
June	One randomly selected weekday. Two randomly selected weekend day.
July	One randomly selected weekday. Two randomly selected weekend day.
August	One randomly selected weekday. Two randomly selected weekend day.
September	One weekend day the weekend following Labor Day weekend.

#### **2.5.4 Spot Counts**

When first arriving at each recreation site where recreation use surveys will be collected, a spot count will be conducted using the recreation use spot count form enclosed in Appendix 3. This information will be statistically analyzed to develop recreational use figures for the Projects. This information will be summarized by season and activity for each type of use in the study report.

#### **2.5.5 Future and Potential Recreation**

To assess future recreation needs within the Project vicinity, the questionnaire enclosed in Appendix 4 will be sent to municipalities and other entities responsible for existing recreation within the Project vicinity. Specifically, the questionnaire will be sent to the City of Hayward, Hayward Area Chamber of Commerce, and Sawyer County for the Hayward Project and the Town of Trego, Trego Lake District, and Washburn County for the Trego Project.

Each entity will be allowed 30 days to respond to the questionnaire and their responses will be incorporated into the license application<sup>3</sup>.

## **2.6 Consistency with Generally Accepted Scientific Practice**

The overall design of the recreational survey is similar to that commonly used in relicensing proceedings and is consistent with generally accepted methods for recreation studies.

<sup>3</sup> Even though the original study summary indicated a report would be developed, NSPW has found the most-efficient way to display the data is in the license application because it can provide the full picture of proposed recreational mitigation and enhancement measures in context with all other proposed mitigation and enhancement measures included in the license application. Therefore, no study report will be developed for the recreation study.

## 2.7 Project Schedule and Deliverables

NSPW anticipates that field work will begin in January 2022 (for winter surveys) and be completed by mid-September. The study results will be incorporated into the license application along with additional recreational mitigation and enhancement recommendations (if any).

## 3. Consultation

The Recreation study was requested by the NPS and WDNR. As a result, the Licensee consulted with the NPS and WDNR on the study plan as discussed in the following sections.

### 3.1 National Park Service

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Recreation Study Plan to the NPS for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED.** Documentation of Consultation is included in Appendix 5.

### 3.2 Wisconsin Department of Natural Resources

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Recreation Study Plan to the WDNR for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED.** Documentation of Consultation is included in Appendix 5.

## 4. References

- EA Engineering. 2021a. Recreation Report for the Hayward Hydroelectric Project (FERC Project No. 2417). February 2021.
- EA Engineering. 2021b. Recreation Report for the Trego Hydroelectric Project (FERC Project No. 2417). February 2021.

## **Appendix 1 – Recreation Site Inventory Form**

Recreation Inventory and Condition Assessment											
Location:								Date:			
Hayward Hydroelectric Project P-2417											
Survey Person:											
GPS Location:											
Amenity Photo Numbers:											
Shoreline Photo Numbers:											
Entryway Photo Number:											
Type of Amenity:		Quantity of Amenities:		Condition of Amenity:				Notes:		Barrier Free? (Y or N)	
				-Not Usable (N)							
				-Needs Repair (R)							
				-Needs Maintenance (M)							
				-Good Working Condition (G)							
Boat Launch		Lanes: 1      Launches: 1		N   R   M   G							
Scenic Overlook				N   R   M   G							
Tailwater Access				N   R   M   G							
Restroom				N   R   M   G							
Trash Receptacles				N   R   M   G						NA	
Other (picnic units, informal trails, camping, etc.)				N   R   M   G							
Parking		No. Spaces (each type):				Condition:		Notes:			
		Standard:	Barrier-Free:	Trailer:	Other (specify):						
										N   R   M   G      Gravel?	
Signage:	Number:	Condition:		Comments: Provide Details on which signs need attention.							
FERC Project Sign		N   R   M   G									
Regulations Signs		N   R   M   G									
Directional		N   R   M   G									
Interpretive		N   R   M   G									
Additional Comments:											
Describe any signs of overuse or anything observed that is not already documented above.											

Recreation Inventory and Condition Assessment											
Location:								Date:			
Trego Hydroelectric Project P-2711											
Survey Person:											
GPS Location:											
Amenity Photo Numbers:											
Shoreline Photo Numbers:											
Entryway Photo Number:											
<b>Type of Amenity:</b>				<b>Quantity of Amenities:</b>		<b>Condition of Amenity:</b>		<b>Notes:</b>		<b>Barrier Free?</b> (Y or N)	
						-Not Usable (N)					
						-Needs Repair (R)					
						-Needs Maintenance (M)					
				-Good Working Condition (G)							
Boat Launch				Lanes: 1      Launches: 1		N   R   M   G					
Scenic Overlook						N   R   M   G					
Tailwater Access						N   R   M   G					
Restroom						N   R   M   G					
Trash Receptacles						N   R   M   G				NA	
Other (picnic units, informal trails, camping, etc.)						N   R   M   G					
<b>Parking</b>				<b>No. Spaces (each type):</b>				<b>Condition:</b>		<b>Notes:</b>	
				Standard:		Barrier-Free:					
<b>Signage:</b>		<b>Number:</b>		<b>Condition:</b>		<b>Comments: Provide Details on which signs need attention.</b>					
FERC Project Sign				N   R   M   G							
Regulations Signs				N   R   M   G							
Directional				N   R   M   G							
Interpretive				N   R   M   G							
<b>Additional Comments:</b> Describe any signs of overuse or anything observed that is not already documented above.											

## **Appendix 2 – Recreation Use Survey Form**

## ON-SITE/IN-PERSON RECREATION INTERVIEW

### Hayward & Trego Hydroelectric Projects (FERC Nos. 2417 and 2711)

#### NPS Recreation Survey Questionnaire

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is in the process of applying for subsequent licenses from the Federal Energy Regulatory Commission (FERC) to continue to operate and maintain the existing Hayward and Trego Hydroelectric Projects (Project or Projects). The Projects are owned, operated, and maintained by NSPW. To obtain a license for the Projects, NSPW must submit a final license application to FERC no later than November 30, 2023. As part of the relicensing process, NSPW is conducting several environmental studies which will enable FERC to prepare an environmental report. The purpose of this survey is to collect information about recreational use and visitors' experiences at public recreation facilities around the Hayward and Trego Project reservoirs.

What is the ZIP code where you live or country if not in the United States?

ZIP code: \_\_\_\_\_ or, country (if not the United States): \_\_\_\_\_

What is your age: \_\_\_\_\_

What is your gender? ☐ Male ☐ Female ☐ Non-binary

Which of these categories best indicates your race and ethnicity? Answer only for yourself.

Please select one or more.

- |  |   |                                     |
|--|---|-------------------------------------|
| <input type="checkbox"/> American Indian/Alaskan       | <input type="checkbox"/> Asian                  | <input type="checkbox"/> White      |
| <input type="checkbox"/> Native Hawaiian/other Pacific | <input type="checkbox"/> Hispanic or Latino     | <input type="checkbox"/> Don't know |
| <input type="checkbox"/> Black/African-American        | <input type="checkbox"/> Not Hispanic or Latino |                                     |

Please let us know if you have any additional comments regarding your recreation experience during your visit: (contact information)

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1. Check the box on the location where you received this survey:

Hayward Project:

- ☐ Hayward Canoe Portage Take-out and Carry-In Access
- ☐ Hayward Canoe Portage Trail and Put-in
- ☐ Informal Tailwater Bank Fishing Access
- ☐ City of Hayward Boat Landing
- ☐ City of Hayward Beach/Fishing Pier
- ☐ Bartz's Bay Informal Ice Fishing Access

Trego Project:

- ☐ Town of Trego Park Boat Landing
- ☐ Town of Trego Boat Landing
- ☐ Trego North Tailwater Access/Canoe Portage
- ☐ Trego South Tailwater Access

2. Below is a list of activities available. Please indicate:

(A) Which of these activities have you participated in **on your current visit** to the area.

(B) Which **ONE** of these activities is your **PRIMARY ACTIVITY** on this trip to the area?

ACTIVITY	(A) Participated in <b>ON THIS TRIP</b> (Check <u>all</u> that apply)	(B) PRIMARY ACTIVITY (Check <u>only one</u> )
Shoreline/tailwater fishing		
Fishing from a boat		
Motorized boating		
Non-motorized boating		
Swimming		
Picnicking		
Wildlife Viewing		
Other (specify)		

3. (A): Were there any activities that you and your group wanted to do on this visit to (AREA) that you were not able to?

☐ YES ☐ NO

(B): If YES: What was it? \_\_\_\_\_

(C): Which of the following reasons, if any, explain why you did not engage in the activity?

- ☐ Rules or regulations did not allow for activity  
☐ Area was temporarily closed to the public  
☐ Not enough time  
☐ Safety concerns  
☐ Not enough information about the activity  
☐ Too crowded  
☐ Difficult road or trail access  
☐ No road or trail access  
☐ Unsatisfactory conditions of facilities  
☐ Resource damage due to overuse  
☐ No facilities or services  
☐ Bad weather  
☐ Flooding or other natural hazard  
☐ Other (please specify) \_\_\_\_\_

4. Does anyone in your personal group have a physical condition or personal limitation that made it difficult to access or participate in [site] activities or services?

☐ YES ☐ NO

If YES, on this visit what activities or services did the person(s) have difficulty accessing or participating in?

(Please describe): \_\_\_\_\_

5. (A) How crowded did you feel while recreating at these locations today at this recreation facility/reservoir?

[Select one number for each or indicate it was not applicable to your visit.]

LOCATION / AREA	Not at all crowded	Slightly crowded	Moderately crowded	Very crowded	Extremely crowded	Not applicable
In parking areas	1	2	3	4	5	<input type="checkbox"/>
On the trails	1	2	3	4	5	<input type="checkbox"/>
At a developed campground	1	2	3	4	5	<input type="checkbox"/>
At a boat-in campsite	1	2	3	4	5	<input type="checkbox"/>
While fishing from the shoreline	1	2	3	4	5	<input type="checkbox"/>
While boating/fishing from a boat	1	2	3	4	5	<input type="checkbox"/>

(B) If you felt crowded, did you modify your recreation plans because you felt crowded?

☐ YES ☐ NO

(C) If YES, what did you do?

- |  |   |
|--|---|
| <input type="checkbox"/> Moved to a new location | <input type="checkbox"/> Chose not to recreate        |
| <input type="checkbox"/> Changed the time of day | <input type="checkbox"/> Continued with current plans |
| <input type="checkbox"/> Changed your activity   | <input type="checkbox"/> Other: _____                 |

6. During the planning process for your visit, how did the possibility of crowds affect your trip plans?

(Please select one response)

- ☐ It did not affect my plans
- ☐ I visited at a time of day I thought would be less crowded
- ☐ I visited on a day of the week I thought would be less crowded
- ☐ I avoided places here I thought would be crowded today
- ☐ Other (please specify) \_\_\_\_\_

7. Did the actions or behavior of any other group or individual interfere with your enjoyment on this trip?

☐ YES ☐ NO

If yes, what type of group or person interfered with your enjoyment on this trip?

Group/Person	Reason(s)		
	Proximity	Loudness	Other (please specify)
Motorized boaters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Non-motorized watercraft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Vehicles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____

8. How satisfied were you with the following amenities at this recreation facility/reservoir today.

**Important:** Please only circle a number for the items **that you used during your current visit** to this specific recreation facility/reservoir. Also, please **check** the “Did Not Use” box, if you did not use the item or it does not exist at the specific recreation facility.

	Very Satisfied	Satisfied	Neither	Dissatisfied	Very Dissatisfied	Did Not Use	If you were dissatisfied for any reason, please explain why:
Restroom	1	2	3	4	5	<input type="checkbox"/>	
Picnic sites	1	2	3	4	5	<input type="checkbox"/>	
Trash receptacles	1	2	3	4	5	<input type="checkbox"/>	
Vehicle parking areas	1	2	3	4	5	<input type="checkbox"/>	
Boat launch parking area	1	2	3	4	5	<input type="checkbox"/>	
Boat launch	1	2	3	4	5	<input type="checkbox"/>	
Boat dock	1	2	3	4	5	<input type="checkbox"/>	
Other:	1	2	3	4	5	<input type="checkbox"/>	
Roads to facility	1	2	3	4	5	<input type="checkbox"/>	
Signage to the facility	1	2	3	4	5	<input type="checkbox"/>	
Signage within the facility	1	2	3	4	5	<input type="checkbox"/>	
Other:	1	2	3	4	5	<input type="checkbox"/>	

9. How did you obtain information to plan your current trip? (Please select all that apply)

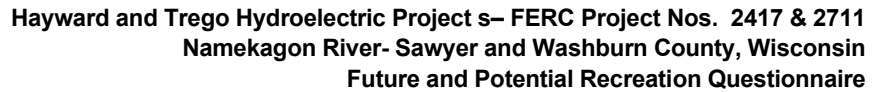
- |  |   |
|--|---|
| <input type="checkbox"/> Federal or State website          | <input type="checkbox"/> Word of mouth                                |
| <input type="checkbox"/> City, local, or municipal website | <input type="checkbox"/> Social media (e.g., Facebook, Twitter, etc.) |
| <input type="checkbox"/> Xcel website                      | <input type="checkbox"/> Travel guides and tour books                 |
| <input type="checkbox"/> Other websites                    | <input type="checkbox"/> Newspaper/magazine article                   |
| <input type="checkbox"/> Maps, brochures, pamphlets        | <input type="checkbox"/> Radio/TV broadcasts                          |
| <input type="checkbox"/> Visitor bureaus/centers           | <input type="checkbox"/> Other (specify): _____                       |
| <input type="checkbox"/> Previous visits                   |   |

## **Appendix 3 – Recreation Use Spot Count Form**

Recreation Observation (Spot Count) Form														
Date:								Time:						
Hayward Project P-2417														
Survey Person:								Note: Please list primary activity by placing a "P" in the box. Use and "S" for secondary activities.						
Temperature:				Weather:				Wind Speed:						
Recreation Site		Number of People	Recreation Activities											Notes
			ATV/Snowmobile	Shoreline Fishing	Boat Fishing	Swimming	Hiking/Walking/Jogging	Bicycling	Picnicking	Bird Watching	Wildlife Viewing	Non-Powered Boating	Power Boating	
Canoe Portage Take-Out & Carry-In Reservoir Access														
Canoe Portage Trail and Put-In														
Informal Tailwater Bank Fishing Area														
Hayward City Boat Landing														
Hayward City Beach/Barrier-Free Fishing Pier														
Bartz's Bay Informal Ice Fishing Access (Jan & Feb only)														
Additional Comments:														

Recreation Observation (Spot Count) Form																	
Date:											Time:						
Trego Project P-2711																	
Survey Person:													Note: Please list primary activity by placing a "P" in the box. Use and "S" for secondary activities.				
Temperature:		Weather:					Wind Speed:										
Recreation Site	Number of People	Recreation Activities														Notes	
		ATV/Snowmobiling	Shore Fishing	Boat Fishing	Swimming	Hiking/Walking / Jogging	Bicycling	Picnicking	Bird Watching	Wildlife Viewing	Non-Powered Boating	Power Boating	Other (specify)				
Town of Trego Park Boat Landing																	
Town of Trego Boat Landing																	
Trego North Tailwater Access (Canoe Portage)																	
Trego South Tailwater Access																	
Additional Comments:																	

## **Appendix 4 – Future and Potential Recreation Questionnaire**





- b. Please list all recreation amenities available at each recreation site or access site you manage (e.g. docks, restrooms, parking areas, interpretive signage, picnic tables, trails, etc.) below:  
(Additional information may be provided on the final sheet of this questionnaire.)

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- c. Please provide the location of each site listed above using a map, street address, or GPS location:  
(Additional information may be provided on the final sheet of this questionnaire.)

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- d. Have any of the sites or amenities listed in 2a and 2b exceeded capacity or not had sufficient parking? (Additional information may be provided on the final sheet of this questionnaire.)

☐ Yes (Please list location, amenity and when capacity is exceeded.) ☐ No

**Recreation Site/Amenity**

**Event(s) Exceeding Capacity**

<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>

Please proceed to question 2e on the next page.



- e. Do you have any planned improvements for the recreation sites listed in 2a and amenities listed in 2b or any plans for development of new recreation sites? *(Additional information may be provided on the final sheet of this questionnaire.)*

☐ Yes *(Please list location, planned improvement, and anticipated opening date below.)*

☐ No

**Planned Improvements/Locations**

**Anticipated Opening Date**

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

- f. Do you believe additional recreation sites/amenities are needed within the Project vicinity? *(Additional information may be provided on the final sheet of this questionnaire.)*

☐ Yes *(Please list reasoning below.)*

☐ No

**Additional Recreation Sites/Amenities Reasoning**

_____
_____
_____
_____
_____
_____
_____

- g. Please indicate if there is a specific representative you wish to designate as a follow-up contact to be used by Xcel Energy or their representative *(Additional information may be provided on the final sheet of this questionnaire.)*

**Representative Contact Information**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

**Additional Information or Comments:**  
(Please indicate applicable section)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

**Please return this questionnaire to Xcel Energy in the enclosed self-addressed, stamped envelope within 30 days of receipt** to allow for follow-up contact by Xcel or Xcel's representative, if needed. *Not responding within 30 days will indicate you or your agency are not aware of any relevant information regarding potential recreation needs in the vicinity of the Hayward or Trego Hydroelectric Projects.*

**Comments, questions, and/or this completed questionnaire may also be sent via email to:**  
**Matthew.J.Miller@XcelEnergy.com**

## **Appendix 5 – Documentation of Consultation**



# United States Department of the Interior

National Park Service  
St. Croix National Scenic Riverway  
401 N. Hamilton Street  
St. Croix Falls, Wisconsin 54024



IN REPLY REFER TO:  
I.A.1

December 3, 2021

Mr. Shawn Puzen  
Mead & Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: Hayward and Trego Hydroelectric Projects Draft Recreation Study Plan, FERC Nos. p-2417 and p-2711, Namekagon River

Dear Mr. Puzen:

The National Park Service (NPS) appreciates the opportunity to provide comments on the *Hayward and Trego Hydroelectric Projects Draft Recreation Study Plan* prepared by Mead & Hunt for Xcel Energy. The Recreation Study Plan is being developed for the Hayward and Trego hydroelectric projects, hereinafter (Projects), on the Namekagon River within the St. Croix National Scenic Riverway that is administered by the NPS. We received this proposed study plan by email dated November 5<sup>th</sup>, 2021. We understand that you will review and address these comments prior to study plan execution starting in January 2021.

## 1. Introduction

We concur and are pleased that this study plan is mostly consistent with the study request delineation and guidance the NPS submitted to Mead and Hunt on April 27, 2021. We offer the following comments to further enhance the study plan and survey instruments.

## 2. Study Plan Elements

### 2.1 Study Goals and Objectives

We concur that the objectives of this study include 1) provision of a subjective assessment of existing recreation facility conditions as well as recommended enhancements; and 2) determination of the capacity of existing facilities to help assess current and future user demand, produce sufficient information to evaluate such impacts, and provide the rationale for recommended recreation enhancements.

### 2.2 Background and Existing Information

We are pleased that the study plan allows for evaluation of the existing recreational facilities within the Projects for recreational use and improvements. These study plans address our April 27<sup>th</sup>, 2021, comment letter in which we disagreed with the findings in the Projects' recreation study reports completed in 2020 that "The number and size/capacity of the facilities appear

sufficient to accommodate the current amount of use on all but the busiest of days.” (NSPW, 2021)

We note in the draft study plan a statement that “In March 2019, the State of Wisconsin published its Statewide Comprehensive Outdoor Recreation Plan (SCORP) for 2019-2023. The SCORP did not identify any specific recreation needs in the immediate vicinity of the Projects.” The SCORPS, by definition, do not identify specific recreation needs in immediate vicinities of specific targeted areas such as these Projects. We suggest deleting this sentence or clarifying by inserting the following:

The SCORP identifies recreation needs by region rather than specific sites or project areas.

### **2.3 Nexus between Project Operations and Effects on Resources**

We are pleased to see a discussion of hydro operations and insufficient public access noted in this section as well as the need for adequate information about impacts. In addition to highlighting fluctuations in reservoir elevation, it is also necessary to consider water depths. Additional studies recommended by the NPS about bathymetry and sedimentation will help inform this nexus. We look forward to reviewing your other study plans and how the results will be integrated with recreational issues.

### **2.4 Study Area**

We recommend revising the first sentence in this section as follows:

The need for additional recreation sites and/or enhancements are not clear given the problematic informal ice fishing on Hayward Lake’s Bartz’s Bay and recent closure of two access areas in the upstream area of the Trego Flowage. These closures may cause additional demand on existing sites within the project area. The inventory and recreational use study will incorporate the recreation sites listed below in Table 2.4-1.

We are pleased to see inclusion of each site the NPS recommended for study including the Town of Trego Park Boat Landing and the Informal Ice Fishing Access site at Bartz’s Bay. We concur that the Bartz’s Bay site need only be surveyed during the January and February survey periods to capture ice fishing activity.

The proposed Recreation Study Plan and the resultant Recreation Study Report should state that the Town of Trego Park Boat Landing on the headwaters of Trego Lake would be omitted from Trego’s revised project boundaries if Xcel’s proposed project boundaries were approved.

### **2.5 Methodology**

#### **2.5.1 Recreation Inventory**

We are pleased that the Recreation Site Inventory Form (Appendix 1) includes all amenity types we recommended. In the interest of consistency, please add “signage” to the list of items to be inventoried under this section since signage is included on the inventory form in the Appendix.

### **2.5.2 Facility Condition Assessment**

We concur with your rating categories (see below) to evaluate condition of each site and documentation of the need for further attention (enhancement) to the facility if warranted.

1) Not Usable and Needs Replacement 2) Needs Repair 3) Needs Maintenance or cleaning 4) Good Working Condition (does not need any attention) 5) Facility Lacking; need to install facility or otherwise add enhancement (identify item).

We note an inconsistency between the list provided in the text above and the list on the forms found in Appendix 1. The latter lacks item Number 5, “Facility Lacking; need to install facility or otherwise add enhancement (identify item).” We recommend that Number 5 be restored to the list of the other four condition types on the forms under both “Type of Amenity” and “Signage.” This option, for example, would be essential for evaluating Hayward’s Bartz’s Bay Informal Ice Fishing Access and identifying if other amenities, including signage, exist.

### **2.5.3 Recreation Use Survey**

We are generally pleased with the sampling days per site during the peak season and appreciate inclusion of our suggestion to include measures to balance timing of interviews. We are concerned that one weekend day a month does not adequately cover the non-peak season use and recommend that at least two sampling days, one weekday and one weekend, be included per month at each surveyed site.

In addition, we are pleased that the Recreation Use Survey Interview Form (Appendix 2) is almost verbatim with the one NPS included in our study request. We suggest a few revisions. So that interviewees may fully understand the importance of providing input, please insert the following clarifying language into the introductory paragraph of the survey form:

First sentence: rephrase to read “Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is in the process of applying for *40-year* subsequent licenses...” (Italics indicate inserted text.)

Last sentence: rephrase to read “The purpose of this survey is to collect information about recreational use and visitors’ experiences at public recreation facilities around the Hayward and Trego Project reservoirs *so that we may better assess existing and future recreational needs to be included in the licenses.*” (Italics indicate inserted text.)

Under Question 2 insert among the list of activities “Ice fishing.”

Revise the ninth response option under Question 3.(C) “Which of the following reasons, if any, explain why you did not engage in the activity?” The ninth item currently states “Unsatisfactory

conditions or facilities.” We recommend revising this response to read “Unsatisfactory *facilities or conditions of land or water* (for example, navigability upon launching).” (Italics indicate inserted or reordered text.)

To provide a more amenable interview experience, we suggest following the order of questions recommended in our study guidance and returning the section regarding interviewee’s demographic details (zip code/country of origin; age; gender; ethnicity; additional comments question) to the end of the interview after item Number 9. This ordering of items allows initial focus on site specifics such as location, recreational use, etc., rather than a person’s demographics.

#### **2.5.4 Recreation Use Spot Count**

We appreciate the thoroughness of the Spot Count Form (Appendix 3) and recommend one change, moving “ATV/snowmobiling” next to “motorboating” so that motorized use is grouped together.

#### **2.5.5 Future and Potential Recreation**

We concur with the list of entities to which this questionnaire will be sent, including Trego Lake District. Please include the National Park Service St. Croix National Scenic Riverway in your list of recipients for both Hayward and Trego projects.

We recommend using the same introductory paragraph, including our suggested edits, found on the Recreation Use Survey Form (Section 2.5.3, above) as an introductory paragraph for the Future and Potential Recreation Questionnaire (Appendix 4). This would help readers understand the importance and context of the questionnaire.

We recommend adding to the questionnaire a map of each project with physical landmarks such as roads and recreation facilities so that participants are better able to focus their comments. In addition, respondents would be able to comply with one of the options for providing site location listed in Question 2.c., “Please provide the location of each site listed above using a map...”

As written, the questionnaire is targeted solely at land managing entities. However, this excludes important partners that help manage resources and/or have extensive knowledge about recreation use, trends, and potential enhancements. We recommend rewording questions to better suit the target audience. For example, Question 2 would read “Is your organization responsible for *or interested in* recreation sites, amenities, ....” (Italics indicate inserted text.)

We recommend editing Question 2.f. so that respondents can suggest enhancements to an existing amenity, “Do you believe additional recreation sites/amenities are needed *or are any enhancements needed at existing* recreation sites/amenities within the Project vicinity? (Additional information may be provided on the final sheet of this questionnaire.) ...”

We recommend rewording the directions for returning completed questionnaires to “Please return this questionnaire to Xcel Energy in the enclosed self-addressed, stamped envelope *or via*

*email at the email address below* within 30 days of receipt to allow for follow-up contact by Xcel or Xcel's representative, if needed." (Italics indicate inserted text.)

Lastly, we disagree with the conclusion found in Footnote 3, page 4, of this section that a separate Recreation Study Report is not necessary. While including all proposed mitigation and enhancement measures in the body of the license application provides a succinct summary, a separate Recreation Study Report provides a comprehensive review of the study plan, survey instruments, data, analysis, and resultant proposed mitigation and enhancement measures. Such a report is invaluable in providing clear access to the information above not only for license application review but also for review and use during the life of the license.

## Conclusion

Thank you for your consideration of these additional comments as you develop your final study plan. The NPS looks forward to the results of this study as well as the opportunity to continue to collaborate with you throughout the licensing process. If you have any questions about our response, please contact Susan Rosebrough at [susan\\_rosebrough@nps.gov](mailto:susan_rosebrough@nps.gov) or (206) 220-4121.

Sincerely,

**THERESA  
HOGAN**

Digitally signed by THERESA  
HOGAN  
Date: 2021.12.04 09:06:56  
-06'00'

Theresa L. Hogan  
Acting Superintendent

Document Content(s)

NPS\_CommentsTregoHaywardProposedRecreationStudyPlan.pdf.....1

WDNR Did Not Provide Comments on Recreation Study Plan

## ATIS Study Plan Consultation

## Darrin Johnson

---

**From:** Shawn Puzen  
**Sent:** Thursday, January 13, 2022 4:52 PM  
**To:** cheryl.laatsch@wisconsin.gov; angietornes@gmail.com; susan\_rosebrough@nps.gov; Lisa\_Yager@nps.gov; jharn@nps.gov; cjpetersen@msn.com  
**Cc:** Darrin Johnson; Miller, Matthew J; Shawn Puzen; brey.j.maurer@xcelenergy.com; Crotty, Scott A  
**Subject:** Hayward and Trego Invasive Species DRAFT Monitoring Plan  
**Attachments:** Appendix 3 Reduced.pdf; Appendix 2 Invasive Study Point Intercept Protocol.pdf; Appendix 4 Wisconsin Point Intercept Worksheet with addtl substrate info.xls; 20220113 Hayward Trego Draft ATIS Study Plan.pdf

**Categories:** Filed by Newforma

Good Afternoon,

Attached is a draft Hayward and Trego Invasive Species Monitoring Plan for your review and comment. The intent is to complete this study during this field season.

By your initial comments on the relicensing of the Hayward and Trego Hydroelectric Project, you requested NSPW complete an invasive species survey.

Prior to executing the study, NSPW is requesting your comments on the enclosed draft study plan.

Please provide your comments as soon as possible, but no later than February 11, 2022.

Please feel free to contact me if you have any questions.

Thanks,

---

### SHAWN PUZEN

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt

Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



120 YEARS OF SHAPING THE FUTURE

**Hayward and Trego  
Hydroelectric Projects  
FERC Nos. 2417 and 2711**

**Draft Study Plan**

**Aquatic and Terrestrial Invasive Species Study**

**Prepared for**



**Prepared by**



meadhunt.com

**January 2022**

## 1. Introduction

Northern States Power Company – Wisconsin (NSPW or Licensee), d/b/a Xcel Energy, currently holds licenses issued by the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the Hayward and Trego Hydroelectric Projects (Project or Projects). The Projects are owned, operated, and maintained by the Licensee. The current licenses, which designate the Projects as FERC Nos. 2417 and 2711 respectively, expire on November 30, 2025. To obtain subsequent licenses, the Licensee must submit a Final License Application (FLA) to FERC no later than November 30, 2023. The FLA, in part, must include an evaluation of the existing botanical resources (including invasive species) and potential impacts to botanical resources associated with continued Project operations.

On March 11, 2021, the Licensee held a Joint Agency Meeting to present information about the Projects. At the meeting, and during the 60-day comment period immediately following, the Licensee received comments and study requests from several entities. The Wisconsin Department of Natural Resources (WDNR) requested that the Licensee complete an invasive species study as part of the relicensing process.

The WDNR recommended that the Licensee conduct an aquatic and terrestrial invasive species study using the WDNR Early Detection Early Response Protocols. The WDNR also noted that additional methodology may be needed for terrestrial species, and other methodologies such as point-intercept, may be appropriate if combined with other studies. The WDNR also requested in-water plant community data within the project boundaries of each Project to provide baseline information on the condition of the aquatic plant community.

## 2. Study Plan Elements

### 2.1 Study Goals and Objectives

The objective of this aquatic and terrestrial invasive species (ATIS) study is to provide baseline data on native and invasive aquatic and terrestrial species. The study also provides a method for identifying newly established invading species early enough to increase chances of control and will help prevent the spread of other nearby invasive species.

### 2.2 Background and Existing Information

There is limited information available regarding invasive species within the Project boundaries. WDNR Lake Facts and Figures webpage identified four invasive species within the Hayward Project, including Chinese mystery snail (*Cipangopaludina chinensis*), curly-leaf pondweed (*Potamogeton crispus*), Eurasian watermilfoil (*Myriophyllum spicatum*), and hybrid Eurasian/northern watermilfoil (*Myriophyllum spicatum* x *Myriophyllum sibiricum*) are present within the Project reservoir (WDNR 2020a). NSPW has also identified purple loosestrife (*Lythrum salicaria*) within the Project reservoir during annual purple loosestrife surveys.

The WDNR Lake Facts and Figures webpage identified four known invasive species within the Trego Project including Chinese mystery snails, curly-leaf pondweed, Eurasian water milfoil and Japanese mystery snails (*Cipangopaludina japonica*).

## 2.3 Nexus between project operations and effects on resources

Invasive species can be introduced to Project waters and lands through recreational activities such as boating, bank fishing, and hiking. These species, once established within the Project boundary, can be transferred downstream through water releases or to areas outside of the Project boundary by recreationists.

## 2.4 Study Area

The ATIS Study will encompass the upstream and downstream areas inundated by the Namekagon River that are contained within the existing and proposed Project boundaries as outlined in the Pre-Application Document (PAD). It will also encompass upland areas owned in fee by the Licensee within the Project boundary, two recreation sites owned by the City of Hayward and two recreation sites owned by the Town of Trego. The study area is depicted in Appendix 1.

## 2.5 Methodology

### 2.5.1 Upstream and Downstream Inundated Areas

Samples will be collected in locations outlined in a point intercept grid provided by the WDNR. Sampling will be conducted completed once in June and once in late July or early August of 2022 to account for both early season and late season species. The sampling will be conducted completed by boat using either a pole-mounted or rope-mounted rake. The methods will be similar to approximating the protocol found in the WDNR Recommended Baseline Monitoring of Aquatic Plants in Wisconsin protocol (point-intercept protocol), including the voucher collection (see Appendix 2). The methodology will also incorporate as many parameters as applicable of those listed in Table 1, page 31 of the protocol.

One rake sample per collection site will be taken by lowering the rake to the bottom and slowly drawing it up to the surface. The sample will be inspected for the presence of invasive species as included in NR40<sup>1</sup>. Their presence and percentage of abundance within the sample will be recorded on a field data sheet accordingly along with the presence and percentage of abundance of native species.

Any areas that are not safely accessible will be noted in the report with one of the following reasons:

- Non-navigable (due to thick emergent plant growth or shallow water);
- Terrestrial (point intercept located in an upland area not owned by Licensee);
- Obstacle (rocks, dock, swim area);
- Temporary obstacle (temporary obstacle should be noted);
- No information (accidentally missed or inaccessible, state reason); and
- Other (provide brief description).

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<sup>1</sup> <https://dnr.wi.gov/topic/invasives/documents/NR40plantlist.pdf>.

Vouchers shall be collected for all NR40 listed aquatic and terrestrial invasive species not currently verified within each Project. Steps for vouchering invasive plant species are listed as follows:

- Take a digital photo(s) of the plant in the setting where it was found. Try to capture details such as flowers, leaf shape, leaf and stem arrangement, and fruits. Include a common object in the photo such as a dollar bill, coin or pencil for a size scale, or stand next to tall plants.
- If possible, collect 5-10 intact specimens to ensure precise identification. Try to get the root system and all leaves, as well as seed heads and flowers when present. Place in a zip-lock bag with a damp paper towel. Place on ice and store in a refrigerator as soon as possible.
- Note the location of the plant you found. If using a GPS device please note the datum being used (e.g., WGS 84 {preferred}, UTM, WI Transverse Mercator, etc.).
- Notify Applicant Representative and then complete the WDNR Form 3200-125 – Aquatic Invasive Plant Incident Report and deliver it, your photo(s), and specimens to your WDNR AIS regional coordinator as soon as possible. See: <https://dnr.wisconsin.gov/topic/Invasives/report>.

Additional information on bed substrates will be collected at each sample point in water depths up to 15 feet deep. Under normal point-intercept protocols, the bed substrate is classified into one of three types; muck, sand, or rock. To assist in determining habitat within the littoral zone, bed substrates will be classified into one of the following nine substrate types: clay, silt, sand, gravel, cobble, boulder, bedrock, wood, or organic. The presence of woody debris on the bottom will also be identified during the rake sampling. Water depth information collected for all survey points during the survey will be used to develop a bathymetric map of each reservoir.

Areas not included in the point intercept grid will be monitored for the aquatic invasive rapid response species identified in the **Wisconsin Aquatic Invasive Species Early Detector Handbook** which is included in Appendix 3. If any rapid response species are identified in any of the surveying efforts, WDNR notification as described in Section 2.5.5 below will occur.

In addition to the rake sampling, one water sample will be collected in both the reservoir and the tailwater during the July/August survey period. The water samples will be provided to the WDNR invasive species coordinator who will then analyze them for the presence of spiny water flea (*Bythotrephes longimanus*), fishhook water flea (*Cercopagis pengoi*), and zebra mussel (*Dreissena polymnorphe*).

In order to determine the presence/absence of Asian clam and other invasive macroinvertebrates, the Licensee will conduct sediment samples at all existing public boat landings. The sampling method will involve using a shovel to scoop approximately 6 inches of sediment into a net with a maximum 3/8-inch mesh. Fine sediment will be flushed out of the net and the remaining materials will be examined for Asian clam and other invasive macroinvertebrates.

### 2.5.2 Upland Shorelines Not Owned by the Licensee

Upland shoreline areas not owned by the Licensee will be surveyed from a boat (or on foot from the water where the use of a boat is not feasible, i.e., shallow areas) while moving slowly along the shoreline. During the survey, the locations of coarse woody habitat (greater than 4 inches in diameter and five feet in length) that is in the water and/or below the high-water line will be noted for future mapping. An overall characterization of the terrestrial plant community will also be made. Invasive terrestrial plants listed in NR40 will be noted and their locations on the shoreline identified by latitude and longitude. If any terrestrial invasive plants listed in NR40 are observed, their location will be recorded via Global Positioning System (GPS). An estimate of relative abundance and the extent of the area where the species is present will be recorded for future mapping. The route traveled during the boat-based surveys will also be recorded for future mapping.

### 2.5.3 Upland Shorelines Owned by the Licensee and Recreation Sites

At both Projects, an “on the ground” meander survey will be conducted on upland areas within the Project boundary owned by Licensee. At the Hayward Project, a meander survey will also take place at the Hayward City Boat Landing and the Hayward City Beach recreation sites. At the Trego Project, a meander survey will also take place at the Town of Trego Boat Landing and the Town of Trego Park Boat Landing.

In addition to surveying for terrestrial invasive species, an overall characterization of the terrestrial plant community will be made. If any terrestrial invasive plants listed in NR40 are observed, their location will be recorded via Global Positioning System (GPS). An estimate of each species relative abundance and areal coverage will be recorded for future mapping. The route traveled during the meander surveys will also be recorded for future mapping.

### 2.5.4 Personnel Qualifications

All surveys will be conducted by an individual with prior aquatic plant identification training and experience with aquatic and terrestrial invasive species monitoring<sup>2</sup>.

### 2.5.5 Information Reporting

Should monitoring reveal a new occurrence of an invasive species listed in the **Wisconsin Aquatic Invasive Species Early Detector Handbook**, contained in Appendix 3, the WDNR shall be notified at [invasive.species@wisconsin.gov](mailto:invasive.species@wisconsin.gov) as soon as possible, but no later than five working days after its discovery<sup>3</sup>. The notification shall include photographs and the online WDNR Early Detection Form.

<sup>2</sup> The contractor(s) selected to complete the work are responsible for obtaining all NPS and WDNR Scientific collector or other permits necessary to complete the work.

<sup>3</sup> In addition to notifying the WDNR, the consultant shall notify the Licensee representative.

Information collected during the study will be summarized in a final report. Completed survey sheets will be appended to the report. Based upon the data collected, additional invasive species mitigation and enhancement recommendations (if any) may be included in the FLA.

## 2.6 Consistency with generally accepted scientific practice

The ATIS Survey follows generally accepted scientific practice regarding field data collection and reporting. Similar protocols have been approved by the Commission in post-licensing compliance plans.

## 2.7 Project Schedule and Deliverables

Results from this study will be summarized in an ATIS Study Report. The study report will include the following elements:

- Project information and background
- Study Area
- Methodology
- Study Results
- Analysis and Discussion
- Agency correspondence and/or consultation
- Literature cited

The written report will summarize the monitoring results including the location of each species observed and their relative abundance. The information will be provided in an Excel spreadsheet format following the point-intercept protocol. The survey locations depicting the presence of aquatic invasive species listed in NR 40 will be differentiated from the locations with negative sample results. The report will also include all field sheets and completed forms for any observed new occurrences of aquatic or terrestrial species as identified in the ***Wisconsin Aquatic Species Invasive Species Early Detector Handbook***, including the verification photographs.

Several maps will be developed and presented in the report including:

- 1) a map showing the overall predominant species along shoreline areas;
- 2) a map showing the locations of coarse woody habitat;
- 3) a map showing the locations and identities of invasive species observed during the surveys;
- 4) a map showing the substrates identified during the point-intercept survey;
- 5) a map showing the predominant substrate type and presence or absence of woody habitat;
- 6) a bathymetric map of the reservoir

NSPW anticipates that field work will be completed by the end of August 2022 and the draft study report will be available by October 31, 2022.

### 3. Consultation

The ATIS study was requested by WDNR. As a result, the Licensee consulted with WDNR as follows:

#### 3.1 Wisconsin Department of Natural Resources

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the ATIS plan to the WDNR for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED**. Documentation of Consultation is included in Appendix 5.

#### 3.2 National Park Service

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the ATIS plan to the NPS for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED**. Documentation of Consultation is included in Appendix 5.

#### 3.3 Trego Lake District

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the ATIS plan to the TLD for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED**. Documentation of Consultation is included in Appendix 5.

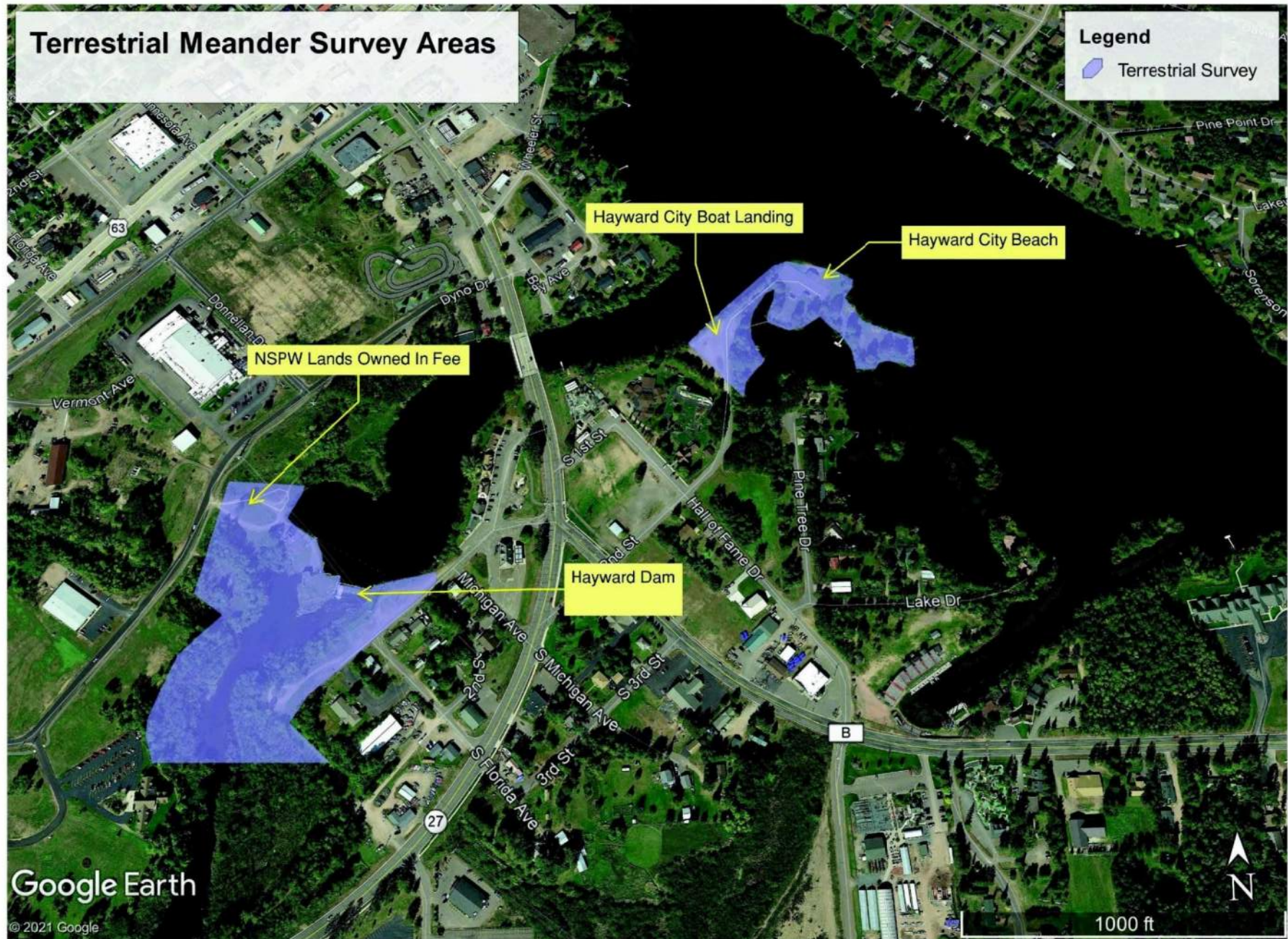
## 4. References

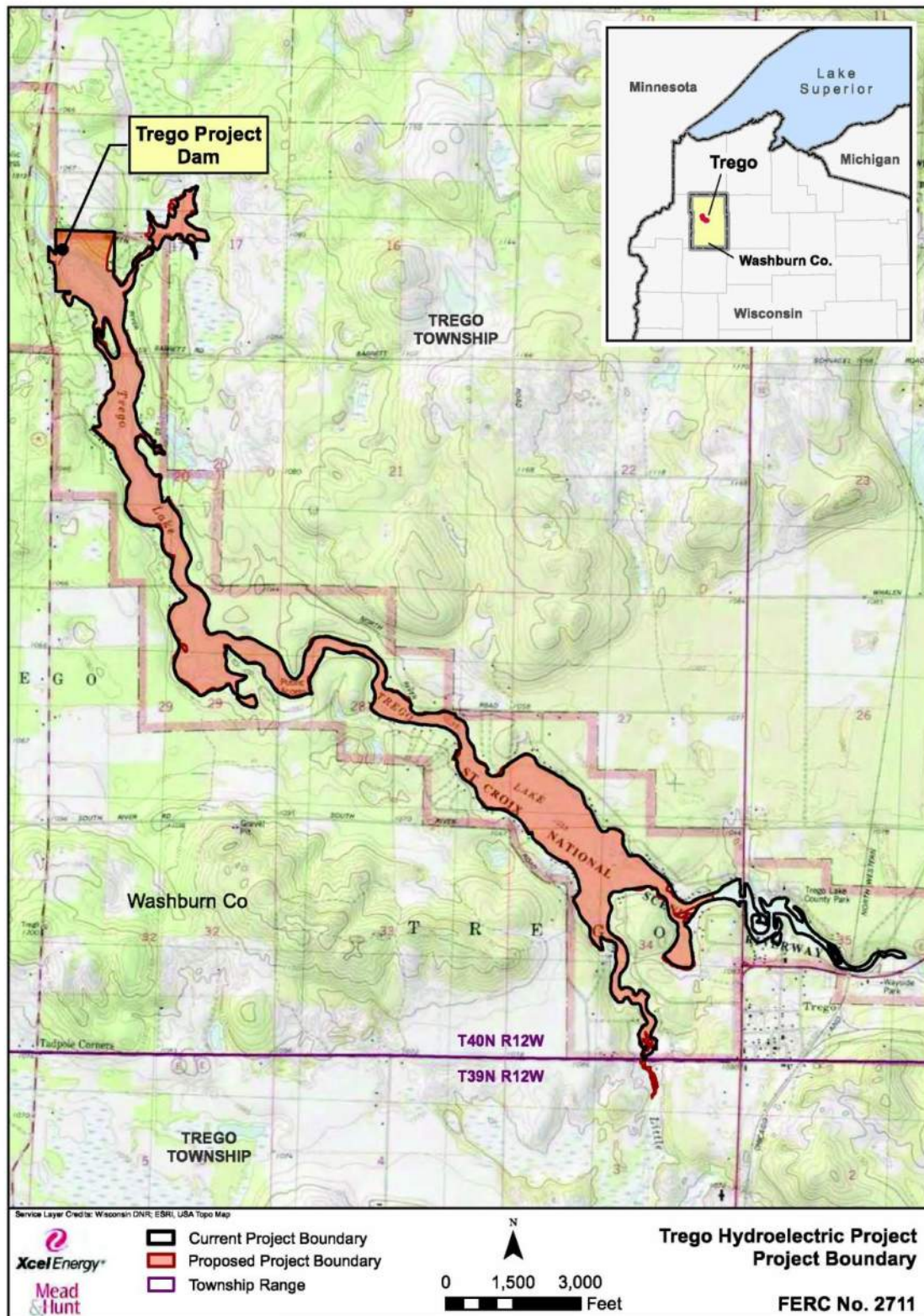
Wisconsin Department of Natural Resources Website. (2020a). Hayward Lake. Facts and Figures. <https://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2725500&page=facts>. Accessed July 27, 2020.

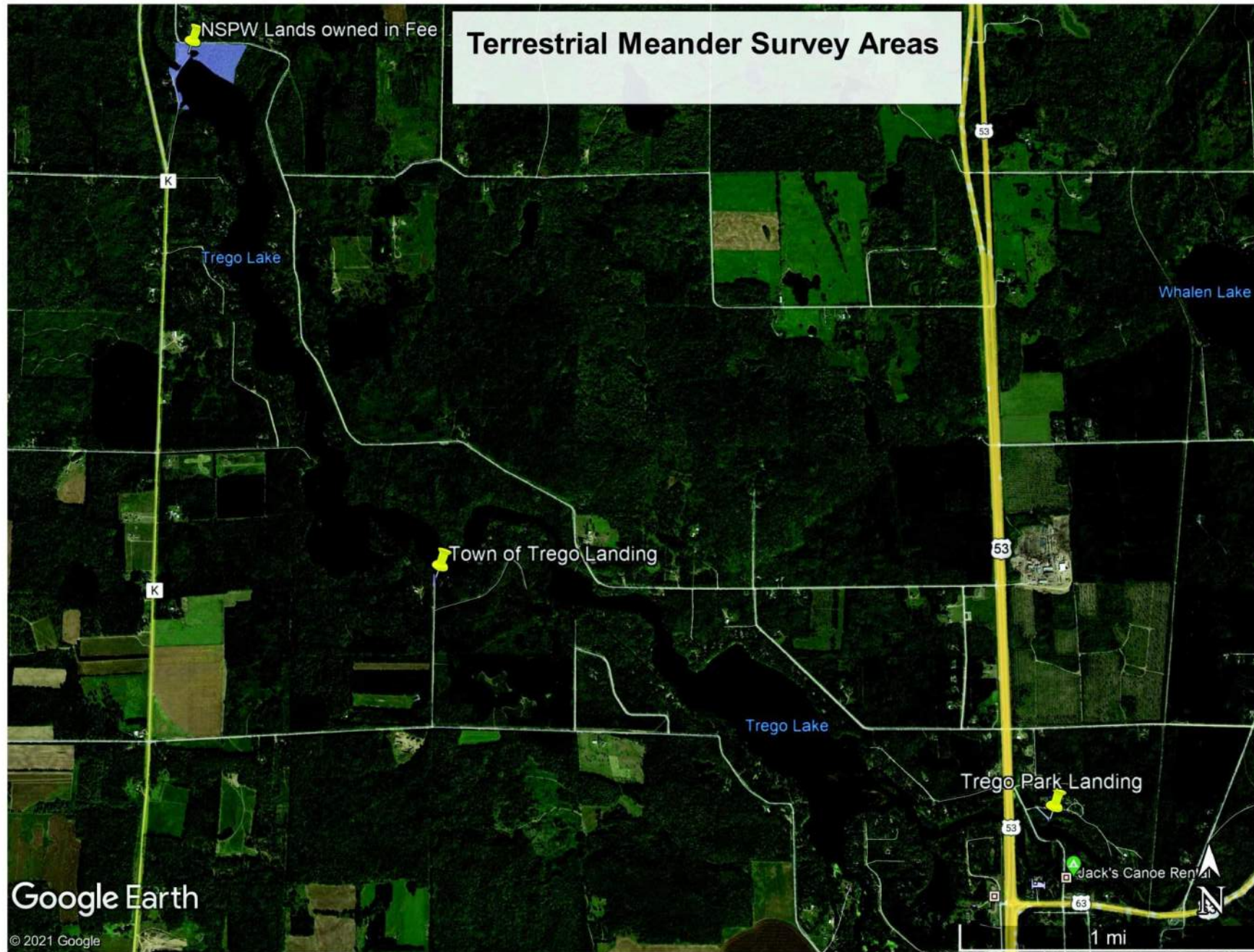
Wisconsin Department of Natural Resources Website. (2020b). Trego Lake. Facts and Figures. <https://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2712000&page=facts>. Accessed July 27, 2020.

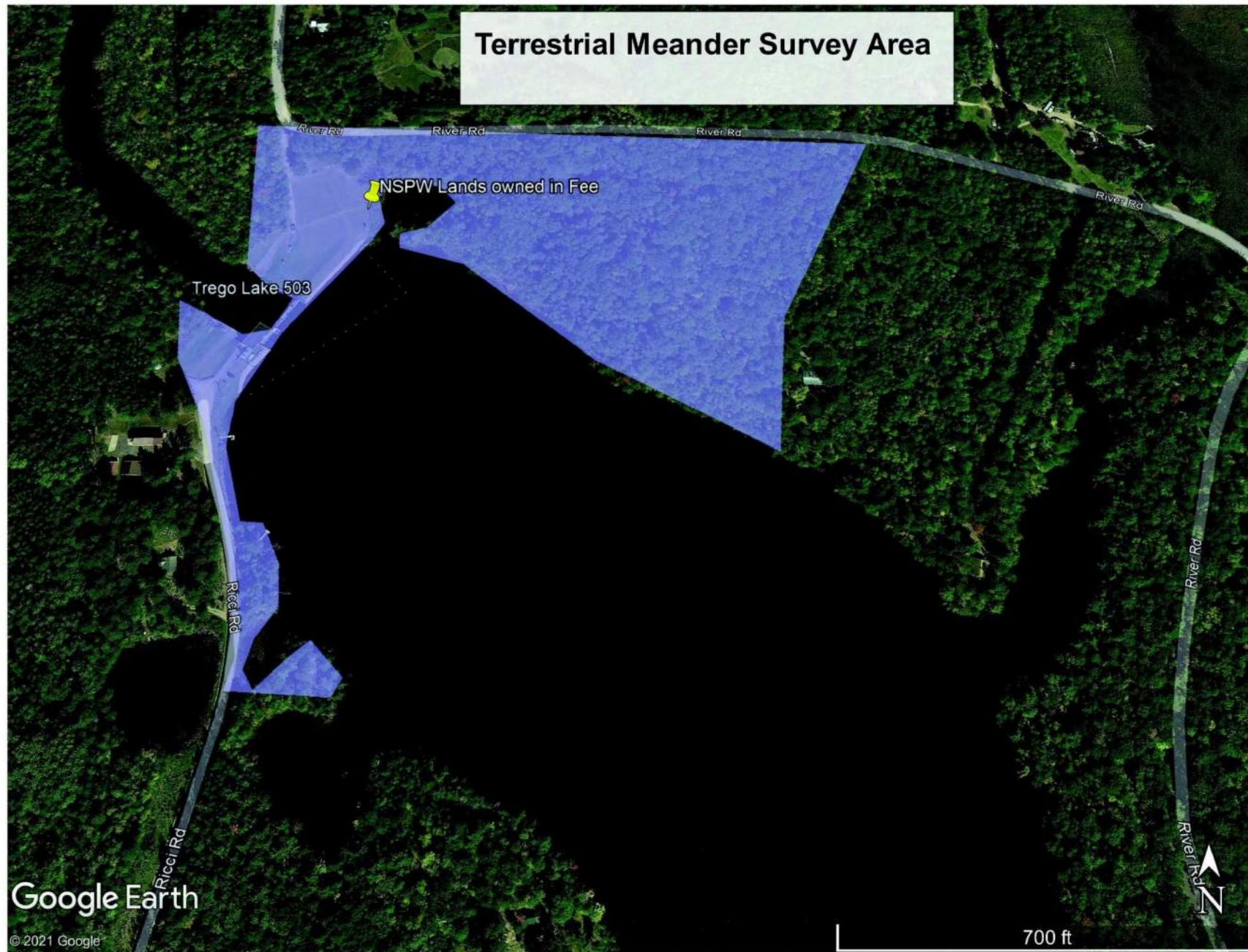
## **Appendix 1 – Invasive Species Study Area**



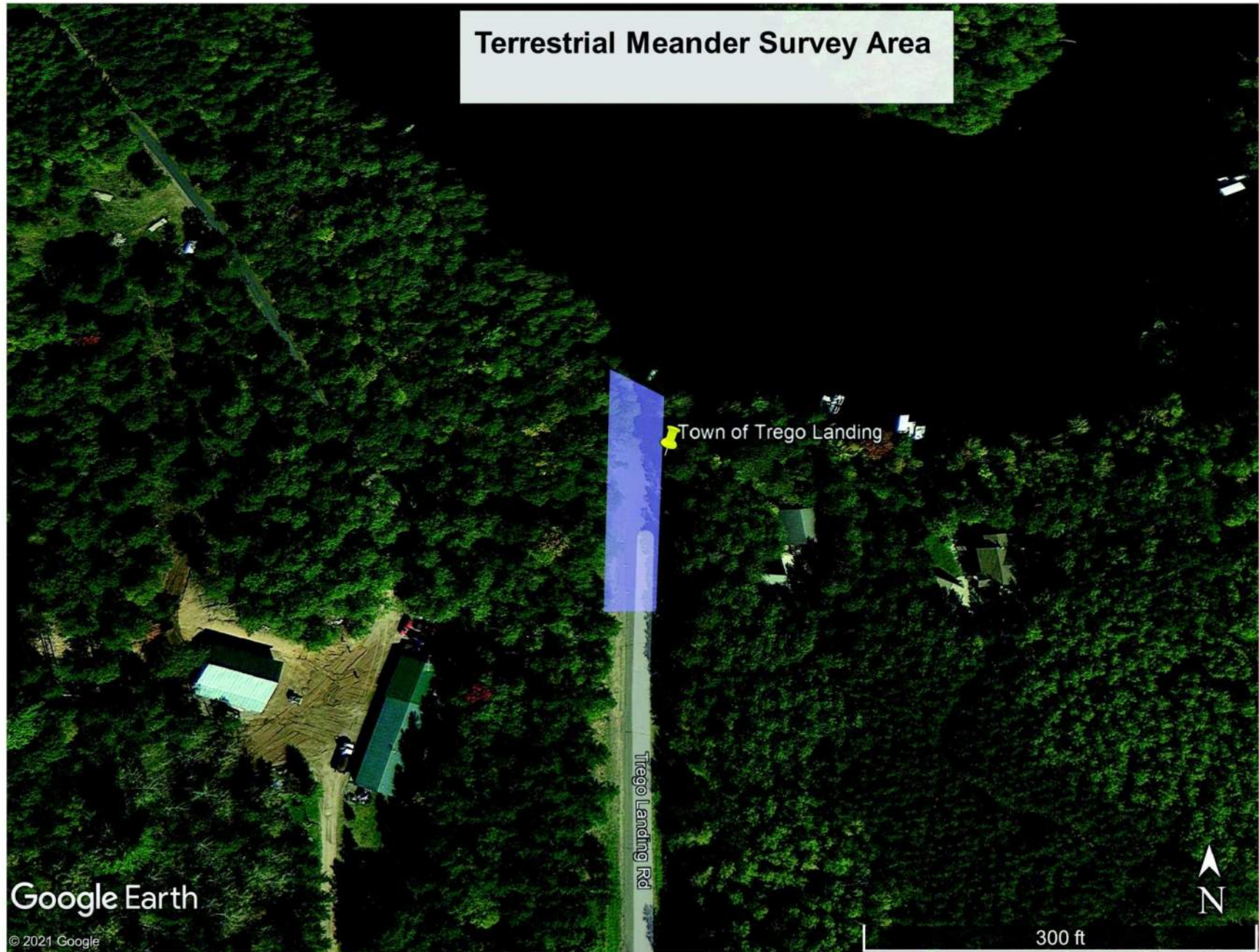


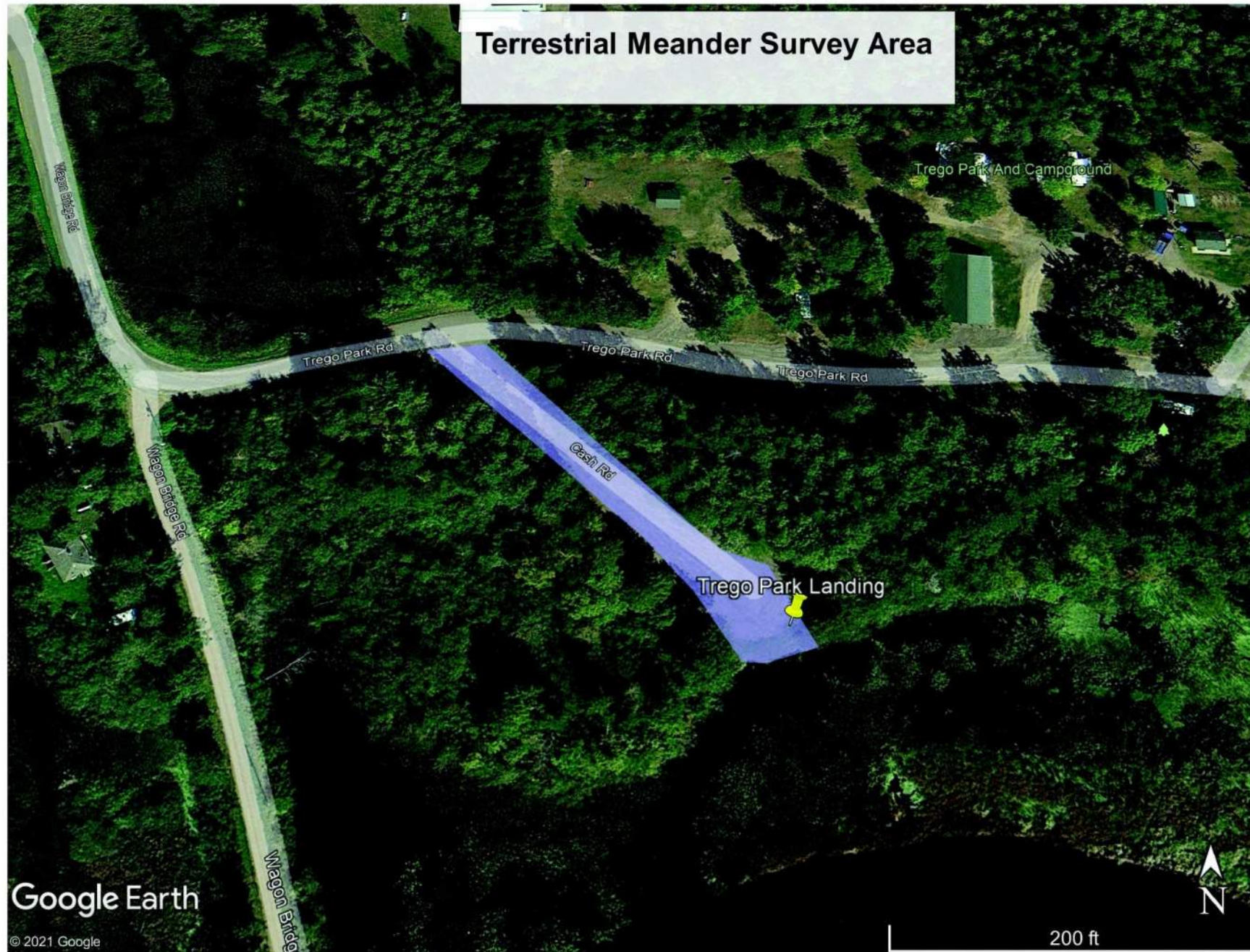






## Terrestrial Meander Survey Area





## **Appendix 2 – Point Intercept Protocol-See Separate File**

# Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis, and Applications



**Jennifer Hauxwell, Susan Knight, Kelly Wagner, Alison Mikulyuk,  
Michelle Nault, Meghan Porzky and Shaunna Chase**

**March 2010**

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**Recommended Baseline Monitoring of Aquatic Plants in Wisconsin:  
Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis,  
and Applications**

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Last Updated:  
March 2010

## **EXECUTIVE SUMMARY**

We outline a baseline monitoring protocol designed to quantitatively assess the distribution and abundance of aquatic plants in lake ecosystems. This protocol employs a point-intercept sampling design, with sites located on a geo-referenced sampling grid placed over the entire lake. At each site, the aquatic plant community is surveyed from a boat with a rake sampler to characterize species presence and rake fullness. In addition, a qualitative survey is recommended to map obvious species and augment the species list generated through quantitative sampling. Application of this methodology allows: 1) assessment of the frequencies of occurrence of different plant species, as well as estimates of species richness, abundance, and maximum depth of plant colonization; and 2) comparisons of aquatic plant variables over time and among lakes. This document contains complete instructions for conducting a baseline aquatic plant survey, including details on obtaining an electronic file of site coordinates, uploading site coordinates into a Global Positioning System (GPS) receiver, conducting field work, entering data, working with data summaries, processing voucher specimens, and provides example applications of the collected data. Final products from each baseline survey will include: 1) raw data from the quantitative survey which provides individual site-by-site species distribution and rake fullness data, 2) summary statistics useful in characterizing and comparing populations, 3) additional species observations from the general qualitative survey, and 4) voucher specimens cataloguing species presence. All electronic data should be sent for long-term record-keeping to the WDNR ([DNRBaselineAquaticPlants@wisconsin.gov](mailto:DNRBaselineAquaticPlants@wisconsin.gov)).

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## INTRODUCTION

In lake ecosystems, the aquatic plant community serves as critical habitat and nursery for fish and other animals, a source of oxygen for all organisms, a refuge for prey as well as a foraging area for predators, a buffer against erosion and sediment resuspension from both waves and shoreline inputs, and can significantly contribute to overall lake primary productivity. Over the past several decades, losses of or changes in assemblages of native submersed aquatic vegetation has been a reoccurring phenomenon due to a relatively limited number of factors. Repeatedly, changes in landscapes and atmospheric conditions as a result of human activities have increasingly affected the ecology of adjacent aquatic systems, including aquatic plant communities. In addition, in-lake aquatic plant management activities have increased due to the increasing spread of invasive exotic plants<sup>1</sup>.

The Wisconsin Department of Natural Resources (WDNR) is charged with protecting and enhancing the state's natural resources, including lake ecosystems. Given the many ecosystem services associated with aquatic plant communities as well as the recent threats to native species, it has become increasingly important to develop monitoring techniques to support science-based decision-making for effectively managing lake ecosystems. In this document, we present a quantitative, replicable monitoring protocol. Standardized, quantitative and replicable data are an essential part of strategic lake management for three reasons. First, good data allows us to better understand each individual lake; we can use survey data to produce detailed lake maps that show the locations of native, rare, or exotic plant species. Data can then be used as a baseline against which any changes in a lake associated with water clarity, exotic species introduction, water level, or lake management activity can be compared. Second, good data helps direct management by taking the conflict and guesswork out of planning. Aquatic plant management requires weighing a number of potential management options, some of which can be very costly or extensive. Baseline data allows lake groups to identify the most appropriate management options and design the best possible management plan. Additionally, by conducting quantitative comparisons between the aquatic plant communities before and after management actions, lake groups and managers may evaluate whether or not management goals were achieved. Third, by compiling and comparing survey information on lakes statewide, we are able to identify regional trends and refine our understanding of aquatic plant populations on a broader scale in both space and time.

## SURVEY OBJECTIVE

In this document, we outline a baseline monitoring protocol designed to assess aquatic plant communities on a whole-lake scale. We recommend a formal quantitative survey conducted at pre-determined sampling locations distributed evenly throughout the lake, accompanied by a general qualitative survey to map obvious species and augment the species list generated through the quantitative survey. Our primary goals in adopting this methodology are to:

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<sup>1</sup> Knight, S., and J. Hauxwell. 2009. Distribution and abundance of aquatic plants- human impacts. *In*: G. Likens (editor-in-chief), *Encyclopedia of Inland Waters*. Elsevier, Oxford, United Kingdom.

1) Collect quantitative data describing the frequencies of occurrence of different plant species, as well as estimates of species richness, abundance, and maximum depth of plant colonization for use in developing various management plans; and

2) Use the data to statistically compare aquatic plant variables over time and among lakes.

*The importance of a statewide standardized protocol is that observed differences in a lake's plant community can be attributed to actual changes in the community over time, without the confounding variation that results from different field workers employing different sampling techniques.*

The quantitative survey employs a point-intercept sampling design, adapted from terrestrial methods, with sites located on a geo-referenced sampling grid placed over the entire lake. At each site, the aquatic plant community is surveyed from a boat with a rake sampler to characterize species presence and rake fullness ratings. Although the presence/absence data cannot be used to estimate biomass or percent cover, it is less sensitive to interannual or seasonal variations in plant abundance<sup>2</sup>. The method is also relatively rapid and cost-effective and can be used on the large scale to collect baseline data and statistically compare communities over time<sup>2,3</sup>. In summary, it has the following attributes for estimation of aquatic plant distribution and abundance:

- Systematic, quantitative, and replicable
- Appropriate for lakes that vary in depth, size, region, shoreline complexity, and vegetation distribution
- Evenly spaced distribution of sites results in a good coverage of the entire lake, precluding the random exclusion of niche habitats
- Procedural simplicity
- Inexpensive implementation
- Results are easily analyzed with scientifically rigorous statistical methods
- Spatial data preserved and can be mapped for both the managers' use and for clearly communicating distributional data with the public

These guidelines are intended to work on most lakes. However, modifications may be required if a lake is uniquely shaped so that a uniform distribution of points isn't representative (long, skinny lake shape), or if obtaining rake samples is difficult due to substrate (rocky/cobble bottom).

*Please note that these are "baseline" recommendations.* Additional monitoring activities may be warranted if the goal is to assess a specific management activity. For example, to gauge the ability of chemical spot-treatments to control relatively small stands of an exotic species in a

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<sup>2</sup> Madsen, J.D. 1999. Point intercept and line intercept methods for aquatic plant management. Aquatic plant control technical note MI-02. Army Engineer Waterways Experiment Station, Vicksburg, MS.

<sup>3</sup> Dodd-Williams, L., G.O. Dick, R.M. Smart and C.S. Owens. 2008. Point Intercept and Surface Observation GPS (SOG): A Comparison of Survey Methods – Lake Gaston, NC/VA. ERDC/TN APCRP-EA-19. Vicksburg, MS: U.S. Army Engineer Research and Development Center

## **Appendix 3 – Aquatic Invasive Species Early Detector Handbook-See Separate File**

relatively large lake, we recommend additional mapping of the beds following the pre- and post-treatment protocol available in Appendix D of the Aquatic Plant Management guide<sup>4</sup>.

*Unlike the procedures used by the Citizen-Based Lake Monitoring Network, this protocol is not designed for most volunteers.* The protocol requires at least one of the field workers be an experienced plant taxonomist and able to identify most plant species in the field. Less experienced volunteers may be able to help with data recording and navigation, but without the help of a professional aquatic ecologist, volunteers may not be able to conduct an entire plant survey without a significant degree of training or study.

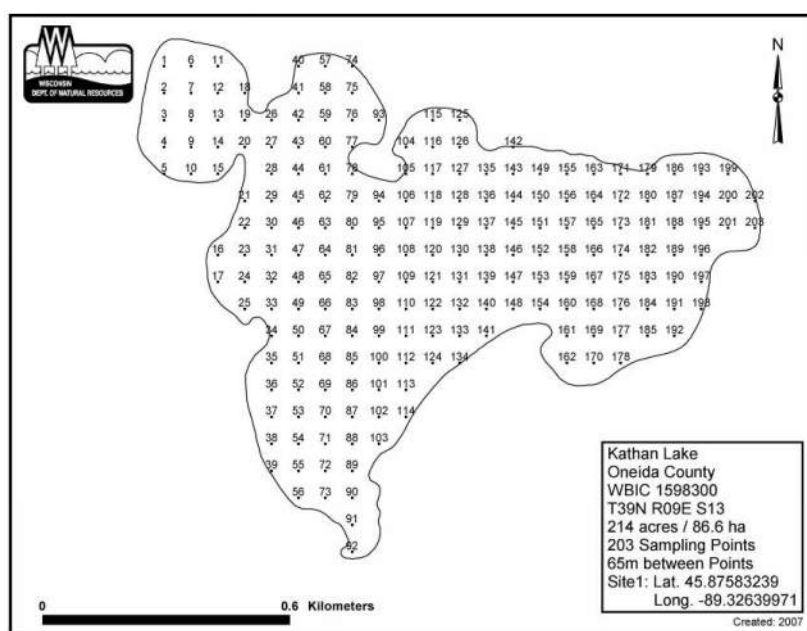
## SURVEY OVERVIEW

### Sampling Sites

This method employs a point-intercept design in which a grid of sampling sites is distributed evenly over the entire lake surface (Figure 1). Lake organizations or individuals can request an electronic file of survey sites by contacting the WDNR Lake Coordinator from their region (see Appendix 1) with the lake name and county, as well as the town, range and section (TRS) or water body identification code (WBIC). Please make requests well in advance of planned field work to allow WDNR staff sufficient time for map creation (recommend at least 1 month). WDNR staff will determine the number of sites and grid resolution based on the estimated size of the littoral zone (the area in which plants grow) and shape of the lake. Grids will be scaled to produce a greater number of sites on lakes that are larger and have more complex shorelines. Lakes with a narrow littoral zone may be assigned a comparatively high number of sampling sites to achieve sufficient survey coverage. Once created, the sampling map (Figure 1) and an associated GPS text file containing the latitude and longitude information associated with each sample site will be provided electronically by the WDNR.

### Timing of Sampling

Surveys should be conducted between early July and mid August. Although certain plant community parameters (such as rake fullness and biomass) can change over the course of the



**Figure 1: The point-intercept grid for Kathan Lake, Oneida County, WI, with 203 sampling sites.**

<sup>4</sup> Aquatic Plant Treatment Evaluation. <http://www.uwsp.edu/cnr/uwexlakes/ecology/APM/Appendix-D.pdf>

growing season, presence/absence data is less sensitive to seasonal variation<sup>2</sup>; presence can often be detected throughout the season. For many species, including Eurasian water milfoil (EWM), plant biomass and density may increase as the season progresses, whereas some species like curly-leaf pondweed (CLP), senesce much earlier in the sampling season. Rake fullness data for these species must be interpreted carefully with the sampling date in mind. If early-senescent species such as CLP are targets of management actions, please contact the WDNR Lake Coordinator in your region to coordinate the best possible sampling time.

### **Time Spent Sampling**

Depending on the size of the lake, a survey may be completed in a few hours, or it may take several days. Ideally, a crew spends one-half to three minutes per sample site; however, this may vary depending on the following factors:

- Distance between sample sites
- Weather (i.e. wind, rain, etc.)
- Rake fullness
- Ease of navigation
- Experience; less experienced field workers may take longer to identify unfamiliar plants. However, most field workers have found that the time spent per site drops dramatically with experience. Others have reported their speed increasing greatly with a few hours of training.



## **PREPARING FOR FIELD WORK**

### **Field Gear**

Necessary equipment:

- Appropriate watercraft and all equipment required by state law
- Double-sided sampling rake attached to a 15-ft (4.6m) pole
- Weighted sampling rake attached to a 40-ft (12m) rope
- Handheld GPS receiver with WDNR sample sites loaded
- Print-out of lake map with WDNR sample sites
- Print-out of WDNR field datasheets on waterproof paper
- Pencils
- Sealable storage bags for voucher specimens
- Waterproof voucher sample labels
- Cooler(s) with ice for storing voucher specimens
- Depth finder

Helpful, but not required:

- Trolling motor for reaching shallow sites
- Bathymetric map
- Plant ID references or guides to aid in plant identification
- Hand lens to aid in plant identification
- Digital camera for plant specimens or field pictures
- Underwater video camera for viewing the maximum depth of plant colonization

### **Loading Sample Site Locations onto the GPS Receiver**

Detailed instructions on loading sample site locations onto the GPS receiver depend greatly on the type of GPS receiver as well as the software used to translate site location from the text file to “waypoints” in the receiver. The WDNR commonly utilizes Garmin 76 model GPS receivers and the WDNR Garmin GPS Standalone Tool software. The WDNR Standalone Tool is only available to WDNR employees, and only works with Garmin GPS receivers. The Minnesota Garmin GPS Tool and appropriate guidance documents are available to the public and can be found online at the Minnesota DNR internet site<sup>5</sup>. The two programs are similar; their chief difference is that the Minnesota tool requires the GPS text file to be comma-delimited instead of tab-delimited. Procedures for other GPS models with a Wide Area Augmentation System (WAAS-capability) may be used; please refer to the manufacturer’s instructions for details on uploading site locations.

Please note that storage capability varies by GPS model. Some GPS receivers are unable to store the large numbers of data sites required in some surveys. In the event that the number of sampling sites exceeds your receiver's storage capacity, the text file containing the survey site information can be split into smaller text files. You will then be able to upload successive files of sites as needed or work from multiple receivers in the field.

*The instructions below describe how WDNR employees can use the WDNR Garmin Standalone Tool software to load sample site locations, or “waypoints,” onto a Garmin 76 model GPS receiver.*

To upload waypoints from a GPS text file to the GPS receiver, you will need:

- **PC/laptop with WDNR Garmin GPS Tool.** Your IT administrator can help you obtain and install the software.
- **GPS text file (.txt extension).** A tab-delimited text file containing the sample sites and their geographical information.
- **A Garmin 76 model GPS receiver with external data port.**



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<sup>5</sup> Available online at: <http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRCGarmin/DNRCGarmin.html> (accessed September, 2009)

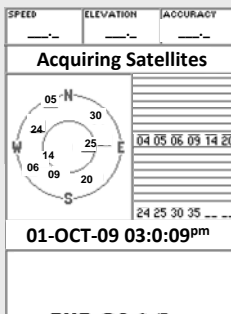


- **PC interface cable (with USB or 9-pin serial connector).** Can be purchased online at <http://www.garmin.com>

### Step 1: Set GPS to the “Simulating GPS” Mode

Operating the receiver in “Simulating GPS” mode prevents the GPS receiver from trying to acquire a satellite signal indoors.

1. Press and hold the red [ON/OFF] button for two seconds to turn the GPS receiver on.
2. Press [PAGE] to navigate through the welcome screens until the “Acquiring Satellites” page is visible.



3. Press the [MENU] button, select “Start Simulator”, and press [ENTER]; the screen heading should now read “Simulating GPS.”

### Step 2: Set Serial Data Format (this setting will **not** have to be re-set upon each use)

Set the serial data format on the Garmin 76 receiver to GARMIN prior to transferring data. Failure to set the serial data format to GARMIN will cause a communication error.

1. Press the [MENU] button twice to reach the main menu, use the rocker key to select “Setup”, and then press [ENTER].
2. Use the rocker key to scroll left or right until the “Interface” tab is highlighted. Use the rocker key to scroll down to highlight the drop-down box and press [ENTER].
3. A menu will appear; select “GARMIN” and press [ENTER]. Press [QUIT] twice to exit the menu.

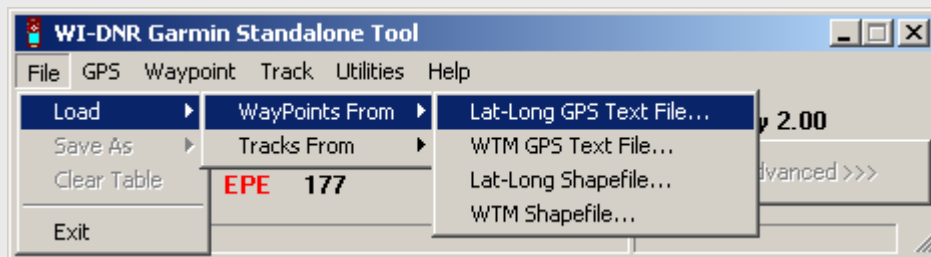
### Step 3: Plug in the PC Interface Cable

1. The GPS receiver should be on and in simulation mode.

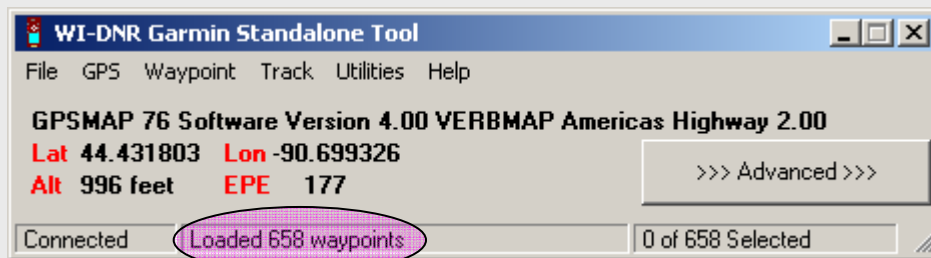
2. Plug the 9-pin serial connector cable into COM port #1 on your PC. If port #1 is in use, plug into the next available port and note the port number. The newest version of the WDNR Garmin GPS Tool (ver. 8.2.8) supports USB connectivity as an alternate to COM port connection.
3. Plug the round end of the PC interface cable into the external data/auxiliary power port under the rubber panel on the back of the GPS receiver.

**Step 4:** Load the GPS text file into the WDNR Garmin Standalone Tool

1. Open the WDNR Garmin GPS Tool file on your computer. Select:  
File > Load > Waypoints From > Lat-Long GPS Text File.



2. Navigate to and select the appropriate GPS text file and select OK. The waypoints will be visible in the Tool's status bar.

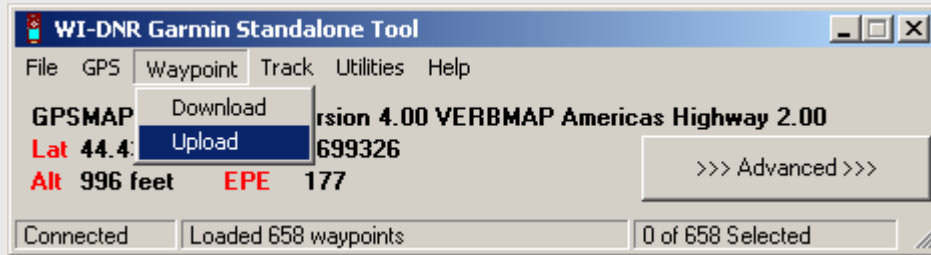


3. If necessary, you can view and edit waypoints by clicking the [Advanced] button on the WDNR Garmin GPS Tool.
4. Troubleshooting COM-enabled setups
  - a. Check that the correct COM port is selected in the WDNR Garmin GPS tool.
    - i. GPS > Assign Port > select correct port #
  - b. Check that the baud rate matches that of the GPS receiver.
    - i. GPS > Assign Port > Baud Rate > 9600
    - ii. A Garmin 76 receiver will transfer at 9600 bits per second

- c. Check that the serial data format is set to “GARMIN” (see Step 2).
- d. If your problem persists, please consult your GPS unit’s user’s manual.

**Step 5:** Upload Waypoint Data from the WDNR Garmin GPS Tool to the GPS receiver

1. In the menu bar, select: Waypoint > Upload



2. A pop-up window will indicate the completion of a successful upload. Click OK.



3. Check that the uploaded waypoints are visible on the GPS receiver: press [MENU] twice to get to the main menu, select “Points”, press [ENTER], select “Waypoints”, and press [ENTER].
4. Troubleshooting
  - a. Storage capability varies by GPS model. In the event that the number of sampling sites exceeds your receiver's storage capacity, the text file containing the survey site information can be split into smaller text files. You will then be able to upload successive files as needed or work from multiple receivers in the field.
  - b. For more help, please refer to the appropriate online documentation or user’s manuals.

## Printing Datasheets

The form used for recording data can be found on the tab labeled “FIELD SHEET” in the Aquatic Plant Survey Data Workbook, downloadable from the University of Wisconsin Extension website (<http://www.uwsp.edu/cnr/uwexlakes/ecology/APM/Appendix-C.xls>). Print the field sheet (waterproof paper recommended), using the “Print Area > Set Print Area” function under the “File” menu to set the appropriate number of rows to print. Under Header (View > Header and Footer > Custom Header) record lake name, Waterbody Identification Code (WBIC), county and survey date.

1	Observer 1: name and hours:						Observer 2: name and hours:						Observer 3: name and hours:						Total hours worked:									
2	Site #	Depth (ft)	Dominant sediment type (M, S, R)	Rake pole (P) or rake rope (R)?	Total Rake Fullness	EWM 1,2,3	CLP 1,2,3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
3	1																											
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## Constructing the Rake Samplers

The rake samplers are each constructed of two rake heads welded together, bar-to-bar, to form a double-sided rake head. The rake head is 13.8 inches (35 centimeters) long, with approximately 14 tines on each side. For use in shallow waters, mount a double-sided rake head to a pole that has the capability to extend to 15 feet (4.6 meters). For use in deeper waters, attach a second double-sided rake head to a rope; this rake head should also be weighted (Figure 2).

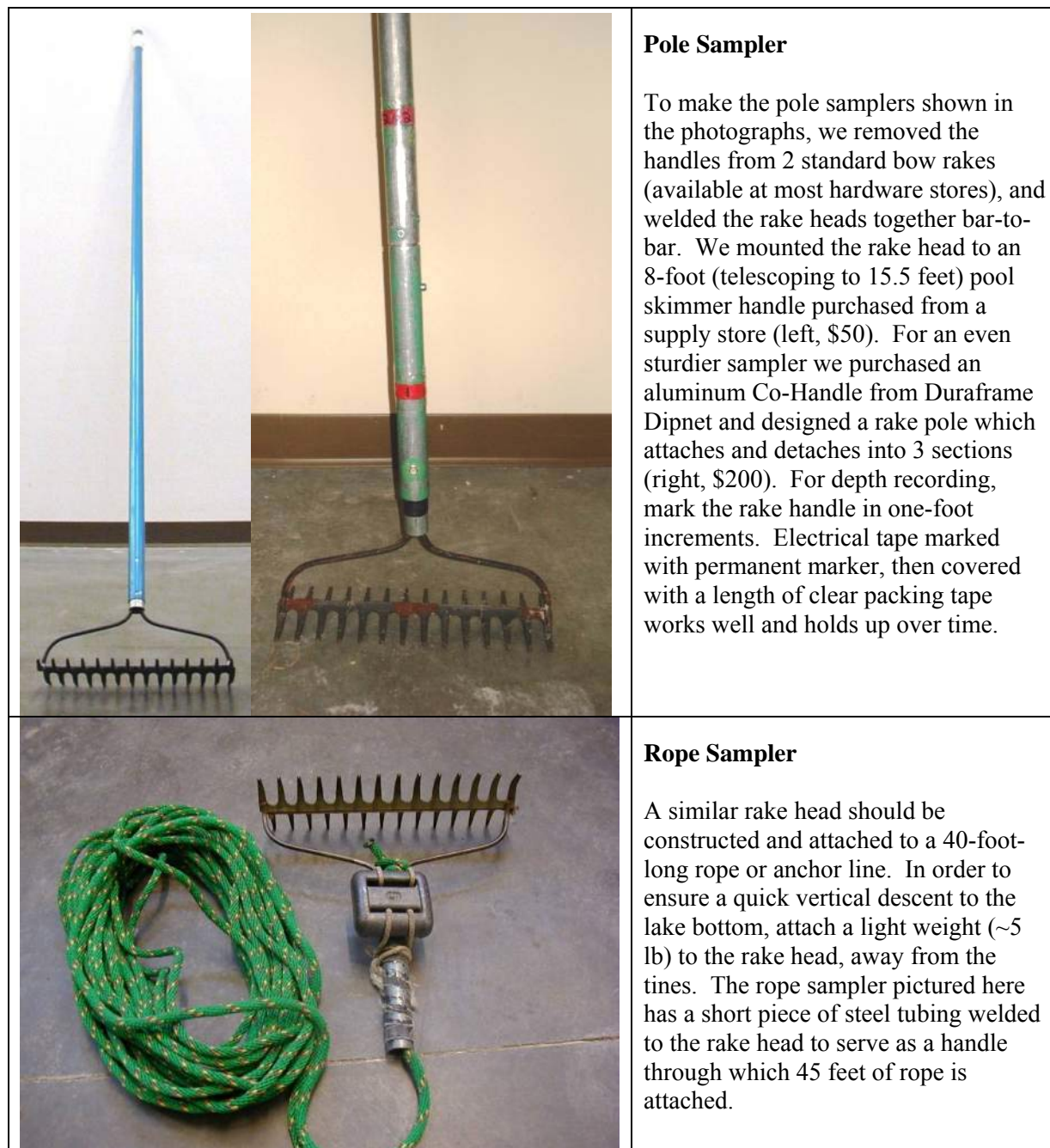


Figure 2: Examples of sampling rakes used during surveys.

## COLLECTING AND RECORDING FIELD DATA

### Using the Rake Samplers

Collect one rake sample per sample site.

In water shallower than 15 feet deep, use the pole sampler. At each sample site, lower the rake straight through the water column to rest lightly on the bottom, twist the rake around twice, and then pull the rake straight out of the water.

In water deeper than 15 feet, drop the rope sampler straight into the water alongside the boat, drag the rake along the sediment surface for approximately one foot (0.3 m), and then pull the rake to the surface.

A large tray or bin may be used to aid in processing the entire sample.

### Navigating to Sites

#### *Accuracy*

The location reported by the GPS receiver has an element of error that varies under different conditions. The total error from the GPS and your navigational error *combined* should not exceed half of the sampling resolution. Therefore, when sampling with a Garmin 76 receiver, navigate at no greater than an 80-foot zoom level and aim to completely cover the sampling site with the arrow. At 80-foot zoom, the locator arrow shown on the screen represents approximately 25 feet in length. In order to sample with acceptable accuracy, the arrow must completely cover the sample site on screen. At coarser zoom levels, because the size of the arrow remains constant, the boat may be more distant from the site even though the arrow completely covers the site. You can use a lower zoom level (120-feet is appropriate) in order to travel from site to site, but as you approach the target site, you must confirm your location at using at least the 80-ft zoom resolution to ensure you are sampling with acceptable accuracy.

#### *Determining Maximum Depth of Plant Colonization*

When sampling, you will have to determine the maximum depth at which the plants are rooted. The maximum depth of colonization (MDC) can vary greatly among lakes, from just a few feet to as deep as the physiological requirements of a species will allow. When sampling a line of sites heading from shore out to deep water, take samples until plants are no longer found on the



rake. Continue sampling at least two sites deeper to ensure you sampled well over the maximum depth of colonization. If no plants are found at these sites, simply record the depth, sampling tool used, and dominant sediment type. Leave the rake fullness and species information blank. Depending on the lake bathymetry, you may choose to continue down the same row to the other side of the lake. Use a depth finder and begin sampling again when the depth reaches that of the last (no plant) site sampled. Alternatively, if the rows are very long, you may choose to move over to the next row and sample sites back into shore, working back and forth along the shoreline and around the lake. However, if the second row is shallower than the first, be sure to start sampling sufficiently far from shore so that the depth is similar to that at which you stopped sampling in the first row. By sampling in this way, over time you will begin to hone in on the maximum depth of plant colonization.



After working several rows crossing the edge of the littoral zone, estimate the maximum depth of colonization (e.g. 20 feet) and only continue to sample deeper sites within 6 feet of this estimation (all sites  $\leq 26$  feet). As you complete more rows and gain confidence in your estimation, you can then begin to gradually omit sampling depths that are too deep for plants to grow. Once you have sampled the deep end of your estimated maximum depth of colonization (i.e. 26 feet) at least three times and have not found any plants, then you can discontinue sampling at anything deeper, but continue to sample any sites shallower ( $\leq 25$  feet). If you then sample a shallower depth three times (i.e. 25 feet) and find no plants at any of those sites, you may now discontinue sampling at these deeper sites and only sample sites shallower than this new sampling depth ( $\leq 24$  feet). Continue to successively eliminate shallower depths in sequence until you establish the maximum depth of colonization. To account for patchiness and other sources of variation, never narrow the sampling window to less than 1.5 feet of the estimated maximum depth of colonization. Use your best judgment when eliminating depths, and remember that plant distribution may be uneven and that different areas of a single lake may have plants growing relatively deeper or shallower. It is good practice to err on the side of oversampling.

## Recording Data

### *Completing the Field Sheet*

#### 1. General site information

Complete the top portion of the “Field Sheet” with the lake name, county, WBIC, date, names of observers, and how many hours each person worked during the survey.



2. Site number

Each site location is numbered sequentially. Each site number will have one row of data on the “Field Sheet.”

3. Depth

Measure and record the depth to the nearest half-foot increment at each site sampled, regardless of whether vegetation is present. The pole mounted rake and rope sampler should be marked to measure the depth of water at a sample site. However, a variety of options exist for taking depth measurements, including sonar handheld depth finders (trigger models) and boat-mounted depth finders. If you are using a depth finder, it is useful to know that the accuracy may decrease greatly in densely vegetated areas. Depth finders sometimes report the depth to the top of the vegetation instead of to the sediment surface. In most cases, it is best to use depth markings on a pole-mounted rake for shallow sites.

4. Dominant sediment type

At each sample site, record the dominant sediment type based on how the rake feels when in contact with the sediment surface as: mucky (M), sandy (S), or rocky (R).

5. Pole vs. Rope

Record whether the pole (P) mounted rake or the rake-on-a-rope (R) was used to take the sample.

6. Rake fullness

At each site, after pulling the rake from the water record the overall rake fullness rating that best estimates the total coverage of plants on the rake (1 - few, 2 - moderate, 3 - abundant; see Figure 3). Also identify the different species present on the rake and record a separate rake fullness rating for each. Account for plant parts that dangle or trail from the rake tines as if they were fully wrapped around the rake head. The rake may dislodge plants that will float to the surface, especially short rosette species not easily caught in the tines. Include the rake fullness rating for plants dislodged and floating but not collected on the rake. Record rake fullness ratings for filamentous algae, aquatic moss, freshwater sponges, and liverworts, but do not include these ratings when determining the overall rake fullness rating. While at a site, perform a brief visual scan. If you observe any species within 6 feet (2m) of the sample site, but not collected with the rake, record these species as observed visually (“V”) on the field sheet. These species will be included in total number of species observed.




Fullness Rating	Coverage	Description
1		Only few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.
2		There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover the tines.
3		The rake is completely covered and tines are not visible.

Figure 3: Illustration of rake fullness ratings used during the survey.

#### 7. Species names

Note that the field datasheet does not include any species names, except for EWM (Eurasian water milfoil) and CLP (Curly-leaf pondweed). The sampling crew must write the species name in subsequent columns the first time that species is encountered. Names must be re-written on successive field sheets as they are encountered. You may use common or Latin names, but be sure there is no ambiguity in the name that will present problems during data entry. The use of standard abbreviations can greatly shorten this process. It is generally safe to shorten the names to include the first three letters of the genus name followed by the first three letters of the species name (i.e. *Ceratophyllum demersum* = CerDem).

#### 8. Inaccessible sites

It may be impossible or unsafe to reach some sample sites. Where the water is very shallow, rocks are present, or dense plant growth prevents navigation, field workers should attempt to access the site as long as doing so is safe and relatively practical. It is often possible to reach difficult sites by using oars or poling; however, keep safety in mind and practice good judgment. Do not get out and drag the boat through mucky sediment to reach a site. If the sampling site is shallow but the substrate is firm, you may be able to walk to the site from shore or from the boat. If you cannot access a site, leave the depth blank and record the appropriate comment on the field datasheet from the list below. Remember to also transfer these to the “Comments” column of the ENTRY sheet (see data entry section):

**a. NONNAVIGABLE (PLANTS)**

1. Sample site cannot be accessed due to thick plant growth.
2. Aquatic plants that are visible within 6 feet of a non-navigable sample site (e.g. water lilies, cattails, bulrushes, etc.) should be recorded as visuals (V) on the datasheet.

**b. TERRESTRIAL**

1. Sample site occurs on land (including islands).
2. Aquatic plants visible within 6 feet of a terrestrial sample site (e.g. water lilies, cattails, bulrushes, etc.) may be included in the general boat survey list, but should not be marked as visuals (V) on the datasheet.
3. Only species rooted in water should be recorded as present or as part of the boat survey.

**c. SHALLOW**

1. Sample site is in water that is too shallow to allow access.
2. Aquatic plants that are visible within 6 feet of a shallow sample site should be recorded as visuals (V) on the datasheet.

**d. ROCKS**

1. Sample site is inaccessible due to the presence of rocks.

**e. DOCK**

1. Sample site is inaccessible due to the presence of a dock or pier.

**f. SWIM AREA**

1. Sample site is inaccessible due to the presence of a designated swimming area.

**g. TEMPORARY OBSTACLE**

1. Sample site is inaccessible due to the presence of a temporary obstacle such as a boater, swimmer, raft, loon, etc.
2. If possible, try to revisit this site later on during the survey once the temporary obstacle has moved.

**h. NO INFORMATION**

1. No information is available about the sample site because it was not traveled to (inaccessible channel, accidentally omitted during survey, skipped due to time constraints, etc.).

**i. OTHER**

1. Site was not sampled for another reason; please provide a brief description.

**9. Filling Out the Boat Survey Datasheet**

Often there will be localized occurrences of certain species (e.g., floating-leaf or emergent species) that are missed by the point-intercept grid. For areas that are outside the grid or in between sampling sites, record the name of the plant and the closest site to the plant. This information will be entered into the “BOAT SURVEY” section of the data entry file. Emergent near-shore vegetation should only be recorded if it’s rooted in water.

### *Collecting and Identifying Voucher Samples*

Voucher each plant species for verification and identification. You can often use plants collected on the rake as vouchers. However, if the sample is of poor quality or lacks reproductive structures, attempt to collect a better specimen. If a better specimen is unavailable, voucher and press what you are able to collect. Remember that the more material collected, the easier identification will be. Whenever possible, collect at least two specimens, and include reproductive material such as seeds, flowers, fruit, roots, etc. Place the voucher plant into a re-sealable plastic bag with a waterproof voucher label. The voucher label should include the species name, or in the case of unknown species, a unique identifier, the lake name, county, sample site, sediment type, collector's name, and the date. Additional information about habitat or co-occurring species may also be included on the tag. Place all specimens in a cooler for transport to the lab. See below, "Pressing Plants" for instructions once back at the laboratory.

### *Plant Identification and Troublesome Taxa*

1. Plants should be identified to species whenever possible. Certain genera, including *Carex*, *Sparganium*, and *Sagittaria* must be flowering and/or fruiting to confirm identification and may not be identifiable to species without these parts.
2. Non-angiosperms such as *Chara* or *Nitella* are identified to genus only. Often, *Isoetes* can be identified to species by looking at spores, if present. Filamentous algae, aquatic moss, and freshwater sponge can be referred to simply as algae, moss, and sponge.
3. If a plant cannot be identified in the field, place the two voucher specimens in a re-sealable bag with a separate voucher label. Take these specimens back to the lab to verify the identity. The label should include a unique identifier, lake, county, the sample site number, and sediment type. The presence and fullness of the species should be recorded on the field datasheet under the same unique identifier name listed on the voucher label.
4. In the lab, try to identify the plant using plant identification keys and a stereo microscope. If you are still uncertain of the identity of the plant, contact a DNR biologist in your region to help with identification. Do not send specimens to an expert until you notify them of your intended shipment and they have instructed you to do so. Once the plant is identified, record this information so that the correct identification is used during data entry.

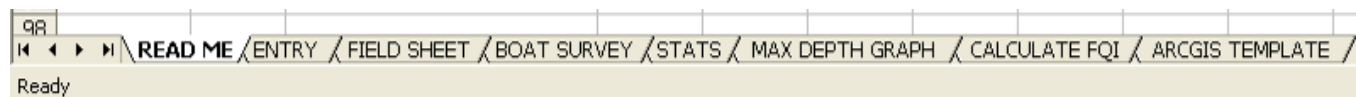


## ENTERING DATA ELECTRONICALLY

### Worksheet Descriptions and Instructions

The Aquatic Plant Survey Data Workbook

(<http://www.uwsp.edu/cnr/uwexlakes/ecology/APM/Appendix-C.xls>) contains eight worksheets:



#### 1. READ ME

Provide a brief description of the six other worksheets included in the workbook.

#### 2. FIELD SHEET

The FIELD SHEET should be printed on waterproof paper for recording the field data.

#### 3. ENTRY

- a. There are many formulas embedded in the ENTRY sheet that allow for the statistical calculations on the STATS sheet. Thus, **DO NOT add or delete columns or rows on the ENTRY or STATS sheets.**
- b. Data collected in the field is recorded on the FIELD SHEET and afterwards transferred to the electronic ENTRY sheet.
- c. Copy latitude and longitude information for the sample sites from the GPS text file and paste into the appropriate columns of the ENTRY sheet.
- d. Record the lake and county name, WBIC, survey date, and the names of the field workers.
- e. There is a column for comments on the ENTRY sheet. Please use the standardized comments discussed on page 18 of this protocol.
- f. Species' Latin names appear alphabetically in the first row of the spreadsheet. Species such as aquatic moss, freshwater sponge, filamentous algae, and liverworts are listed separately at the end of the alphabetical list.
- g. Additional species not already listed should be added in the columns at the end of the alphabetical list (sp1, sp2, etc.). Any vouchered specimens that are awaiting ID confirmation should be entered here as well. You should use the same unique voucher identifier established in the field to for ease of updating the information.

- h. We strongly recommend double-checking the electronically entered data against the original field datasheets to ensure that no errors or omissions occurred during the entry process.

#### 4. BOAT SURVEY

- a. Enter information on plants observed during the survey that were observed more than 6 feet away from a sample site.
- b. Additional comments about field conditions, known management activities, or other observations can also be recorded in this worksheet.

#### 5. STATS

The STATS worksheet automatically calculates summary statistics using the data entered into the ENTRY worksheet (see Appendix 2, Table 1). There are several summary calculations including:

##### a. Individual Species Statistics:

- i. **Frequency of occurrence within vegetated areas (%)**: Number of sites at which a species was observed divided by the total number of vegetated sites. Frequency of occurrence is sensitive to the number of sample sites included. Including non-vegetated sites will lower the frequency of occurrence.
- ii. **Frequency of occurrence at sites shallower than maximum depth of plants**: Number of sites a species was observed at divided by the total number of sites shallower than maximum depth of plants.
- iii. **Relative frequency (%)**: This is a proportional value that reflects the degree to which an individual species contributes to the sum total of all species observations. The sum of the relative frequencies of all species is 100%. Relative frequency is not sensitive to whether all sampled sites, including non-vegetated sites, are included. Relative frequency does not take into account aquatic moss, freshwater sponges, filamentous algae, or liverworts.
- iv. **Relative frequency (squared)**: This value is only part of a calculation and is not used directly.
- v. **Number of sites where a species was found**: This is the sum of the number of sites at which a species was recorded on the rake.
- vi. **Average rake fullness**: Mean rake fullness rating, ranges from 1-3.
- vii. **Number of visual sightings**: This is the total number of times a plant was seen within 6 feet of the boat, but not collected on the rake.
- viii. **Present (visual or collected)**: Automatically fills in “present” if the species was observed at a sample site.

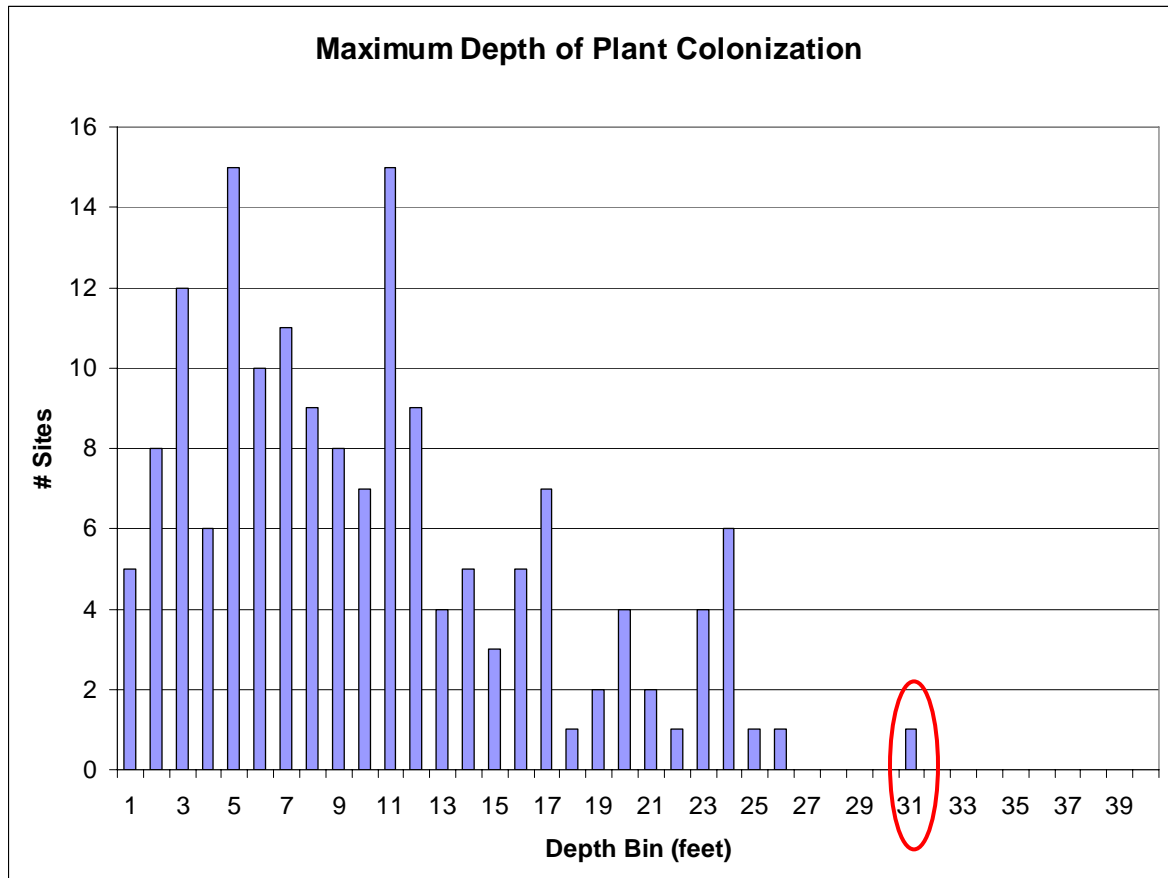
**b. Summary Statistics:**

- i. Total number of sites visited:** Total number of sites where depth was recorded, even if a rake sample was not taken.
- ii. Total number of sites with vegetation:** Total number of sites where at least one plant was found on the rake.
- iii. Total number of sites shallower than maximum depth of plants:** Total number of sites where the depth was less than or equal to the maximum depth at which plants were found. This value is used for frequency of occurrence at sites shallower than maximum depth of plants.
- iv. Frequency of occurrence at sites shallower than maximum depth of plants:** Number of times plants were recorded at a site divided by the total number of sites sampled that were shallower than the maximum depth of plants.
- v. Simpson's Diversity Index:** A nonparametric estimator of community heterogeneity. It is based on relative frequency and thus is not sensitive to whether all sampled sites (including non-vegetated sites) are included. The closer the Simpson Diversity Index is to 1, the more diverse the community.
- vi. The maximum depth of plants:** This is the depth of the deepest site sampled at which vegetation was present. Please note that this value does not take into account aquatic moss, freshwater sponges, filamentous algae, or liverworts. See "MAX DEPTH GRAPH" below for more information.
- vii. Number of sites sampled using rake on rope (R)**
- viii. Number of sites sampled using rake on pole (P)**
- ix. Average number of all species per site (shallower than max depth):** Mean number of species found at sample sites which were less than or equal to the maximum depth of plant colonization.
- x. Average number of species per site (vegetated sites only):** Mean number of species found at sample sites where vegetation was present.
- xi. Average number of native species per site (shallower than maximum depth):** This does not include Eurasian water milfoil, Curly-leaf pondweed, Purple loosestrife, Spiny naiad, or Reed canary grass.
- xii. Average number of native species per site (vegetated sites only)**
- xiii. Species richness:** Total number of species observed not including visual sightings. Please note that this value does not include aquatic moss, freshwater sponges, filamentous algae, or liverworts.
- xiv. Species richness (including visuals):** Total number of species observed including visual sightings recorded within 6 feet of the sample site (but does not include additional species found during the boat survey).

**6. MAX DEPTH GRAPH**

The maximum depth of colonization is an important metric to characterize accurately, as it can indicate changes in water clarity and water quality over time. This worksheet automatically displays a histogram of plant occurrences by water depth. Occasionally, unrooted plants floating in the water column are snagged by the rake, which can sometimes result in an inaccurate estimation of the maximum depth of colonization. It is

important to examine the reported maximum depth of plant colonization in order to detect potential outliers. As a general rule, a single plant occurrence reported at a site which is 2 or more feet deeper than the next shallowest site with plants is considered an outlier, and should be excluded when determining the maximum depth of plant colonization (see Figure 4).



**Figure 4: Distribution of plant occurrences versus water column depth. The value circled in red is more than 2 feet deeper than all other plants found during the survey, and is considered an outlier. Outliers should be omitted when determining the maximum depth of plant colonization.**

It is necessary to delete the occurrence of this outlier from the ENTRY spreadsheet so that the automatically-calculated statistics will reflect the revised maximum depth of colonization. To do this, locate the sampling point number on the ENTRY worksheet where the outlier was found. Scroll across the row until you find the outlier to omit. Once you've located the cell with the outlier, press delete to clear the cell. Right click on the cell and select "Insert Comment". Briefly describe the occurrence of the outlier and the reason for omitting it. Follow the same steps with the overall rake fullness column, deleting out the contents of the cell and including a brief comment. Please also include information regarding any omissions of outliers and revised MDC directly on the STATS spreadsheet, typing all comments in the space below "See Max Depth Graph Worksheet to Confirm".

	Entry	sp.	Depth (ft)	Dominant sediment type (M=mucl., S=Sand, R=Rock) Sampled holding rake pole (P) or rake-rope (R)?	comments	Total Rare F-fulness Microphyllum apicatum - Eurasian water-nitil or Hybrid Potamogeton crispus (Curlyleaf pondweed) Acorus americanus - Shieldlily Alisma triviale, Northern water-plains Bidens bonariensis (Formerly Megalobidens), Water meadow Boboschoenus fluitans, River burdock Brassica schrobleri, Watercress Calla palustris, Wild calla Calthice hermaphrodites, Autumnal water-starwort Carex comosa, Common water-lily Catabrosa aquatica Cerastophyllum
104		103	2 S	P		
105		104	11.5 M	P		
106		105	13.5 M	P		
107		106	13 M	P		
108		107	0.5 S	P		
109		108	2 S	P		
110		109	8.5 S	P		
111		110	13.5 M	P		
112		111	19 M	R		
113		112	25 M	R		
114		113	33 M	R		
115		114			DEEP	
116		115			DEEP	
117		116			DEEP	
118		117			DEEP	
119		118	31 S	R	naultm:	
120		119	24 S	R	overall rake fullness of 1 (coontail) found at 31 ft; omitted for being 5 feet deeper than all other plants recorded during survey;	
121		120	15.5 S	P	MDC revised = 26 ft	
122		121	12.5 S	P		
123		122	12 S	P		
124		123	5 S	P		
125		124			TERRESTRIAL	
126		125	7.5 M	P		
127		126	15.5 M	P		

## **Saving the File**

Once the data is electronically entered into the Aquatic Plant Survey Data Workbook (<http://www.uwsp.edu/cnr/uwexplakes/ecology/APM/Appendix-C.xls>), please save the file with a name indicating the lake, county, WBIC, and year sampled. The format we recommend is: Lake\_County\_WBIC\_(year).xls. For example, Lake Mendota sampled in 2009 would be named: Mendota\_Dane\_805400\_(2009).xls

## **Double-Checking the Data**

We strongly recommend double-checking the electronic data against the field sheet to catch any errors made during the entry process.

## **Sending the Data**

Send the final electronic file to the WDNR via email ([DNRBaselineAquaticPlants@wisconsin.gov](mailto:DNRBaselineAquaticPlants@wisconsin.gov)). There should be one file for each completed lake survey.

## **Creation of Plant Distribution Maps**

Aquatic plant distribution maps can be easily created using the point-intercept data collected during the survey. Instructions on how to create these maps can be found in Appendix 3 and 4.

## **Statistical Analysis of Data**

Statistical comparisons of datasets can easily be analyzed between pre- and post-management activities or between two survey years by using a simple chi-square analysis. The chi-square analysis is commonly used to examine whether or not there was a statistically significant change in the occurrence of a plant species between the survey years or after management activities have occurred. The “Compute Pre-Post Data” worksheet (available at: <http://www.uwsp.edu/cnr/uwexplakes/ecology/APM/Apendix-D1.xls>), allows users to enter in the number of sites at which a species was recorded during each survey, and provides an output indicating whether or not differences reflect a statistically significant change in the plant community.

## **PRESSING PLANTS – PREPARATION OF VOUCHER SPECIMENS**

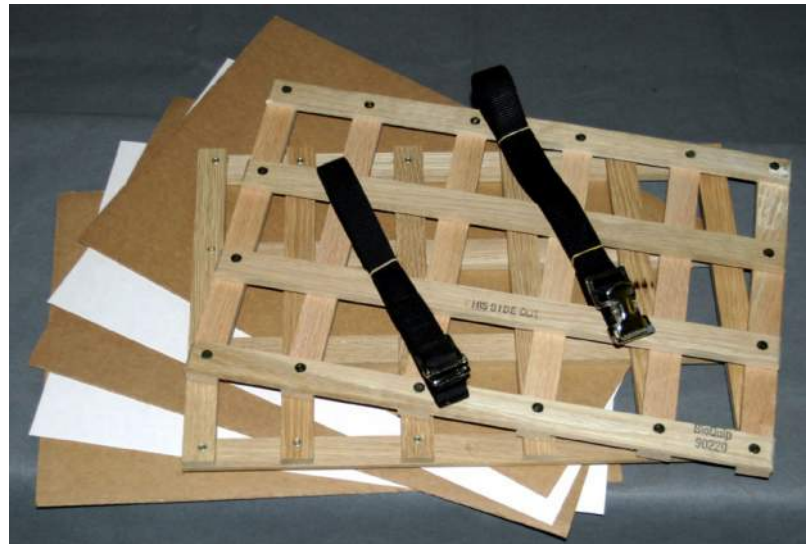
### **“Floating” Specimens**

Because most aquatic plants, especially finely dissected specimens, tend to stick to paper as they dry, it is usually better to “float” the plant directly onto herbarium paper. However, if the plant is large and robust, or not entirely aquatic (such as bulrushes, emergent sedges or pickerelweed) you can press the plant in newsprint.

1. Use a pencil to label the mounting paper with the plant name, geographic location, date collected, and serial code (a unique identifier in a series that identifies all specimens you have pressed; we use the initials of the presser followed by the year and a sequential number; i.e. AM2009-01). Mount only one species per sheet, and do not cut herbarium sheets in half.
2. Carefully rinse the plant so it is free of epiphyton, silt, and other debris.
3. Fill a sink or tray with about one inch of water. Slip the labeled mounting paper into the water.
4. Float the plant in the water and arrange it onto the sheet.
5. If the plant has fine leaflets, such as water milfoil or bladderwort, cut off one leaf and display it floated out onto the paper so that leaflet characteristics can be readily observed.
6. The plant may be bent into a “V” or “W” or curled shape to fit on the sheet.
7. Slowly lift the paper out of the water by one end. Keeping the plant in place, let the water slowly drain off.
8. Use a toothpick or probe to spread out plant parts for better display, making sure to expose identifiable characteristics such as stipules, sheaths or seeds.

### Pressing Specimens

- Cover the plant with a sheet of waxed paper or plastic wrap if it is especially delicate (we recommend this technique especially for bladderworts and other fine, delicate species).
- Place the specimen sheet inside folds of newspaper.
- Place the newspaper between two sheets of blotting paper, and the blotting paper between two sheets of corrugated cardboard.
- Place multiple specimens in a plant press. Use rope or straps to compress plants to keep specimens flat as they dry.
- Place the press somewhere warm and dry. Placing the press on its long edge on top of a ventilated aluminum or aluminum-lined box containing incandescent light bulbs allows for quick drying. Remove plants after several days when they are thoroughly dry.



## Suggested Herbarium Materials

Herbarium and science supply businesses such as the Herbarium Supply Company ([www.herbariumsupply.com](http://www.herbariumsupply.com); 800-348-2338) sell many herbarium products including mounting paper, plant presses, blotting paper, and cardboard spacers. When ordering herbarium mounting paper, look for acid-free, non-glossy, 100% rag, and heavy or standard weights.

## Preparing Dried Specimens for Shipment to an Herbarium

1. **Package specimens.** Place each dried specimen with unique identifier clearly marked on the newsprint or mounting paper in the fold of a single sheet of newspaper and place all of the newspaper/specimens between two pieces of cardboard. Tie or rubber band the cardboard bundle together, and put it into a padded envelope or a box. As long as the package is going to or from an educational institution, a special 4<sup>th</sup> class mailing rate called “Library Rate” can be used.
2. **Label information.** Both of the herbaria utilized by the WDNR label the dried plant specimens themselves. Prepare an electronic spreadsheet with the relevant information for each specimen. Send the file to Mark Wetter ([mawetter@wisc.edu](mailto:mawetter@wisc.edu)) for the Madison herbarium or to Robert Freckmann ([rfreckma@uwsp.edu](mailto:rfreckma@uwsp.edu)) for the Stevens Point herbarium. Each row (i.e. each specimen) in the file will need a unique identifier such as the collector’s initials followed by a specimen number. Use the same identifier on the specimen so the herbaria can match the label to the specimen. Each row of the spreadsheet should include columns for the following (column heading in **bold**, example in plain text):
  - a. **Specimen Identifier** CD2009-01
  - b. **Collector Name** Isabel Velez
  - c. **Preparer's Name** (If different from collector) Chad Douwe
  - d. **Lake Name** Little John Jr.
  - e. **County** Vilas
  - f. **Date collected** 7 July 2009
  - g. **Specimen ID** *Potamogeton spirillus*, Spiral-fruited pondweed
  - h. **Habitat** muck over sand
  - i. **Associated species (if known)** *Najas gracillima*, *Potamogeton friesii*
  - j. **TRS** T41N R07E S29
  - k. **WBIC** 1861700
  - l. **More detailed location** (if known) SW edge of lake, 1 m depth
  - m. **GPS lat/long coordinates** (if known) N 46°15.037' W090°01.804'
  - n. **Herbarium of deposition** UWSP
3. **Send pressed plants** to Mark Wetter or Ted Cochrane (UW- Madison), or to Dr. Robert Freckmann (UW-Stevens Point). **Please notify the herbarium of your intention and wait for confirmation before sending plants:**

Mark Wetter or Ted Cochrane  
University of Wisconsin-Madison Herbarium  
Department of Botany, Birge Hall  
430 Lincoln Drive  
Madison, WI 53706-1381  
tel.: (608) 262-2792  
FAX: (608) 262-7509  
[www.botany.wisc.edu/herbarium/](http://www.botany.wisc.edu/herbarium/)

Dr. Robert Freckmann  
Robert Freckmann Herbarium  
0310 CNR Addition  
1900 Franklin Street  
Stevens Point, WI 54481  
[rfreckma@uwsp.edu](mailto:rfreckma@uwsp.edu)

- 4. Send electronic record to the WDNR.** Please send a copy of the electronic herbarium file along with the plant data to [DNRBaselineAquaticPlants@wisconsin.gov](mailto:DNRBaselineAquaticPlants@wisconsin.gov).

## CONCLUSIONS

There will be four products from each plant survey. First, there will be the raw data from the quantitative survey which provides a lakewide plant species list and distribution and rake fullness data for each species observed. Second, there will be summary statistics useful in characterizing and comparing populations. Third, there will be observations from the general boat survey. Fourth, voucher specimens will provide a catalog of plant species present in the lake and will bolster the state collections. All electronic data should be sent by email to the WDNR ([DNRBaselineAquaticPlants@wisconsin.gov](mailto:DNRBaselineAquaticPlants@wisconsin.gov)).

## ACKNOWLEDGEMENTS

We would like to extend our sincere thanks to the WDNR Lake Coordinators and Aquatic Plant Management staff for recommendations and comments in the design, implementation, and applications of the data and the survey methodology. The many hours the field staff put into testing this methodology was integral to its successful development, and we are very grateful for all of their hard work.

## Appendix 1

Current (02/2010) contact information for regional WDNR aquatic plant management (APM) and lake coordinators

### **Northern Region (NOR)**

(Ashland, Barron, Bayfield, Burnett, Douglas, Florence, Forest, Iron, Langlade, Lincoln, Oneida, Polk, Price, Rusk, Sawyer, Taylor, Vilas, & Washburn Co.)



#### **Frank Koshere**

APM Coordinator

715-392-0807

frank.koshere@wisconsin.gov

#### **Kevin Gauthier, Sr.**

Florence, Forest, Langlade, Lincoln, Oneida, & Vilas Co.

715-365-8937

kevin.gauthiersr@wisconsin.gov

#### **Pamela Toshner**

Barron, Bayfield, Burnett, Douglas, Polk, & Washburn Co.

715-635-4073

pamela.toshner@wisconsin.gov

#### **Jim Kreitlow**

Ashland, Iron, Price, Rusk, Sawyer, & Taylor Co.

715-365-8947

james.kreitlow@wisconsin.gov

### **Southeast Region (SER)**

(Kenosha, Milwaukee, Ozaukee, Racine, Sheboygan, Walworth, Washington, & Waukesha Co.)



#### **Heidi Bunk**

: Ozaukee, Sheboygan, Walworth, Washington, & Waukesha Co.

262-574-2130

heidi.bunk@wisconsin.gov

#### **Craig Helker**

Kenosha, Milwaukee, & Racine Co.

262-884-2357

craig.helker@wisconsin.gov

### **South Central Region (SCR)**

(Columbia, Dane, Dodge, Green, Grant, Iowa, Jefferson, Lafayette, Richland, Rock, & Sauk Co.)



#### **Susan Graham**

Lake & APM Coordinator

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## Appendix 2

This appendix contains examples of statistical outputs created through the point-intercept sampling method for Kathan Lake, Oneida County. The data was collected during a survey conducted August 21-22, 2007.

**Table 1. Summary Statistics**

<b>Total number of sites set-up</b>	<b>203</b>
<b>Total number of sites visited</b>	<b>171</b>
<b>Total number of sites with vegetation</b>	<b>149</b>
<b>Total number of sites shallower than maximum depth of plants</b>	<b>165</b>
<b>Frequency of occurrence at sites shallower than maximum depth of plants</b>	<b>90.30</b>
<b>Simpson Diversity Index</b>	<b>0.94</b>
<b>Maximum depth of plants (ft)</b>	<b>9.50</b>
<b>Number of sites sampled using rake on Rope (R)</b>	<b>0</b>
<b>Number of sites sampled using rake on Pole (P)</b>	<b>171</b>
<b>Average number of all species per site (shallower than max depth)</b>	<b>3.96</b>
<b>Average number of all species per site (veg. sites only)</b>	<b>4.39</b>
<b>Average number of native species per site (shallower than max depth)</b>	<b>3.56</b>
<b>Average number of native species per site (veg. sites only)</b>	<b>3.95</b>
<b>Species Richness</b>	<b>37</b>
<b>Species Richness (including visuals)</b>	<b>38</b>
<b>Species Richness (including visuals &amp; boat survey)</b>	<b>40</b>

**Table 2. Individual species frequency of occurrences**

Common Name	Scientific Name	% Frequency (Littoral)	% Frequency (Whole lake)	% Frequency (in vegetated areas)	Relative Frequency (%)
Bushy pondweed	<i>Najas flexilis</i>	41.2	39.8	45.6	10.4
Common waterweed	<i>Elodea canadensis</i>	40.6	39.2	45.0	10.2
Eurasian water milfoil*	<i>Myriophyllum spicatum</i> *	40.0	38.6	44.3	10.1
Filamentous algae	<i>Algae</i> spp.	26.1	25.1	28.9	6.6
Coontail	<i>Ceratophyllum demersum</i>	23.0	22.2	25.5	5.8
Stoneworts	<i>Nitella</i> spp.	21.8	21.1	24.2	5.5
Watershield	<i>Brasenia schreberi</i>	20.6	19.9	22.8	5.2
Small bladderwort	<i>Utricularia minor</i>	17.6	17.0	19.5	4.4
Small pondweed	<i>Potamogeton pusillus</i>	17.0	16.4	18.8	4.3
Common bladderwort	<i>Utricularia vulgaris</i>	16.4	15.8	18.1	4.1
Wild celery	<i>Vallisneria americana</i>	15.2	14.6	16.8	3.8
Flat stem pondweed	<i>Potamogeton zosteriformis</i>	13.9	13.5	15.4	3.5
Stiff pondweed	<i>Potamogeton strictifolius</i>	11.5	11.1	12.8	2.9
Ribbon leaf pondweed	<i>Potamogeton epihydrus</i>	9.1	8.8	10.1	2.3
White water lily	<i>Nymphaea odorata</i>	7.9	7.6	8.7	2.0
Muskgrasses	<i>Chara</i> spp.	7.3	7.0	8.1	1.8
Freshwater sponge	Sponge spp.	6.1	5.8	6.7	1.5
Moss	Moss spp.	6.1	5.8	6.7	1.5
Large-leaf pondweed	<i>Potamogeton amplifolius</i>	5.5	5.3	6.0	1.4
Spiny-spored quillwort	<i>Isoetes echinospora</i>	4.9	4.7	5.4	1.2
Waterwort	<i>Elatine minima</i>	4.2	4.1	4.7	1.1
Creeping spikerush	<i>Eleocharis palustris</i>	4.2	4.1	4.7	1.1
Water horsetail	<i>Equisetum fluviatile</i>	4.2	4.1	4.7	1.1
Northern water milfoil	<i>Myriophyllum sibiricum</i>	4.2	4.1	4.7	1.1
Thin floating-leaf bur-reed	<i>Sparganium</i> sp.	4.2	4.1	4.7	1.1
Spatterdock	<i>Nuphar variegata</i>	3.6	3.5	4.0	0.9
Spiral-fruited pondweed	<i>Potamogeton spirillus</i>	3.6	3.5	4.0	0.9
American bur-reed	<i>Sparganium americanum</i>	3.6	3.5	4.0	0.9
Shoreweed	<i>Littorella uniflora</i>	3.0	2.9	3.4	0.8
Brown-fruited rush	<i>Juncus pelocarpus</i> f. <i>submersus</i>	2.4	2.3	2.7	0.6
Variable pondweed	<i>Potamogeton gramineus</i>	2.4	2.3	2.7	0.6
Twin-stemmed bladderwort	<i>Utricularia geminiscapa</i>	1.8	1.8	2.0	0.5
Pipewort	<i>Eriocaulon aquaticum</i>	0.6	0.6	0.7	0.2
Clasping leaf pondweed	<i>Potamogeton richardsonii</i>	0.6	0.6	0.7	0.2
Broad-leaved arrowhead	<i>Sagittaria latifolia</i>	0.6	0.6	0.7	0.2
Thin-leaved pondweed	<i>Potamogeton</i> sp.	0.6	0.6	0.7	0.2
Flat-leaved bladderwort	<i>Utricularia intermedia</i>	0.6	0.6	0.7	0.2
Cattail	<i>Typha</i> sp.	Visual	Visual	Visual	Visual
Needle spikerush	<i>Eleocharis acicularis</i>	Boat Survey	Boat Survey	Boat Survey	Boat Survey
Three-way sedge	<i>Dulichium arundinaceum</i>	Boat Survey	Boat Survey	Boat Survey	Boat Survey

**Table 3. Number of sites where species was found and average rake fullness rating**

Common Name	Scientific Name	# sites where species was found	# sites where species was found (including visuals)	Average rake fullness rating
Bushy pondweed	<i>Najas flexilis</i>	68	68	1.28
Common waterweed	<i>Elodea canadensis</i>	67	67	1.28
Eurasian water milfoil*	<i>Myriophyllum spicatum</i> *	66	71	1.47
Filamentous algae	<i>Algae</i> spp.	43	43	1.00
Coontail	<i>Ceratophyllum demersum</i>	38	38	1.37
Stoneworts	<i>Nitella</i> spp.	36	36	1.00
Watershield	<i>Brasenia schreberi</i>	34	58	1.68
Small bladderwort	<i>Utricularia minor</i>	29	29	1.10
Small pondweed	<i>Potamogeton pusillus</i>	28	28	1.14
Common bladderwort	<i>Utricularia vulgaris</i>	27	27	1.30
Wild celery	<i>Vallisneria americana</i>	25	26	1.36
Flat stem pondweed	<i>Potamogeton zosteriformis</i>	23	25	1.22
Stiff pondweed	<i>Potamogeton strictifolius</i>	19	19	1.16
Ribbon leaf pondweed	<i>Potamogeton epihydrus</i>	15	18	1.27
White water lily	<i>Nymphaea odorata</i>	13	42	1.69
Muskgrasses	<i>Chara</i> spp.	12	12	1.25
Freshwater sponge	Sponge spp.	10	11	1.00
Moss	Moss spp.	10	10	1.20
Large-leaf pondweed	<i>Potamogeton amplifolius</i>	9	10	1.33
Spiny-spored quillwort	<i>Isoetes echinospora</i>	8	11	1.00
Waterwort	<i>Elatine minima</i>	7	8	1.00
Creeping spikerush	<i>Eleocharis palustris</i>	7	9	1.14
Water horsetail	<i>Equisetum fluviatile</i>	7	15	1.43
Northern water milfoil	<i>Myriophyllum sibiricum</i>	7	7	1.00
Thin floating-leaf bur-reed	<i>Sparganium</i> sp.	7	7	1.00
Spatterdock	<i>Nuphar variegata</i>	6	22	1.17
Spiral-fruited pondweed	<i>Potamogeton spirillus</i>	6	6	1.00
American bur-reed	<i>Sparganium americanum</i>	6	11	1.50
Shoreweed	<i>Littorella uniflora</i>	5	5	1.00
Brown-fruited rush	<i>Juncus pelocarpus</i> f. <i>submersus</i>	4	5	1.25
Variable pondweed	<i>Potamogeton gramineus</i>	4	5	1.00
Twin-stemmed bladderwort	<i>Utricularia geminiscapa</i>	3	3	1.00
Pipewort	<i>Eriocaulon aquaticum</i>	1	2	1.00
Clasping leaf pondweed	<i>Potamogeton richardsonii</i>	1	1	2.00
Broad-leaved arrowhead	<i>Sagittaria latifolia</i>	1	1	1.00
Thin-leaved pondweed	<i>Potamogeton</i> sp.	1	1	1.00
Flat-leaved bladderwort	<i>Utricularia intermedia</i>	1	1	1.00
Cattail	<i>Typha</i> sp.	Visual	3	n/a
Needle spikerush	<i>Eleocharis acicularis</i>	Boat Survey	Boat Survey	n/a
Three-way sedge	<i>Dulichium arundinaceum</i>	Boat Survey	Boat Survey	n/a

## Appendix 3

### Creating a Plant Distribution Map Using Point Intercept Data in ArcGIS 9.3

This is a protocol for making a plant distribution map using ArcGIS 9.3 and the Excel (2003 version) file of data from the point intercept (PI) survey. This protocol can be changed in a number of different ways and still produce a similar product. The best way to make PI-based maps depends on the particular dataset; however, this procedure works well in most cases. Similar images may be created in PowerPoint or in photo editing software if the dataset is not large or complex.


1. After entering the PI survey data into the Aquatic Plant Survey Data Workbook (Appendix-C.xls), save the file using a unique name. We recommend the convention: Lake\_County\_WBIC\_(YYYY).xls
2. Prepare <Lake\_County\_WBIC\_(YYYY).xls> For Join
  - a. Open file in Excel
  - b. **File → Save As → Lake\_County\_WBIC\_(YYYY)\_JOIN.xls (DO NOT MODIFY ORIGINAL FILE)**
  - c. Delete all worksheets except for ENTRY and ARCGIS TEMPLATE (make sure to scroll left and delete the README sheet)
    - i. Click on worksheet tab; Edit → Delete Sheet → Delete
  - d. Delete the following columns
    - i. Entry columns (A & I) and calculated columns (B-H)
      1. Columns B-H are normally hidden. To “unhide” them, cursor over the column heading (A) at the top of the sheet and click/drag to highlight it and the adjacent column (I). Right click the highlighted region, then select unhide. Columns B-H are colored blue. Now delete all columns A-I.
    - ii. Latitude, Longitude columns (possibly hidden, located between sampling point and depth columns)
    - iii. Replace first row of ENTRY with ARCGIS TEMPLATE
      1. Copy the entire first row of truncated species names from the ARCGIS TEMPLATE worksheet
      2. Highlight the first row on the ENTRY worksheet and replace with the template (Edit → Paste)
    - iv. Species columns with no data
      1. Add a count row to identify empty columns to delete
        - a. Select all cells and remove any validation
          - i. Select All (Ctrl-A)
          - ii. Data → Validation → OK → Allow Any Value → OK
        - b. In the row below the last sampled point, and in the first column under a plant species, enter the formula =counta(
        - c. Then highlight the column up to the first sampling point. The beginning of this procedure is depicted below.

- d. Finally, add a closing ) and hit enter. The final formula will be similar to this: =counta(G2:G500)
- e. Point the cursor over the bottom right corner of the cell until cursor turns into a “+”. Click/Drag this formula all the way across to the end of the species list.
- f. Delete any columns where the sum row is equal to 0
- g. Then delete the sum row
- e. Delete any rows after the last applicable sample point
  - i. The “sample\_pt” column is usually populated up to 4000 points; delete any rows where the sampling point column is numbered, but these sample points are greater than the number of points set-up in the lakewide grid, and therefore the row doesn’t contain any information.
- f. Add a “dummy” row so all data imports into ArcGIS as “text”
  - i. Add a row directly above the first sampled point
  - ii. In this newly created row, under the Sampling Point column, enter the number equal to the total number of sample points plus 1 (i.e. total sampling points in example image is 187. The number 188 would be entered into the “dummy” row under the sampling point)
- g. Enter “Z” in all other cells in all columns that contain any information

- h. Save the file and close Excel
3. Save the lake specific polygon and point shapefiles to a folder on a local drive
  - a. We’ll refer to this folder as “MapFolder”
4. Open ArcMap
  - a. Select to Start using ArcMap with “a new empty map” and click “OK”

5. Add Data (either method “a” or “b”)

a. Using Add Data Button

- i. Select the “Add Data” button; or File → Add Data 
- ii. Navigate to MapFolder
- iii. Highlight both the lake polygon (lake\_county\_WBIC\_poly.shp) and point (lake\_county\_WBIC\_XXmpts.shp) shapefiles
- iv. Click on ‘Add’

b. Directly from ArcCatalog

- i. Situate ArcMap and ArcCatalog windows so that you can see both
- ii. Navigate to MapFolder in ArcCatalog
- iii. Highlight both the lake polygon (lake\_county\_WBIC\_poly) and point (lake\_county\_WBIC\_XXmpts) shapefiles
- iv. Drag and drop these shapefiles into ArcMap
- v. Note: Shapefiles should only be saved, deleted, moved, etc. in ArcCatalog. Using Windows Explorer with shapefiles can result in accidental deletion of individual shapefile files (i.e. \*.shp, \*.dbf, \*.sbn, \*.shx, \*.sbx, and \*.sbn files must all be stored together. ArcCatalog packages these files together so nothing gets lost)

6. Defining Shapefile Projections

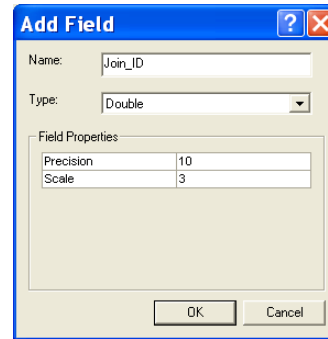
a. If after adding in your shapefiles a warning message regarding “Unknown Spatial Reference” appears, the shapefiles coordinate system is not defined

- i. To define and verify projection, please contact [DNRBaselineAquaticPlants@wisconsin.gov](mailto:DNRBaselineAquaticPlants@wisconsin.gov)
- ii. Alternatively, the shapefile projection can be defined manually by using the Define Projection Tool located in ArcToolbox
  1. ArcToolbox → Data Management Tools → Projections and Transformations → Define Projection
  2. Input Dataset or Feature Class
    - a. Select the shapefile that needs a defined projection
  3. Click on the browse button (right side of dialog box)
  4. In the Spatial Reference Properties dialog box, click on the “Select” button
  5. Browse for the correct coordinate system
    - a. Projected Coordinate System → State Systems → NAD 1983 HARN Wisconsin TM.prj; Click Add.
      - i. Do not use the US Feet system
      - ii. The coordinate system name may also be displayed as NAD 1983 HARN Transverse Mercator
    - iii. Coordinate system parameters:
      1. Projection → Transverse Mercator
      - False Easting → 520000.00000000
      - False Northing → -4480000.000000
      - Central Meridian → -90.00000000
      - Linear Unit → Meter

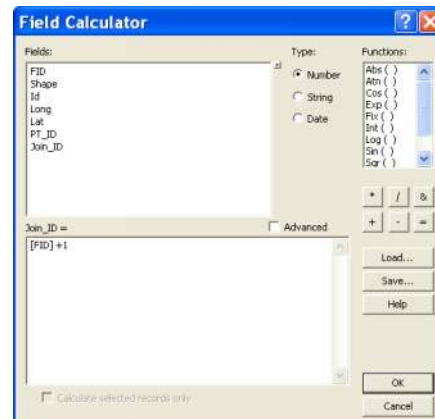
6. Select “OK” on Spatial Reference Properties dialog box, and “OK” on define projection tool

7. Edit Attribute Table for point shapefile

- a. Open Attribute Table
  - i. Right click on point shapefile in ArcMap table of contents
  - ii. Select “Open Attribute Table”
- b. Add a Field
  - i. Select the “Options” button → “Add Field”
  - ii. Name: Join\_ID
  - iii. Type: Double
  - iv. Precision: 10
  - v. Scale: 3



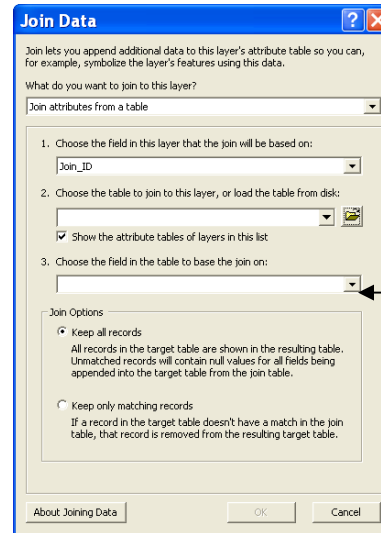
- c. Populate Join\_ID Column
  - i. Right click on “Join\_ID” column heading
  - ii. Select “Field Calculator”
  - iii. If Field Calculator warning message pops up, click “Yes”
  - iv. Set expression by double-clicking FID in the “Fields:” box and typing +1. The white box under “Join\_ID =” should now read [FID] +1
  - v. Click “OK”
  - vi. Your Join\_ID column should now be populated in sequential order, starting with point #1 at the top
  - vii. Close the attribute table
  - viii. Note: This expression is assuming that each unique ID was based off of the calculation [FID] +1 when creating the initial point file. If the unique ID’s were not created in sequential order based on the FID field, then calculate Join\_ID field accordingly (example: Truncate a unique ID such as ‘Como001’ so that it just reads ‘001’ in the Join\_ID field.)



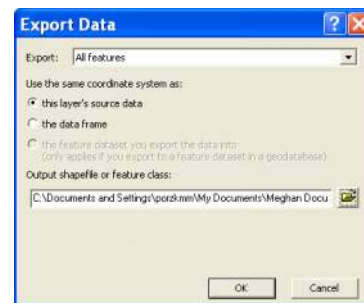
8. Join shapefile to <Lake\_County\_WBIC\_(YYYY)\_JOIN.xls>

- a. Right click on point shapefile in ArcMap table of contents
- b. Select Joins and Relates → Join...
- c. Set the following options:
  - i. Join Attributes from a table
  - ii. Join will be based on “Join\_ID”
  - iii. Choose the table to join to this layer
    1. Click on Window Folder (See arrow)

2. Navigate to and double-click on the Excel file saved in step 2
3. Double-click on the 'ENTRY \$' sheet
4. Click "Add"
- iv. Base the join on "sample\_pt"
- v. Join Options: Keep All Records (If using ArcGIS 9.2, these options can be viewed by clicking the "Advanced" button)
- vi. Click "OK"
- vii. If prompted to create index, select "Yes"



9. Export joined shapefile to make it permanent
  - a. Right click on joined point shapefile in ArcMap table of contents
  - b. Select Data → Export Data
  - c. Set the following options:
    - i. Export: All Features
    - ii. Use the same coordinate system as: this layer's source data
    - iii. Output shapefile or feature class: Save in MapFolder as **Lake\_County\_WBIC\_XXpts\_YEAR\_JOIN.shp**
  - d. Click "OK"
  - e. When asked if you want to add the exported data to the map as a layer, select "Yes"
    - i. This final joined shapefile will now be referred to as "Joined Point Shapefile"
  - f. Remove the Join from the original point shapefile
    - i. Right click on point shapefile in ArcMap table of contents
    - ii. Select Joins and Relates → Remove Join(s) → Remove All Joins
  - g. In the table of contents, uncheck or remove the original point shapefile that was used to create the Joined Point Shapefile.

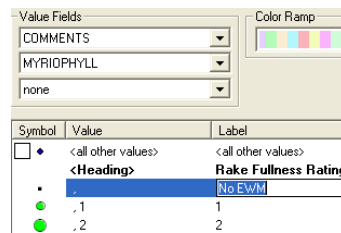


## 10. Check Join Results

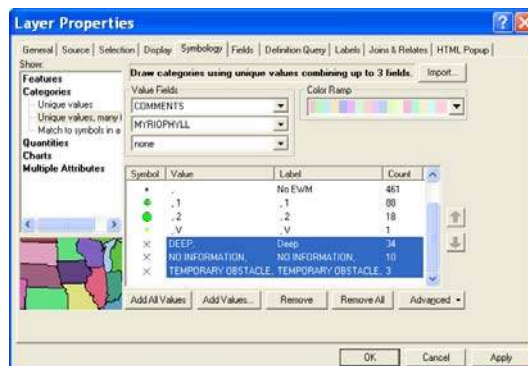
- a. Right click on the Joined Point Shapefile in the table of contents
- b. Select "Open Attribute Table"
- c. Verify that Join was successful
  - i. All data present in Excel file should now be located in the Joined Point Shapefile attribute table, and the Join\_ID and Sample\_Pt columns will be identical

## 11. Display Plant Distribution Data

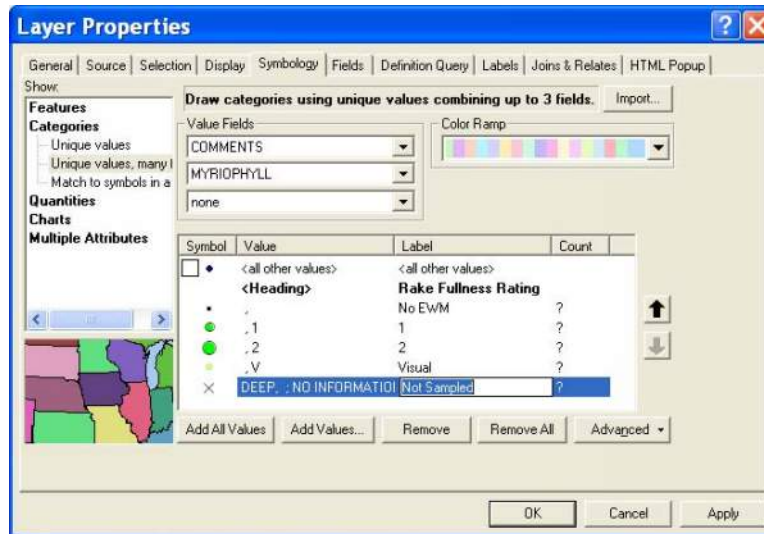
- Right click on the Joined Point Shapefile in the table of contents
- Select “Properties”
- Select “Symbology” tab
- On left side of dialog box under “Show:”, select “Categories – Unique Values, Many Fields”
- Value Fields should be “Comments”. Be sure to select the appropriate Comments field, as there may be two that appear similar.
- You will then choose additional Value Fields to display species information (i.e. If you want to display both EWM and CLP species information, then both EWM and CLP need to be chosen as Value Fields)
- Select “Add All Values”
  - All possible values are now displayed, separated by a comma. Each position indicates the unique values for each Value Field you designated in steps e & f, in the order entered. That is, if you selected ‘comments’, ‘EWM’, and ‘CLP’ as your value fields, the first value might read: ‘ , , ‘ indicating points that were sampled, but had neither a comment, EWM, nor CLP present. The next value might read ‘ , ,1’, which includes points with no comments, no EWM, and fullness rating of 1 for CLP.
  - Points with information for the ‘comments’ value field were likely not sampled; the comment listed should clarify how to work with these points.
- Un-check <all other values> box
- Double-click on symbol next to each value to set symbology
  - You must now choose appropriate symbols and colors for the different variables being expressed.
  - Typically we use increasing sizes of a green circle for EWM density ratings (values: 1, 2, 3), a small light green circle for visuals (V), a small black dot for sites sampled that had no relevant plant data, and a small “x” symbol for all sites not sampled
- You can change the label name of the symbol being represented by clicking on the respective space under “Label”. (e.g. change “ , , ” to “No EWM”; “ , ,1” to “1”; “ , V” to “Visual”; “Deep, ” to “Not Sampled”)



- You can also group values together (e.g. No Information, Deep, Shallow, etc)
  - Hold down the Shift key and highlight all rows that should be grouped



- ii. Right click on highlighted rows and select “Group Values”
- iii. The final Layer Properties dialog box should look similar to this: Note: If you want to change the order that these will appear in the legend, highlight a row and use the arrows on the right side to move.
- iv. Click “Apply” then “OK” to update symbols on map



- v. The polygon shapefile fill color and outline may also be modified similarly under the “Symbology” tab

## 12. Map Page Layout

- a. Verify that the coordinate system is defined correctly for the Data Frame
  - i. Select View → Data Frame Properties → Coordinate System Tab
  - ii. If the coordinate system is incorrectly defined, browse for the correct coordinate system
    1. Predefined → Projected Coordinate System → State Systems → NAD 1983 HARN Wisconsin TM.prj
- b. View → Layout View
- c. File → Page and Print Setup → Select Landscape or Portrait
- d. Modify size/shape of data frame to fit on entire page and serve as map border
  - i. Right click data frame, select Properties, under the ‘Frame’ tab, change border to a thickness of 2 and select OK.
- e. Insert → North Arrow
  - i. Size and position appropriately
- f. Insert → Scale Bar
  - i. Select “Alternating Scale Bar 1” and click “OK”
  - ii. Double-click on Scale Bar in Layout view to edit properties
  - iii. Set the following properties:
    1. Number of divisions: 2
    2. Number of subdivisions: 1
    3. Set units to kilometers

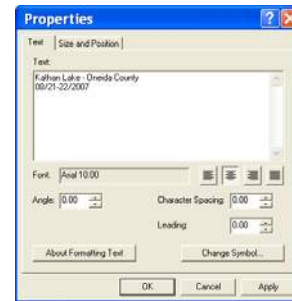


4. Click “OK”

g. Insert → Text

i. Double-click on Text Box to edit information

1. Create text box with the following information:
  - a. Lake Name, County, Date Sampled, etc.
2. Format text as appropriate using “Change Symbol...” button



h. Insert → Picture → Navigate to WDNR Logo (Black & White)

i. Size and position appropriately

i. Legend

i. In the table of contents, modify the displayed name of your shapefile as you would like it to appear in your legend by single clicking on the text

ii. Insert → Legend

iii. Choose which layers you want to include in your legend

1. Include the layer that has the plant distribution symbology information
2. You may have to remove the polygon layer by highlighting it under “Legend Items” and clicking the single left angle bracket (<), then select “Next”

iv. Remove the word “Legend” from the Legend Title and select “Next”

v. Continue selecting “Next” and then “Finish”

vi. Format legend text

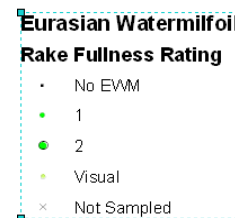
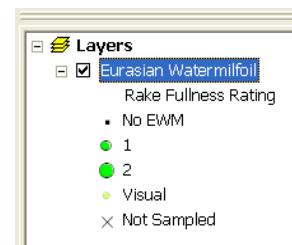
1. Right click on Legend and select “Properties”

vii. Size and position legend as appropriate

j. If you’re going to be switching between maps quickly to look at comparisons between years or species, we suggest making and refining the layout first, then saving it as an ArcMap Template so you can use the same one each time

i. File → Save As → Save As Type: ArcMap Template

k. Check printed map for color accuracy before you export (Step 13). Sometimes the colors may look different on screen, but may print with the same hue and value, making interpretation impossible. You can set a custom color if necessary.



### 13. Saving Map as JPEG

a. File → Export Map

i. Save as type: JPEG

ii. Set Resolution: 300 dpi

iii. Navigate to appropriate folder and Save

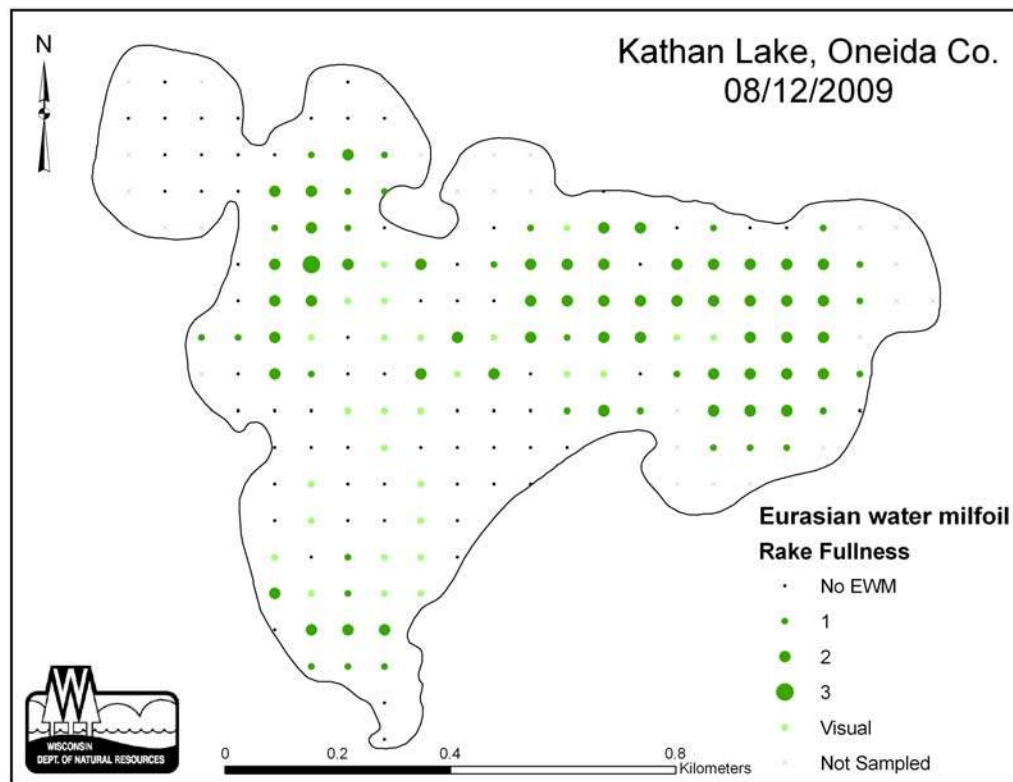


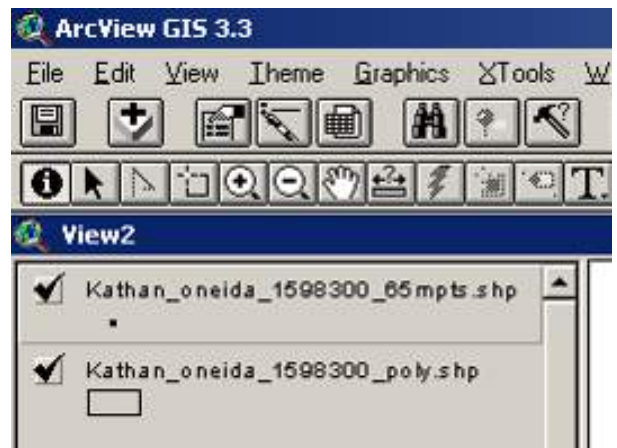
Figure 6: Example plant distribution map created using point-intercept data and ArcGIS 9.3 software for Kathan Lake, Oneida County.

## Appendix 4

### Creating a Plant Distribution Map Using Point Intercept Data in ArcGIS 3.3

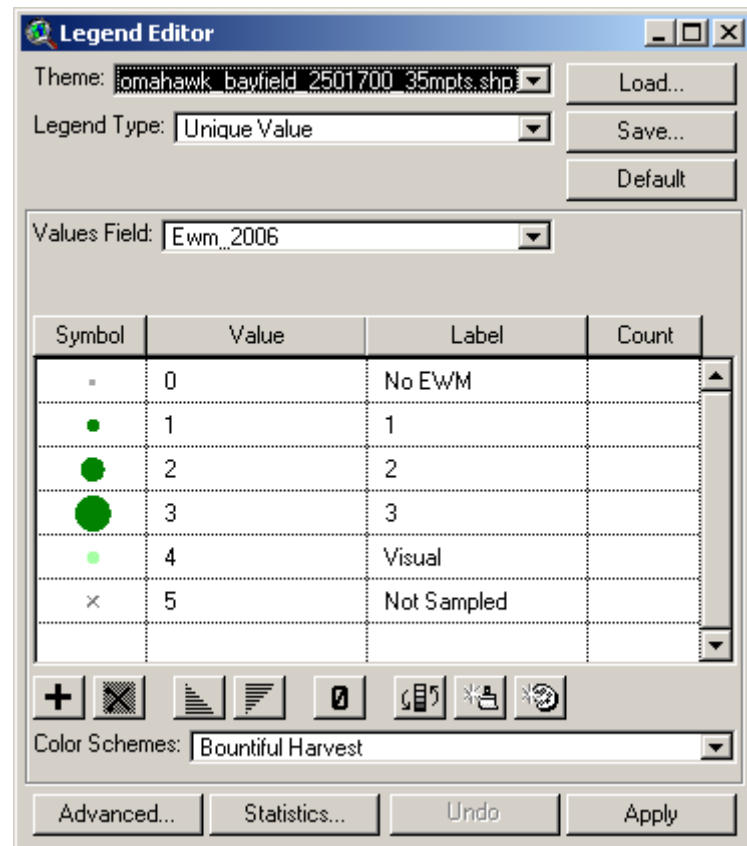
This is a protocol for making plant maps using ArcView GIS 3.3 and the Aquatic Plant Survey Data Workbook Excel file <Appendix-C.xls.>. This protocol can be changed in a number of different ways and still produce a similar product. The best way to make PI-based maps depends on the particular dataset; however, this procedure works well in most cases. Similar images may be created in PowerPoint or in photo editing software if the dataset is not large or complex.

1. Save the ArcView shapefiles (\*.shp, \*.dbf, \*.sbn, \*.shx, \*.sbx, \*.sbn) to a folder on a local drive.
  - a. We'll refer to this folder as "MapFolder"
2. Open ArcView and create a new project with a new view.
  - a. Click "yes" to add data
3. Add shapefiles from MapFolder
  - a. You can add multiple files at once by holding down "shift" while you click the individual files
4. View window: select the point file
  - a. Make sure both themes have the box checked in order to view them
  - b. Click once on the point layer to activate that theme (raised box around that item)
  - c. If necessary, drag the activated point layer above the polygon layer in order to see the sample points
5. Open theme table
  - a. Theme > Table or
  - b. The open theme table shortcut button
6. Start editing, add variable column
  - a. Table > Start Editing
  - b. Edit > Add Field
    - i. Enter the name of the field (e.g. EWM\_2009)
    - ii. Specifications 'type', 'width', and 'decimal places' do not need to be changed
    - iii. Click "OK"
7. Stop editing, save edits
  - a. Table > Stop Editing, 'Yes' to save edits
8. Export point file



- a. File > Export
  - b. Select 'dBASE'
  - c. Select MapFolder to save file
  - d. Default will be named <table1.dbf>
  - e. Close table
9. Set-working directory
  - i. File > Set Working Directory
  - ii. Change working directory to MapFolder
10. Save project, exit ArcView
  - a. File > Save Project As > save in MapFolder (for ease of reference, lets call the file EWM\_Map.apr)
  - b. Exit ArcView
11. Open file saved in step 8 with Excel
  - a. Open excel; Open a file, when prompted to find the file, navigate to MapFolder
  - b. In "Files of type" option bar select "All files"
  - c. Open <table1.dbf>
12. List information under data field created (EWM\_2009)
  - a. Open PI data entry excel file (WiAPMS.xls)
  - b. Copy columns "Sample point, Depth, Comments, & EWM"
  - c. Paste special "values" into new excel workbook
    - i. Edit > Paste Special > Values
  - d. Highlight all data, sort by comments
    - i. Data > Sort > Comments
  - e. Enter the number 5 into EWM column for all unsampled sites (deep, terrestrial, non-navigable, etc) (this is so the legend can code these sites)
  - f. Highlight EWM data column and replace all blanks with 0 (zero), and V (visuals) with 4
    - i. Edit > Replace, replace all
  - g. Highlight all data, re-sort by sampling site
    - i. Data > Sort > Sampling Point
  - h. Copy EWM column, excluding header, paste into the .dbf file (already open, originally created in step 8)
  - i. "Save as" this file as the **original dbf** file's name (the copy you placed in MapFolder, not the original file, obviously)
    - i. i.e. overwrite the ISS original (e.g. Kathan\_Oneida\_1598300\_65mpts.dbf) with the new file you just modified in excel. The name must be EXACTLY the same!!
    - ii. Close excel
13. Reopen project in ArcView
  - a. Open existing project

- b. Open MapFolder and click on EWM\_Map.apr (or whatever you chose to name it in step 9)
14. Create legend
  - a. Double-click point symbol in the View frame to open the legend window
  - b. In “Legend Type” option bar, choose “Unique Value”
  - c. In “Values Field” option bar select “EWM\_2009” column (or whatever column you want this map to show)
  - d. Apply
  - e. You must now choose appropriate symbols and colors for the different variables being expressed by the legend. You can change the symbol by double clicking on it
  - f. Typically we use increasing sizes of a green circle for EWM density ratings (values: 1, 2 , 3), a small light green circle for visuals (value: 4), a small black dot for sites sampled, but without EWM, (value: 0), and a small “x” symbol for sites not sampled (value: 5).
  - g. You can change the label name of the symbol being represented by clicking on the respective cell under “Label”. (e.g. change “5” to “Not Sampled”, change “4” to Visual)
  - h. The color or shading of the polygon can also be changed by double clicking on the theme



15. Set units
  - a. View > Properties
  - b. Change map units to “meters” and distance units to “kilometers”
16. Layout
  - a. View > Layout
  - b. Select Landscape or Portrait
  - c. Double-click ‘View1’ to change map title
  - d. Double-click scale bar to adjust range or units
  - e. If you’re going to be switching between maps quickly to look at comparisons between years or species, we suggest making and refining the layout first, then saving it as a Template (Layout > Store as Template) so you can use the same one each time.

- f. Check printed map for color accuracy before you export (step 17). Sometimes the colors may look different on screen, but may print with the same hue and value, making interpretation impossible. You can set a custom color if necessary.

17. Save as JPEG

- a. Have the final layout window active
- b. Select File > Export
- c. In “List Files of Type” option bar, select JPEG
- d. Click ‘Options’ button
  - i. Set resolution to highest number
  - ii. Likely 144 DPI and Quality = 100
- e. Type file name, choose location in which to save the JPEG
- f. Click OK

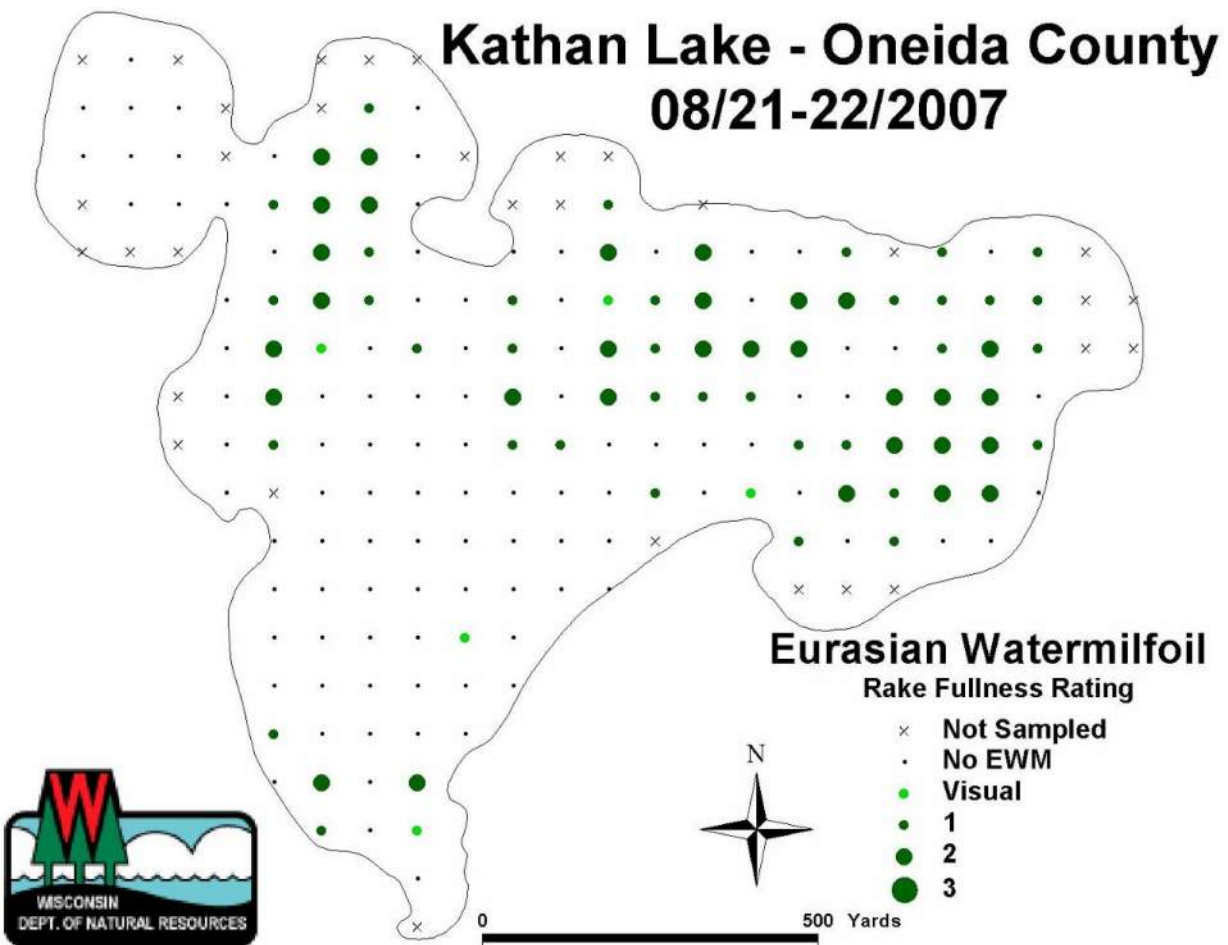


Figure 7: Example plant distribution map created using point-intercept data and ArcGIS 3.3 software for Kathan Lake, Oneida County.

**Document citation:**

Hauxwell, J., S. Knight, K. Wagner, A. Mikulyuk, M. Nault, M. Porzky and S. Chase.  
2010. Recommended baseline monitoring of aquatic plants in Wisconsin: sampling design, field and laboratory procedures, data entry and analysis, and applications. Wisconsin Department of Natural Resources Bureau of Science Services, PUB-SS-1068 2010. Madison, Wisconsin, USA.

## Science Services

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  - providing science-based support services for department initiatives.
  - collaborating with local, state, regional, and federal agencies and academic institutions in Wisconsin and around the world.
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## **Appendix 3 – Aquatic Invasive Species Early Detector Handbook**



WISCONSIN  
AQUATIC INVASIVE SPECIES  
EARLY DETECTOR  
HANDBOOK



## NOTES

## TABLE OF CONTENTS

### EARLY DETECTOR BASICS

- 4 How to prepare
- 5 Example map
- 6 Assembling a monitoring kit
- 8 How to sample AIS from shore
- 10 How to sample AIS from a boat
- 12 Photographing Aquatic Invasive Species

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- 16 Brittle naiad
- 17 Carolina fanwort
- 18 Curly-leaf pondweed
- 19 Eurasian watermilfoil
- 21 European frog bit
- 22 Flowering rush
- 23 Narrow-leaf cattail / hybrid cattail
- 24 Parrot feather
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- 34 Asian clam (*Corbicula*)
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## AIS EARLY DETECTORS

Early detection of aquatic invasive species (AIS) can be the difference between long-term management and potential eradication--the difference between \$\$\$ and \$. Once they become well-established, invasive species can be very difficult to control, and may be impossible to eradicate. Early detection and rapid response to new AIS populations in Wisconsin has resulted in some populations being eradicated from entire lakes, including notable invaders like Eurasian watermilfoil, flowering rush, and yellow floating heart (cover photo). The best possible option for a lake is to have trained eyes on the water often, so that a suspicious plant or animal can be detected early and quickly responded to.

Your Citizen Lake Monitoring Network staff and local Aquatic Invasive Species Coordinators are ready to help you! They can provide hands-on training workshops, assist with identification, suggest the best locations to monitor on your lake, and more. This is a team effort to stop invasive species from spreading to our favorite fishing spots, our cherished swimming holes, and the peaceful places where we love to observe native plants and animals. We can all do our part. Thank you for being a partner to protect the amazing lakes of Wisconsin.

This booklet is adapted from *Aquatic Invasive Species Early Detectors: A How-to Guide*, produced by the Minnehaha Creek Watershed District, Minnetonka, Minnesota, used with permission.

Produced by the Wisconsin Citizen Lake Monitoring Network, UW-Extension Lakes Program.

**Photos by Paul Skawinski** except the following:

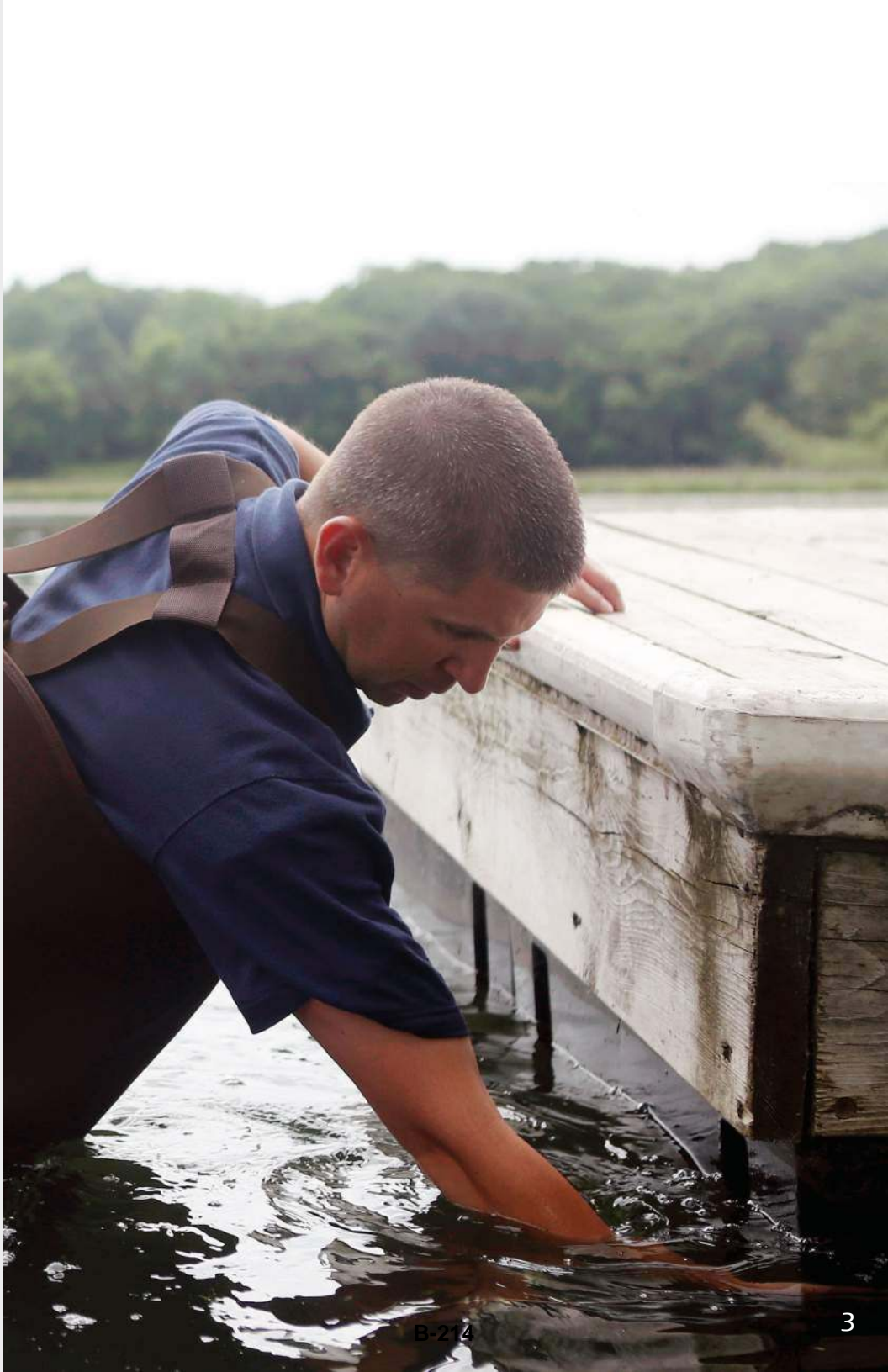
**Jeff Gunderson**, Minnesota Sea Grant (top photo, p. 38);

**Jeffrey Thompson**, Minnesota Public Radio; (page 3)

**Minnehaha Creek Watershed District**; (pages 6, 10)

**Tina Wolbers**, Minnesota Department of Natural Resources (top photo, page 32)





## HOW TO PREPARE

1

Know which invasive species are already present in the lake or stream you are monitoring. Lists of invasive species in each water body can be found on the Wisconsin Department of Natural Resources website: [dnr.wi.gov/lakes/invasives/AISbywaterbody.aspx](http://dnr.wi.gov/lakes/invasives/AISbywaterbody.aspx)

2

Determine several locations to sample. Be sure to target boat landings, inlets/outlets, public parks, developed shorelines, and a variety of sediment types (mucky, sandy, etc.). Your own shoreline is also a great place to keep an eye on. Mark these sampling locations on a map so that you can show others where you sampled or found a suspicious species.

3

Refer to the *Assembling a Monitoring Kit* section on page 6 to prepare for monitoring. If any of your gear has been used in another waterbody, be sure that it doesn't contain any plants, animals, or debris that could be holding invasive species.



### Inspect

your equipment for any attached plants, animals, or mud



### Remove

all attached debris



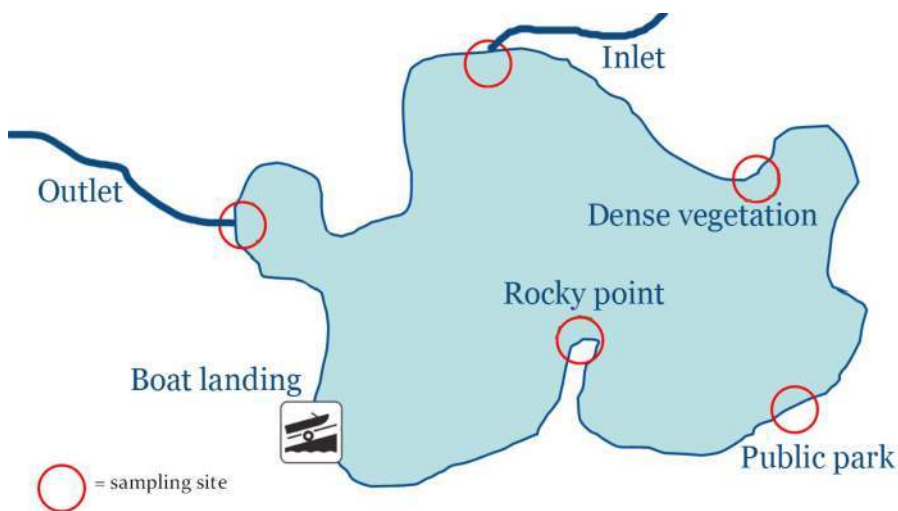
### Drain

water from your boat, motor, live wells, bait buckets, and any other location that holds water



## EXAMPLE MAP

Great maps can be found for public lakes across the state by searching [dnr.wi.gov](http://dnr.wi.gov) for “lake maps”.





## ASSEMBLING A MONITORING KIT

Use the checklist below to assemble an AIS monitoring kit. Items marked with an asterisk (\*) can be provided by your Regional Citizen Lake Monitoring Network Coordinator or local Aquatic Invasive Species Coordinator.

- 1) Aquatic plant sampling rake\*
- 2) Waterproof labels\*
- 3) Ziploc bags\*
- 4) Hand lens\*
- 5) Pencil\*
- 6) AIS monitoring forms\*
- 7) Polarized sunglasses
- 8) Towel to dry your hands and equipment
- 9) Underwater viewing scope (optional)

Waders (10) and snorkeling gear (11) can also be very useful tools for AIS monitoring, but are not required. Volunteers wishing to do a very thorough check of an area may choose to use these items.



A steel rake head (usually with at least 30 feet of rope attached to it) is a very effective aquatic plant sampling tool. You can buy a rake head by itself, or simply cut the handle off of a rake and tie the rope to the head. If desired, a double-sided rake can be made by attaching two rake heads together with cable ties or welding.



Polarized sunglasses reduce glare and allow a person to see much more clearly into the water.



A towel is useful to wipe your hands and your gear!

8

# HOW TO SURVEY FOR AQUATIC INVASIVE SPECIES FROM SHORE

Identify the public boundaries of the site. Beginning at one of the boundaries, conduct the sampling steps outlined below, and repeat these steps at five points spaced about equally between the site boundaries.



**1. Scan** the area for at least 30 seconds, examining plants in the water and any plant fragments/shells that are washed up on shore.



**2. Toss** your sampling rake from shore into the water, aiming for concentrations of plants or anything suspicious that you noticed during your scan. Be sure to hang on to the end of your rope!



**3. Retrieve** the rake and examine the attached vegetation and animals. Snails, mussels, and other creatures will often be attached to the vegetation or stuck on the rake itself. Continue tossing the rake until you feel that you have adequately sampled this location (usually 2-3 rake tosses). Use this handbook to help you identify suspicious plants and animals.

If there is a dock or pier, use it as one of your sampling locations. You can sample off of any side of the dock. If you are able to see or touch the legs of the dock, this is a good way to look for zebra mussels.

Place a sample of any suspected invasive species in a plastic bag with a waterproof label. Bags, labels, and pencils are included in your monitoring kit. Seal the bag tightly and place it somewhere secure until you can get it into a refrigerator or deliver it to an expert.



**4. Report** what you found. If you did not find any suspected invasive species, that's great! We want to know the good news! Please enter this information into the Surface Water Integrated Monitoring System (SWIMS) database, or email the *Aquatic Invasives Surveillance Monitoring* form to your local Aquatic Invasive Species Coordinator. This form can be used to record results from one day or from an entire season of monitoring, whichever is most convenient for you. Please enter or mail your results by November 1st so we can compile information from across the state.

If you found a suspected invasive species, please record that on the form. Then take digital photographs of the invasive species (please include the waterproof label in the photos) and email the photos to your local AIS Coordinator (DNR or county). Please save all suspicious plants and animals in the refrigerator or in a cooler until you hear back. Your AIS Coordinator may ask to see the actual specimen to confirm its identification.

**Who** is my local AIS Coordinator? Visit the Wisconsin DNR website at [dnr.wi.gov](http://dnr.wi.gov) and type "AIS Coordinator" into the search box. Then click on your county to find contact information for AIS staff that cover your area.

If you need help finding this information, please contact:

Paul Skawinski  
Statewide Citizen Lake Monitoring Network Coordinator  
[Pskawins@uwsp.edu](mailto:Pskawins@uwsp.edu) or 715-346-4853

## HOW TO SURVEY FOR AQUATIC INVASIVE SPECIES FROM A BOAT

Identify sites with a high risk of invasive species introductions, such as boat landings, public parks, bridges, and inlets. Conduct the sampling steps outlined below at each site you have identified around the lake. While motoring/paddling between sites, stay shallow enough that you can see aquatic plants, and watch for AIS as you go.

**1. Scan** the area for suspicious plants and animals, both in the water and along the shoreline. Scan for at least 30 seconds at each site.

**2. Toss** your sampling rake into the water, once from each side of the boat. Aim for concentrations of plants or anything suspicious that you noticed during your scan. Be sure to hang on to the end of the rope!

**3. Retrieve** the rake and examine the attached vegetation and animals. Snails, mussels, and other creatures will often be attached to the vegetation or stuck on the rake itself. Continue tossing the rake until you feel that you have adequately sampled this location (usually 2-3 rake tosses). Use the identification resources provided to help you identify suspicious plants and animals.

Place a sample of any suspected invasive species in a plastic bag with a waterproof label. Bags, labels, and pencils are included in your monitoring kit. Seal the bag tightly and place it somewhere secure until you can get it into a refrigerator or deliver it to an expert.



**4. Report** what you found. If you did not find any suspected invasive species, that's great! We want to know the good news! Please enter this information into the Surface Water Integrated Monitoring System (SWIMS) database, or email the *Aquatic Invasives Surveillance Monitoring* form to your local Aquatic Invasive Species Coordinator. This form can be used to record results from one day or from an entire season of monitoring, whichever is most convenient for you. Please enter or mail your results by November 1st so we can compile information from across the state.

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# PHOTOGRAPHING AQUATIC INVASIVE SPECIES

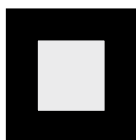
Most aquatic invasive species can be readily identified from a good photograph. Here are some tips to make your specimen easy for your local AIS Coordinator to identify.



**Light it up!** Have the sun or other light source behind you, not behind the object. Shadows make it difficult to see colors and patterns.



**Show scale.** Some species can be differentiated based on size. Use a coin, hand, key, or the ruler at the front of this handbook to demonstrate size.



**Have a contrasting background.** Small features of plants and animals are tough to see against backgrounds that are busy or contain similar colors/textures.


Wisconsin Citizen Lake Monitoring Network  
Use these labels when submitting a sample of an aquatic plant or animal for identification

Which species do you think it is?  
*Asian clam*

Lake & county where it was collected:  
*Lulu Lake, Walworth Co.*

Date:  
*8/10/16*

Your name and contact information:  
*Paul Skawinski*  
*715-346-4853 Pskawins@uwsp.edu*





# PLANT ID

## BRAZILIAN WATERWEED AND HYDRILLA

Plant type: Submergent

Status: Prohibited

Native look-alike:

Common waterweed



## INVASIVE

Brazilian waterweed  
(*Egeria densa*)

- Rings (whorls) of 4-8 leaves around the stem
- Fine teeth on leaf edges. This usually requires a hand lens to see
- No teeth underneath the leaves





## NATIVE

Common waterweed  
(*Elodea canadensis*)

- Rings (whorls) of 3 leaves around the stem
- Smooth leaf edges
- No teeth underneath the leaves

## INVASIVE

Hydrilla  
(*Hydrilla verticillata*)

- Rings (whorls) of 4-8 leaves around the stem
- Fine teeth on leaf edges
- Teeth are also produced underneath the leaf, along the centerline





## BRITTLE NAIAD

Plant type: Submergent

Status: Prohibited

Native look-alike: Slender naiad

### INVASIVE

Brittle naiad  
(*Najas minor*)

- Noticeably toothed
- Readily breaks into small fragments
- Leaves curve strongly downward

### NATIVE

Slender naiad  
(*Najas flexilis*)

- Teeth on edge of leaf require magnification to view
- Flexible
- Leaves straight or slightly curving



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## CAROLINA FANWORT

Plant type: Submergent

Status: Prohibited

Native look-alike: Water marigold

### INVASIVE

Carolina fanwort  
(*Cabomba caroliniana*)

- Leaves on short stalks, attaching on opposite sides of the stem
- Flower white with a yellow center
- May have tiny, floating leaves

### NATIVE

Water marigold  
(*Bidens beckii*)

- Ring/whorl of leaves around the stem
- Leaves do not have stalks
- Yellow, daisy-like flower





## CURLY-LEAF PONDWEED

Plant type: Submergent

Status: Restricted

Native look-alike: Claspingleaf pondweed



### INVASIVE

Curly-leaf pondweed  
(*Potamogeton crispus*)

- Leaves are usually very wavy
- Finely toothed leaf edges
- Leaf tips are blunt
- Leaf base not wrapped around stem

### NATIVE

Claspingleaf pondweed  
(*Potamogeton richardsonii*)

- Leaves are gently wavy
- Leaf edges smooth, no teeth
- Leaf tips are pointed
- Leaf base wraps around stem



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## EURASIAN WATERMILFOIL

Plant type: Submergent

Status: Restricted

Native look-alikes: Other watermilfoils, common bladderwort

### INVASIVE

Eurasian watermilfoil  
(*Myriophyllum spicatum*)

- 12+ pairs of leaflets per leaf
- Stems usually weak and limp, reddish-brown to pink
- Leaves at tip of branches often red

### NATIVE

Northern watermilfoil  
(*Myriophyllum sibiricum*)

- 5-10 pairs of leaflets per leaf
- Stems tan to green, usually stiff, holding shape out of water
- Leaves at tips of branches usually green



## NATIVE

### Whorled watermilfoil (*Myriophyllum verticillatum*)

- 8-17 pairs of leaflets per leaf
- Stems brown or dark green
- Rings (whorls) of leaves packed closely together on the stem



## NATIVE

### Common bladderwort (*Utricularia macrorhiza*)

- Leaves contain many small sacs (bladders) that trap invertebrates
- Stems are unrooted, usually tangled on other vegetation





## EUROPEAN FROG-BIT

Plant type: Floating

Status: Prohibited

Native look-alike: White water lily

### INVASIVE

European frog-bit  
(*Hydrocharis morsus-ranae*)

- Free-floating, roots hang below
- Small, heart-shaped leaves (2-3")
- Small, white flower, 3 petals

### NATIVE

White water lily  
(*Nymphaea odorata*)

- Rooted to the bottom
- Round leaves with a slit/notch
- Large leaves up to 12" diameter
- Large, white flower, many petals



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## FLOWERING RUSH

Plant type: Emergent/submergent

Status: Restricted

Native look-alike: Bur-reeds

## INVASIVE

Flowering rush  
(*Butomus umbellatus*)

- Cluster of pink/red flowers held above the plant
- Can be emergent or submergent
- Tall, dark green leaves are triangular in cross-section and often twisted near the top
- Produces small, onion-like growths on the roots called bulbils
- Usually 3-6 feet tall





## NARROW-LEAF CATTAIL

Plant type: Emergent  
Status: Restricted

### INVASIVE

Narrow-leaf cattail  
(*Typha angustifolia*)

- Leaves 4-10mm wide
- Male and female flowerheads separated by 1" or more
- Pollen is shed as single grains

Note: Narrow-leaf and broad-leaf cattails can hybridize. Hybrid cattail (*Typha x glauca*) typically has a gap of 1/4" to 1" between the male and female flowerheads, sheds pollen mostly in single grains but also as clusters of two, three, and four, and grows in very dense stands.

### NATIVE

Broad-leaf cattail  
(*Typha latifolia*)

- Leaves >12mm (1/2") wide
- Male and female flowerheads touching, or nearly touching
- Pollen is shed in clusters of four grains



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## PARROT FEATHER

Plant type: Emergent/submergent  
Status: Prohibited

### INVASIVE

Parrot feather  
(*Myriophyllum aquaticum*)

- 6-30 pairs of short leaflets
- Rings/whorls of 4-6 widely spaced leaves
- Can emerge up to 8" from the water





## PHRAGMITES

Plant type: Shoreline or emergent

Status: Prohibited/restricted (split-listed)

Native look-alike: Native Phragmites

### INVASIVE

Non-native Phragmites  
(*Phragmites australis*  
ssp. *australis*)

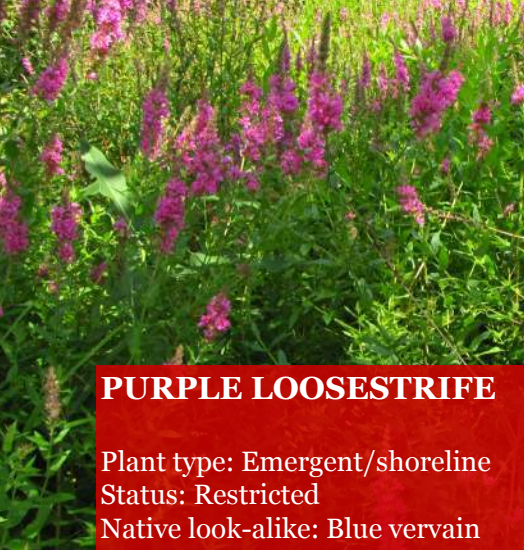
- Often more than 10 feet tall
- Large, feathery seedheads
- Dark green leaves
- Dull, ridged stem

### NATIVE

Native Phragmites  
(*Phragmites australis*  
ssp. *americanus*)

- Usually less than 8 feet tall
- Sparse seedheads
- Bright green leaves
- Smooth, glossy stem, often reddish





## PURPLE LOOSESTRIFE

Plant type: Emergent/shoreline

Status: Restricted

Native look-alike: Blue vervain

### INVASIVE

Purple loosestrife  
(*Lythrum salicaria*)

- Flowers pink-purple, with 6 petals, blooming in a tall spike
- Leaves have smooth edges and are opposite or in rings/whorls of 3,
- Square or 6-sided stem



### NATIVE

Blue vervain  
(*Verbena hastata*)

- Flowers blue, with 5 petals, blooming one ring/whorl at a time
- Leaves opposite with toothed edges
- Square stem



## STARRY STONEWORT

Plant type: Submergent

Status: Prohibited

Native look-alike: Native stoneworts



### INVASIVE

Starry stonewort  
(*Nitellopsis obtusa*)

- Rings/whorls of 4-6 branchlets
- Smooth stem
- Uneven forking near end of branchlets
- Produces star-shaped bulbils in sediments
- Stiff; holds shape out of water

### NATIVE

Slender stonewort  
(*Nitella flexilis*)

- Rings/whorls of 4-6 branchlets
- Smooth stem
- Symmetrical forking near end of branchlets
- Does not produce bulbils in sediments
- Delicate; collapses out of water



B-239



27



## WATER CHESTNUT

Plant type: Floating  
Status: Prohibited

## INVASIVE

Water chestnut  
(*Trapa natans*)

- Triangular, toothed leaves
- Leaf bases are inflated
- Mostly free-floating
- Fruits with sharp spines formed underneath the leaves
- Entire plant may be over 1 foot in diameter





## WATER HYACINTH

Plant type: Floating  
Status: Prohibited

## INVASIVE

Water hyacinth  
(*Eichhornia crassipes*)

- Leaves are waxy and very shiny
- Leaf base is inflated
- Lavender flower with a purple/yellow spot
- Roots hang below the plant
- Forms interconnected colonies





## WATER LETTUCE

Plant type: Floating  
Status: Prohibited

## INVASIVE

Water lettuce  
(*Pistia stratiotes*)

- Free-floating
- Roots hang below the plant
- Leaves are thick, ridged, fuzzy, and light green
- Forms dense, interconnected colonies
- Resembles a floating head of lettuce





## YELLOW FLOATING HEART

Plant type: Floating

Status: Prohibited

Native look-alike: Bullhead pond lily

### INVASIVE

Yellow floating heart  
(*Nymphoides peltata*)

- Heart-shaped leaves up to 4 inches long
- Leaves have wavy edges
- Yellow flowers have five fringed petals
- Plant is rooted to the bottom

### NATIVE

Bullhead pond lily  
(*Nuphar variegata*)

- Heart-shaped leaves up to 15 inches long
- Leaves do not have wavy edges
- Yellow flower is cup-shaped
- Plant is rooted to the bottom





## YELLOW IRIS

Plant type: Emergent

Status: Restricted

Native look-alike: Blue-flag Iris

## INVASIVE

Yellow Iris  
(*Iris pseudacorus*)

- 3-5 feet tall
- Leaves are dark green or blue-green
- Flower is yellow
- Center of leaf is sharply thickened



## NATIVE

Blue-flag Iris  
(*Iris versicolor* & *Iris virginica*)

- 2-4 feet tall
- Leaves light green
- Flower is blue
- Center of leaf gradually thickened





# ANIMAL ID

B-245



## ASIAN CLAM

Status: Prohibited  
Native look-alike: Fingernail clams

### INVASIVE

Asian clam  
(*Corbicula fluminea*)

- Distinctly raised rings on shell
- Up to 2 inches across
- Shell yellow-brown, often blue inside, solid and opaque
- Three large hinge teeth on each shell



### NATIVE

Fingernail clams  
(many species)

- Rings of shell not distinctly raised
- Under 1 inch across
- Shell light to dark brown and white inside
- Shell translucent and fragile
- 1 or 2 teeth at the hinge



## BANDED & CHINESE MYSTERY SNAILS

Status: Restricted

### INVASIVE

Banded mystery snail  
(*Viviparus georgianus*)

- 1-1.5 inches tall
- Horizontal brown bands on shell
- Bands may be hidden by algae or sediment

### INVASIVE

Chinese mystery snail  
(*Cipangopaludina chinensis*)

- Up to 3 inches tall
- Dark brown shell, often with short ridges near the shell opening





## FAUCET SNAIL

Status: Prohibited

Native look-alike: Several other small snails. Consult an expert for verification.

## INVASIVE

Faucet snail  
(*Bithynia tentaculata*)

- Small, 12-15mm long (1/2 inch)
- Light brown to black
- 5-6 spirals
- Shell opening is on right side and teardrop-shaped





## NEW ZEALAND MUDSNAIL

Status: Prohibited

Native look-alike: Several other small snails. Consult an expert for verification.

## INVASIVE



New Zealand mudsnail  
(*Potamopyrgus antipodarum*)

- Very small, 4-6mm long (1/8-1/4 inch)
- 7-8 spirals separated by deep grooves
- Gray to brown
- Shell opening is on right side
- Typically found in cold streams





## ROUND GOBY

Status: Restricted

Native look-alike: Sculpins

## INVASIVE

Round goby  
(*Neogobius melanostomus*)

- Commonly 3-6 inches long
- Round head with bulging eyes
- Pelvic fins on underside are fused into one circular fin
- Dark spot on back of dorsal fin





## RUSTY CRAYFISH

Status: Restricted

Native look-alike: Several native crayfishes

## INVASIVE

Rusty crayfish  
(*Orconectes rusticus*)

- Rusty brown spot on each side
- Body is mostly light brown
- Up to 5 inches long
- Claws have black and orange bands





## SPINY WATER FLEA

Status: Prohibited

### INVASIVE

Spiny waterflea  
(*Bythotrephes longimanus*)

- About 1cm (3/8") in length
- Very long tail spine
- Often seen as clumps on fishing line, anchor lines, downriggers





## ZEBRA AND QUAGGA MUSSEL

Status: Restricted (Zebra), Prohibited (Quagga)

### INVASIVE

Zebra mussel  
(*Dreissena polymorpha*)

- D-shaped shell
- Sits flat on its side
- Color varies but is usually light brown to white with brown-black stripes
- Up to 1.25" in length
- Usually attached to hard surfaces



### INVASIVE

Quagga mussel  
(*Dreissena bugensis*)

- Teardrop-shaped shell
- Does not sit flat on its side
- Color varies but is usually light brown to white with brown stripes
- Can grow up to 1.5" in length
- Usually attached to hard surfaces





Wisconsin's Citizen Lake Monitoring Network supports nearly a thousand volunteers like you as they monitor the health of Wisconsin's lakes. This information is used to assess the health of our lakes, develop lake management plans and invasive species management strategies, identify long-term trends, evaluate effects of land use practices, and more.

Visit our website to learn more!

[uwsp.edu/uwexplakes](http://uwsp.edu/uwexplakes)

## **Appendix 4 – Terrestrial Invasive Species Monitoring Form**

Terrestrial Invasive Species Monitoring Form																											
		Site #	Latitude Coordinates		Longitude Coordinates	Japanese honeysuckle	Multiflora rose	Purple loosestrife	Common buckthorn	Glossy buckthorn	Sawtoothed buckthorn	Dahurian buckthorn	Japanese buckthorn	Chinese buckthorn	Dahrian buckthorn	Kudzu-vine	Exotic bush honeysuckles	Exotic olives	Salt cedars	Poison hemlock	Giant hogweed	Oriental bittersweet	Lesser celandine	Teasel	Japanese knotweed	Giant knotweed	Bohemian knotweed
Project		1			Relative Abundance																						
County					Length of Shoreline																						
Date		2			Relative Abundance																						
Field Crew					Length of Shoreline																						
		3			Relative Abundance																						
					Length of Shoreline																						
			4			Relative Abundance																					
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		29			Relative Abundance																						
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		30			Relative Abundance																						
					Length of Shoreline																						

## **Appendix 5 – Documentation of Consultation**

## Darrin Johnson

---

**From:** Shawn Puzen  
**Sent:** Friday, January 14, 2022 8:11 AM  
**To:** Joan Harn  
**Cc:** Shawn Puzen  
**Subject:** FW: Hayward and Trego Invasive Species DRAFT Monitoring Plan  
**Attachments:** Appendix 3 Reduced.pdf; Appendix 2 Invasive Study Point Intercept Protocol.pdf; Appendix 4 Wisconsin Point Intercept Worksheet with addtl substrate info.xls; 20220113 Hayward Trego Draft ATIS Study Plan.pdf

**Categories:** Filed by Newforma

Hi Joan,

This email was returned to me yesterday.

Sorry for the inconvenience.

Thanks,

---

### SHAWN PUZEN

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt  
Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



120 YEARS OF SHAPING THE FUTURE

---

**From:** Shawn Puzen <Shawn.Puzen@meadhunt.com>  
**Sent:** Thursday, January 13, 2022 4:52 PM  
**To:** cheryl.laatsch@wisconsin.gov; angietornes@gmail.com; susan\_rosebrough@nps.gov; Lisa\_Yager@nps.gov; jharn@nps.gov; cjpetersen@msn.com  
**Cc:** Darrin Johnson <Darrin.Johnson@meadhunt.com>; Miller, Matthew J <Matthew.j.miller@xcelenergy.com>; Shawn Puzen <Shawn.Puzen@meadhunt.com>; brey.j.maurer@xcelenergy.com; Crotty, Scott A <scott.a.crotty@xcelenergy.com>  
**Subject:** Hayward and Trego Invasive Species DRAFT Monitoring Plan

Good Afternoon,

Attached is a draft Hayward and Trego Invasive Species Monitoring Plan for your review and comment. The intent is to complete this study during this field season.

By your initial comments on the relicensing of the Hayward and Trego Hydroelectric Project, you requested NSPW complete an invasive species survey.

Prior to executing the study, NSPW is requesting your comments on the enclosed draft study plan.

Please provide your comments as soon as possible, but no later than February 11, 2022.

Please feel free to contact me if you have any questions.

Thanks,

---

**SHAWN PUZEN**

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER

Mead & Hunt

Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



**120 YEARS OF SHAPING THE FUTURE**



# United States Department of the Interior

National Park Service  
St. Croix National Scenic Riverway  
401 N. Hamilton Street  
St. Croix Falls, Wisconsin 54024



IN REPLY REFER TO:  
I.A.1

February 8, 2022

Mr. Shawn Puzen  
Shawn.Puzen@meadhunt.com  
Mead & Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: Hayward and Trego Hydroelectric Projects Draft Aquatic and Terrestrial Invasive Species Study Plan, FERC Nos. p-2417 and p-2711, Namekagon River

Dear Mr. Puzen:

The National Park Service (NPS) appreciates the opportunity to provide comments on the *Hayward and Trego Hydroelectric Projects Draft Aquatic and Terrestrial Invasive Species Study Plan*. This study plan was prepared by Mead & Hunt for Xcel Energy for the Hayward and Trego hydroelectric projects on the Namekagon River, within the St. Croix National Scenic Riverway (Riverway) administered by the NPS. The NPS is interested in the protection of native species and limiting the spread of invasive species throughout the Riverway. The NPS requested to review this study plan in our initial comments because Xcel/NSPW is using this study to fulfill some of the information the NPS recommended for inclusion in other study plans and because of our interest in wild rice, which Xcel/NSPW also proposed to include in this study.

We received this proposed study plan by email dated January 13, 2022. We understand you intend to complete field work by the end of August 2022 and the draft study report will be available by October 31, 2022.

## 1. Introduction

We concur and are pleased that this study plan responds to the request from the Wisconsin Department of Natural Resources (WDNR), using WDNR protocols. We note that some elements of this study relate to components that NPS recommended for inclusion in other studies. We offer the following comments.

### 2.1 Study Goals and Objectives

Although the objective of the Aquatic and Terrestrial Invasives Species (ATIS) study is to provide baseline data, the NPS encourages including analysis and description of changes that have occurred under the existing license, when information is available. The NPS 08/31/2021 comment letter highlighted the need to include analysis of change from previous surveys associated with sediment deposition, aquatic plant growth, and recreation access (including flooding) as part of the ATIS and Recreation studies. This will help inform the development of protection, mitigation, and enhancement measures in the subsequent license.

## **2.2 Background and Existing Information**

The NPS requests analysis of change from annual purple loosestrife surveys conducted under the existing license.

## **2.3 Nexus between Project Operations and Effects on Resources**

Please describe conditions, including sediment and substrate conditions, under which invasive species become established after introduction to better understand how inundation and sedimentation capture due to the dam contribute to establishment.

## **2.4 Study Area**

The NPS concurs with the proposed study area.

## **2.5 Methodology**

### **2.5.1 Upstream and Downstream Inundated Areas**

The plan notes that water depth information collected for all survey points will be used to develop a bathymetric map for each reservoir. The NPS raised concerns about this method in our comments on 08/31/2021.

The NPS continues to remain concerned about whether the new bathymetric map will be of sufficient detail to detect changes from the previous map as well as evaluate changes over time through the license period. The NPS requests that additional points be included in the survey, particularly in the area recommended for removal from the boundary at the upper end of the Trego reservoir. Please consider adding detailed information as requested in the WDNR sediment study. In addition, the NPS recommends that the study report include a description of changes that have been seen in the bathymetry and aquatic vegetation since the last map cited in the Preliminary Application Document (PAD).

The initial study plan summary indicated that information about aquatic vegetation, including wild rice, would be part of the ATIS study. There is no specific mention of wild rice in this study plan, however. Section 4.10.3.6 of the PAD acknowledges the relationship of Ojibwe Tribes and the wild rice beds of Northern Wisconsin. The same section acknowledges that Ojibwe Tribes retained the right to hunt, fish, and gather in ceded lands in the Treaty of 1837 and that the Hayward and Trego Projects are both located within the 1837 Ceded Territory.

In an 08/11/20 email, WDNR expressed to the Licensee that Trego Lake enjoys ASNRI Outstanding and Exceptional Status due, in part, to the presence of wild rice. In a 04/27/21 letter, our agency requested a study documenting the presence/extent/type of aquatic vegetation, including “highly valued wild rice.” The NPS has responsibility to review water resources projects under Section 7 of the Wild and Scenic Rivers Act to ensure the project will not have a direct and adverse effect on the values for which the river was designated. The Hayward and Trego Projects are in segments of the Riverway that possess outstandingly remarkable cultural values based on the presence of resources related to American Indian heritage. Wild rice is a resource of particular importance, given its cultural significance to Ojibwe Tribes.

For these reasons, NPS suggests the special importance of wild rice be reflected in the study plan and that the presence and extent of wild rice be mapped within the Study Area.

Also of note, the scientific name for zebra mussel is misspelled in the second to last paragraph on page 3.

#### **2.5.2 Upland Shorelines Not Owned by the Licensee and 2.5.3 Upland Shorelines Owned by the Licensee and Recreation Sites**

The plan notes that observed locations of terrestrial invasive plants listed in NR40 will be recorded via Global Positioning System (GPS), with provisions for future mapping. To ensure that this information is useful for NPS management, please provide shapefiles and metadata.

Please cite the source of the protocol to be used for the meander terrestrial surveys included in section 2.5.3.

What source(s) will be used to identify early detection terrestrial species?

#### **2.5.4 Personnel Qualifications**

The NPS appreciates recognition of the need for obtaining all necessary local, state, and federal permits required for completing the work.

The NPS requests that Xcel (or contractors working on Xcel's behalf) apply for and receive a NPS scientific research and collecting permit to conduct the work outlined in this proposal. Please contact Caitlin Nagorka, natural resources program manager, St. Croix National Scenic Riverway at [caitlin\\_nagorka@nps.gov](mailto:caitlin_nagorka@nps.gov) for next steps regarding this permit requirement.

#### **2.7 Project Schedule and Deliverables**

The NPS requests that the Analysis and Discussion report include a description of how ATIS have changed over the life of the current license. Special attention should be given to the years of data collected under existing license articles for surveys of purple loosestrife and any other aquatic vegetation that has been monitored during the license. Special attention should also be given to bathymetric changes.

The NPS requests that the following additional individual maps be developed and presented:

1. For the reasons included in our agency's comments on Section 2.5.1, a map documenting the presence and extent of wild rice should be included as a deliverable of the study.
2. A map series showing how the presence of purple loosestrife has changed over the life of the current license, given that this has been the subject of monitoring under the current Hayward license.

The NPS also requests a copy of the GIS shapefiles with Metadata for all maps.

## Conclusion

Thank you for your consideration of these additional comments as you develop your final study plan. The NPS looks forward to the results of this study as well as the opportunity to continue to collaborate with you throughout the licensing process. Please include the following contacts in all future communication and distribution of study plans and reports:

- Lisa Yager, NPS, St. Croix National Scenic Riverway – [lisa\\_yager@nps.gov](mailto:lisa_yager@nps.gov)
- Jonathan Moore, NPS, St. Croix National Scenic Riverway – [jonathan\\_moore@nps.gov](mailto:jonathan_moore@nps.gov)
- Susan Rosebrough-Jones, NPS Hydropower Program – [susan\\_rosebrough@nps.gov](mailto:susan_rosebrough@nps.gov)
- Joan Harn, consultant working with NPS – [jharn.nps@gmail.com](mailto:jharn.nps@gmail.com)
- Angie Tornes, consultant working with NPS – [angietornes@gmail.com](mailto:angietornes@gmail.com)

If you have any questions about our response, please contact Lisa Yager at [lisa\\_yager@nps.gov](mailto:lisa_yager@nps.gov).

Sincerely,

**THERESA HOGAN**

Digitally signed by THERESA  
HOGAN  
Date: 2022.02.08 08:22:49 -06'00'

Theresa Hogan  
Acting Superintendent

## WDNR and TLD Did Not Provide Comments on ATIS Study Plan

## Mussel Study Plan Consultation

## Darrin Johnson

---

**From:** Shawn Puzen  
**Sent:** Wednesday, February 2, 2022 2:55 PM  
**To:** cheryl.laatsch@wisconsin.gov; angietornes@gmail.com; susan\_rosebrough@nps.gov; Lisa\_Yager@nps.gov; Joan Harn  
**Cc:** Darrin Johnson; Miller, Matthew J; Shawn Puzen; brey.j.maurer@xcelenergy.com; Crotty, Scott A  
**Subject:** Hayward and Trego Mussel DRAFT Monitoring Plan  
**Attachments:** 20220202 Hayward-Trego Mussel Study Plan sent to Agencies.pdf

Good Afternoon,

Attached is a draft Hayward and Trego Mussel Monitoring Plan for your review and comment. The intent is to complete this study during this field season.

By your initial comments on the relicensing of the Hayward and Trego Hydroelectric Project, you requested NSPW complete a mussel survey.

Prior to executing the study, NSPW is requesting your comments on the enclosed draft study plan.

Please provide your comments as soon as possible, but no later than March 4, 2022.

Please feel free to contact me if you have any questions.

Thanks,

---

### SHAWN PUZEN

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt

Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
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120 YEARS OF SHAPING THE FUTURE

**Hayward and Trego  
Hydroelectric Projects  
FERC Nos. 2417 and 2711**

**Draft Mussel Study Plan**

**Prepared for**



**Prepared by**



**February 2022**

## 1. Introduction

Northern States Power Company – Wisconsin (NSPW or Licensee), d/b/a Xcel Energy, currently holds licenses issued by the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the Hayward and Trego Hydroelectric Projects (Project or Projects). The Projects are owned, operated, and maintained by the Licensee. The current licenses, which designate the Projects as FERC Nos. 2417 and 2711 respectively, expire on November 30, 2025. To obtain subsequent licenses, the Licensee must submit a final license application to FERC no later than November 30, 2023. The final license application, in part, must include a review of freshwater mussel data in the vicinity of the Projects.

On March 11, 2021, the Licensee held a Joint Agency Meeting to present information about the Projects. At the meeting, and during the 60-day comment period immediately following, the Licensee received comments and study requests from several entities. Wisconsin Department of Natural Resources (WDNR) requested that mussel surveys be completed.

The WDNR recommended that the Licensee conduct a mussel study using the WDNR Guidelines for Sampling Freshwater Mussels in Wadable Streams and the WDNR Quantitative Habitat Assessment Methodology. This study plan is consistent with the WDNR request.

## 2. Study Plan Elements

### 2.1 Study Goals and Objectives

The objective of this mussel study is to provide baseline data determine freshwater mussel regarding the general density and diversity of freshwater mussels, including characterizing mussel habitat within the Project area. The study will provide a better understanding of baseline conditions for the Project area.

### 2.2 Background and Existing Information

No federally or state threatened/endangered or special concern mussel species are known to occur in the impounded sections of the reservoirs; however, listed species may occur downstream from the dams or further upstream from the impounded reaches of the reservoirs (WDNR, 2021).

### 2.3 Nexus between project operations and effects on resources

The operations of the Projects could influence the freshwater mussel populations located within the Project boundary.

### 2.4 Study Area

The mussel study will include the sampling of two riverine reaches in each Project vicinity, one upstream of the dam in a riverine area of the impoundment and one downstream of the Project powerhouse outside of the mixing zone. The study areas are depicted in Appendix 1.

## 2.5 Methodology

### 2.5.1 Mussel Survey

The 2015 Wisconsin Department of Natural Resources Guidelines for Sampling Freshwater Mussels in Wadable Streams (Guidelines) and other standard survey methodologies were used to develop the mussel survey parameters (Piette, 2015). The Guidelines provide information on minimum survey efforts for wadable conditions and have been modified for non-wadable conditions. The objective of this mussel study is to provide baseline data regarding mussel diversity within the vicinity of the Projects including a general characterization of mussel habitat within the Project boundary.

Two river reaches will be surveyed at each Project. At the Hayward Project, Reach 1 will begin approximately 430 meters above the Highway 77 Bridge and extend 1,000 meters upstream. Reach 2 will begin at the canoe portage put-in and extend 1,000 meters downstream. At the Trego Project, Reach 1 will begin at the Wagon Bridge Road crossing and extend 1,000 meters downstream. Reach 2 will begin 45 meters below the Trego Dam and extend 1,000 meters downstream.

Surveys will consist of sampling transects extending bank to bank that will be spaced every 100 meters in each reach creating a series of 10 transects per reach. Transects will be numbered 1-10 from downstream to upstream, and a random number selector will be utilized to select five transects for survey in each reach.

Searches along each transect will be conducted in 10-meter-long segments and will extend 0.5 meters on each side of the transect. A rapid visual search for signs of freshwater mussels (living or shell material) will be performed within the segment. The rapid visual search entails an initial search of 0.2 minutes per square meter along each 10-meter segment to determine if mussels are present. If mussels are present within a segment, a semi-quantitative search will be triggered, and the time will be extended to 1 minute per square meter. During the semi-quantitative search, divers will visually search, probe the substrate, and turn over rocks to detect small, burrowed mussels.

General stream conditions and morphology within the study area will be recorded, including bottom substrate composition using the Wentworth Scale (% observed of silt, sand, gravel, etc.) will be recorded. The survey will be conducted only when visibility at depth is at least 20 inches.

In addition to the mussel sampling within the transects, a general description of mussel habitat within the Project boundary will be provided.

### 2.5.2 Data and Mussel Handling

Live mussels found will be kept submersed in ambient river water and kept cool and moist during processing. All live mussels will be identified to species, counted, and sexed (sexually dimorphic species only) by the team malacologist. Dead shell specimens will be scored as fresh dead

(dead < 1 year; lustrous nacre), weathered dead (dead one to many years; chalky nacre, fragmented, and worn periostracum), or subfossil (dead many years to many decades; severely worn and fragmented). Detailed digital images of the study area and representative mussel species will be recorded. A station location data sheet will also be populated per the Guidelines. Data will be recorded using the forms in Appendix 2 to allow distinction between searches. Mussel taxonomy will follow the names presented by Williams et al., 2017.

If any federally or state-listed species is observed, dead or alive, the Licensee will be notified immediately. WDNR and U.S. Fish and Wildlife Service (USFWS) will be notified per surveyor collection permit requirements. No live mussels will be harmed or taken during the study. Any federally or state-listed species that are encountered will be individually hand placed into their places of origin.

### **2.5.3 Personnel Qualifications**

All surveys will be conducted by individuals with prior mussel identification training and experience with aquatic and mussel surveys.<sup>1</sup>

### **2.5.4 Survey Report**

A draft report will be developed within 30 days of completion of field work for agency review and comment. A final report will be completed within two weeks of receiving agency comments. The report shall include a description of mussel survey activities and provide summary tables of all data collected, including mussel species numbers, sizes, and distribution within the study area. The report shall also describe general mussel density and diversity within the vicinity of the two Projects.

A general description of mussel habitat within the Project boundaries, including the reservoirs, bypass reaches and tailwater areas, will also be provided. GIS-based mapping will provide a visual representation of the findings. The report, including completed survey sheets, will be summarized and appended to the DLA.

## **2.6 Consistency with generally accepted scientific practice**

The Mussel Study follows generally accepted scientific practice regarding field data collection and reporting. Similar protocols have been used in other FERC relicensing studies.

## **2.7 Project Schedule and Deliverables**

The study will be completed in 2022. Scientific collector's permits will be obtained, as appropriate, from the WDNR and National Park Service (NPS) prior to the field work commencing. To minimize thermal stress to the mussel specimens, field work will generally be completed between June and mid-September when water temperatures exceed 50 degrees Fahrenheit. Normal to low water conditions

---

<sup>1</sup> Consultant(s) selected to complete the work will be responsible for obtaining any NPS or WDNR scientific collectors permits required.

and good underwater visibility must be present to effectively conduct field work; therefore, project activities will be planned accordingly.

NSPW anticipates that all field work will be completed by mid-September with a draft report available by October 1, 2022.

### 3. Consultation

The mussel study was requested by WDNR. The Licensee consulted with WDNR and NPS as follows.

#### 3.1 Wisconsin Department of Natural Resources

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Mussel Study plan to the WDNR for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED**. Documentation of Consultation is included in Appendix 3.

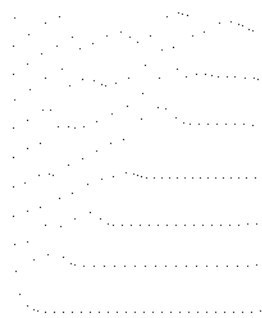
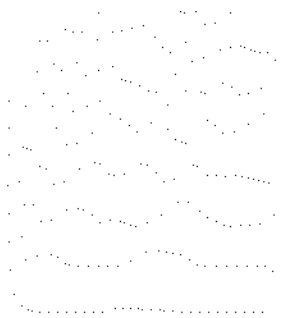
#### 3.2 National Park Service

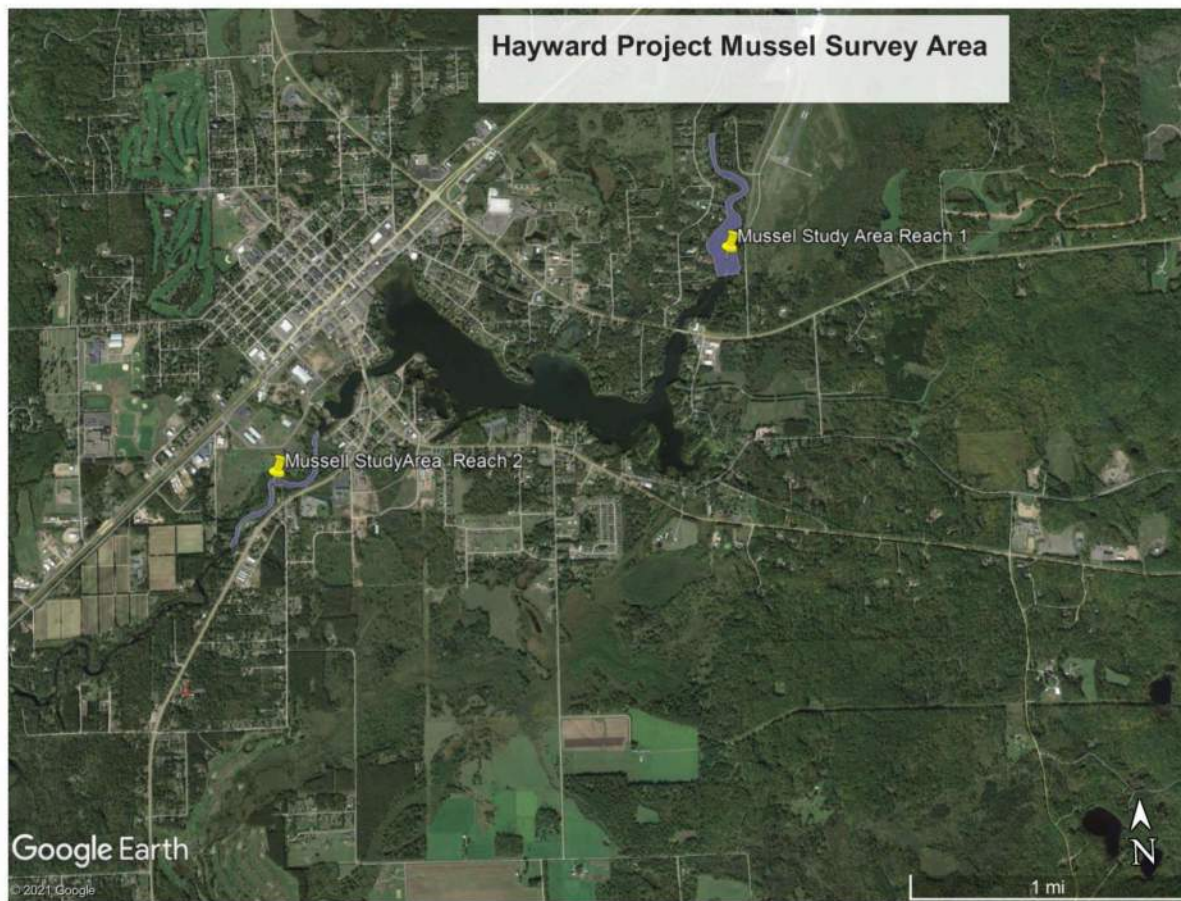
On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Mussel Study plan to the NPS for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED**. Documentation of Consultation is included in Appendix 3.

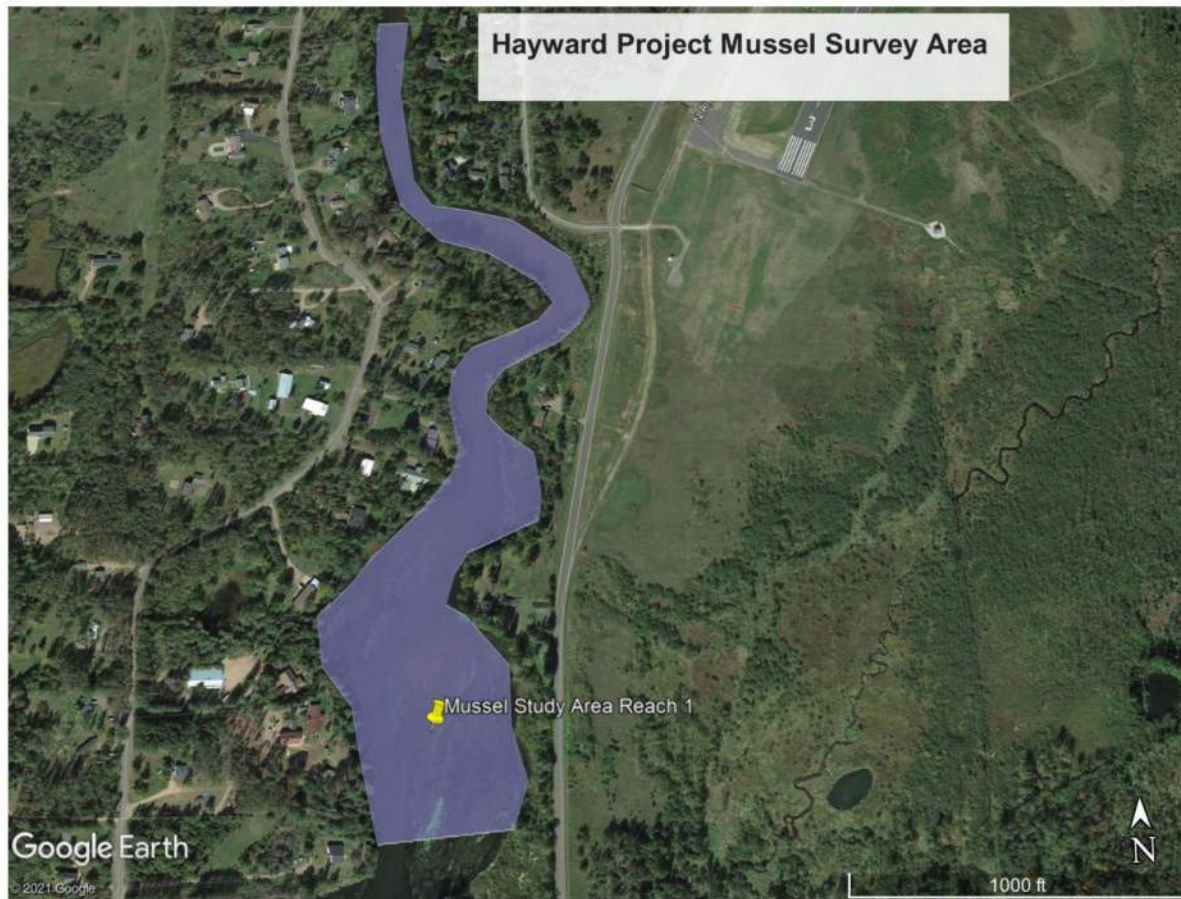
### 4. References

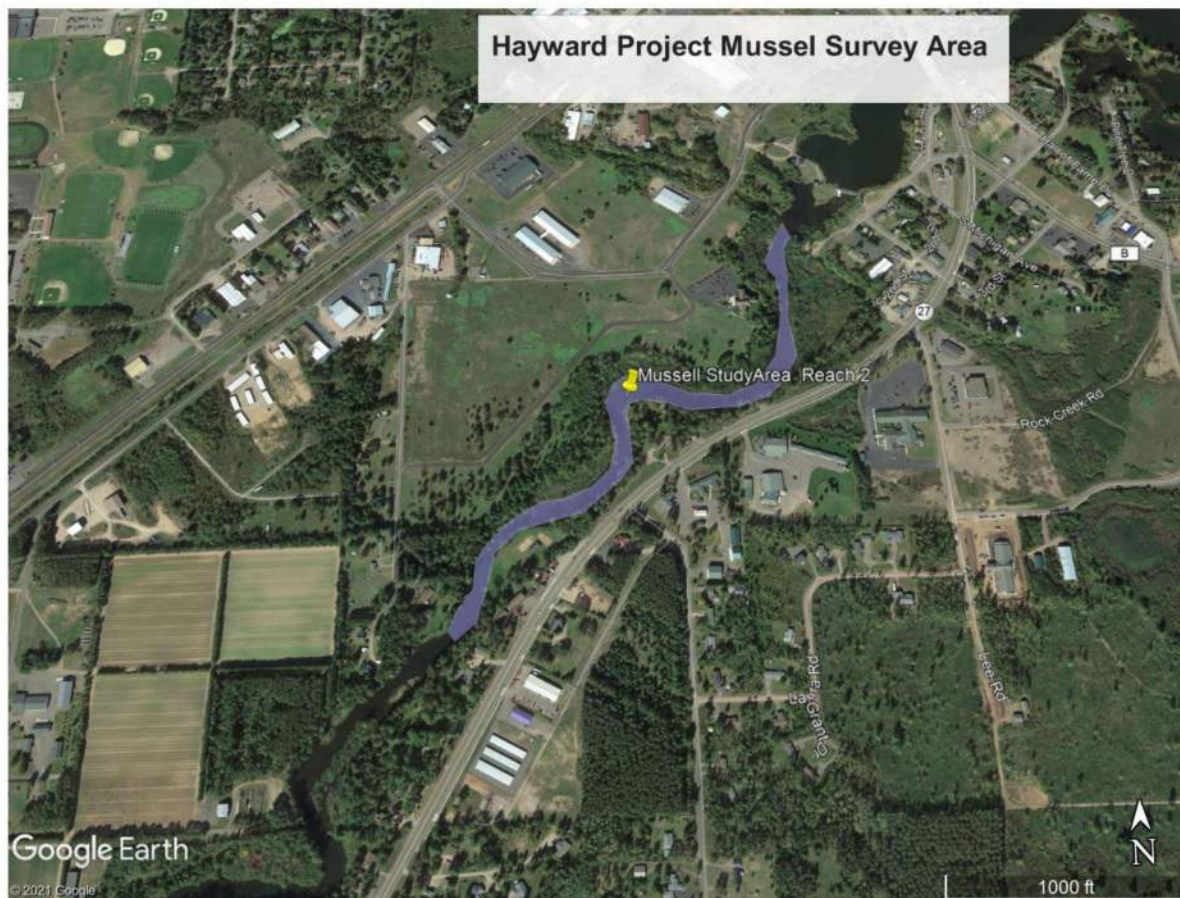
- Piette, R.R. 2015. Guidelines for sampling freshwater mussels in wadable streams. Wisconsin Department of Natural Resources. 50 pp.
- Smith, D.R. 2006. Survey design for detecting rare freshwater mussel species. Journal of the North American Benthological Society 25:701-711.
- Williams, J.D et. al. 2017. A revised list of the freshwater mussels (Mollusca: Bivalvia Unionida) of the United States and Canada. Freshwater Mollusk Biology and Conservation, 20(2), 33-58.
- Wisconsin Department of Natural Resources. 2020. Study Requests Relicensing of Hayward (P-2417) and Trego (P-2711) Projects. May 7, 2021.

## Appendix 1 – Mussel Survey Locations







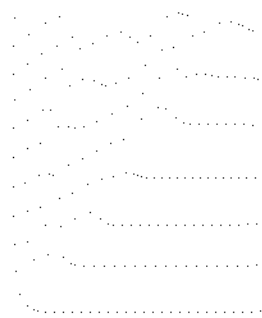
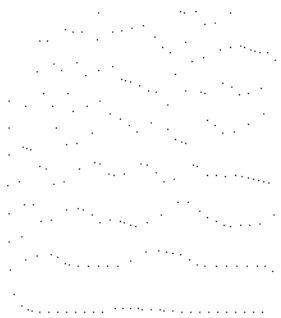








## Appendix 2 – Mussel Survey Data Forms



Substrate and Water Depth Per Segment										
Reach	Transect	Segment	Water Depth (ft)	Substrate Characteristic (%)						
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt	LWD
Reach 1	T1	10								
	T1	20								
	T1	30								
	T1	40								
	T1	50								
	T1	60								
	T1	70								
	T1	80								
	T1	90								
	T1	100								
	T1	110								
	T1	120								
	T1	130								
	T1	140								
	T1	150								
	T1	160								
	T1	170								
	T1	180								
Reach 1	T2	10								
	T2	20								
	T2	30								
	T2	40								
	T2	50								
	T2	60								
	T2	70								
	T2	80								
	T2	90								
	T2	100								
	T2	110								
	T2	120								
	T2	130								
	T2	140								
	T2	150								
	T2	160								
	T2	170								
	T2	180								
Reach 1	T3	10								
	T3	20								
	T3	30								
	T3	40								
	T3	50								
	T3	60								
	T3	70								
	T3	80								
	T3	90								
	T3	100								
	T3	110								
	T3	120								
	T3	130								

Substrate and Water Depth Per Segment										
Reach	Transect	Segment	Water Depth (ft)	Substrate Characteristic (%)						
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt	LWD
	T3	140								
	T3	150								
	T3	160								
	T3	170								
	T3	180								
Reach 1	T4	10								
	T4	20								
	T4	30								
	T4	40								
	T4	50								
	T4	60								
	T4	70								
	T4	80								
	T4	90								
	T4	100								
	T4	110								
	T4	120								
	T4	130								
	T4	140								
	T4	150								
	T4	160								
	T4	170								
	T4	180								
Reach 1	T5	10								
	T5	20								
	T5	30								
	T5	40								
	T5	50								
	T5	60								
	T5	70								
	T5	80								
	T5	90								
	T5	100								
	T5	110								
	T5	120								
	T5	130								
	T5	140								
	T5	150								
	T5	160								
	T5	170								
	T5	180								
	T1	10								
	T1	20								
	T1	30								
	T1	40								
	T1	50								
	T1	60								
	T1	70								
	T1	80								

Substrate and Water Depth Per Segment										
Reach	Transect	Segment	Water Depth (ft)	Substrate Characteristic (%)						
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt	LWD
Reach 2	T1	90								
	T1	100								
	T1	110								
	T1	120								
	T1	130								
	T1	140								
	T1	150								
	T1	160								
	T1	170								
	T1	180								
Reach 2	T2	10								
	T2	20								
	T2	30								
	T2	40								
	T2	50								
	T2	60								
	T2	70								
	T2	80								
	T2	90								
	T2	100								
	T2	110								
	T2	120								
	T2	130								
	T2	140								
	T2	150								
	T2	160								
	T2	170								
	T2	180								
Reach 2	T3	10								
	T3	20								
	T3	30								
	T3	40								
	T3	50								
	T3	60								
	T3	70								
	T3	80								
	T3	90								
	T3	100								
	T3	110								
	T3	120								
	T3	130								
	T3	140								
	T3	150								
	T3	160								
	T3	170								
	T3	180								
	T4	10								
	T4	20								
	T4	30								

Substrate and Water Depth Per Segment										
Reach	Transect	Segment	Water Depth (ft)	Substrate Characteristic (%)						
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt	LWD
Reach 2	T4	40								
	T4	50								
	T4	60								
	T4	70								
	T4	80								
	T4	90								
	T4	100								
	T4	110								
	T4	120								
	T4	130								
	T4	140								
	T4	150								
	T4	160								
	T4	170								
	T4	180								
Reach 2	T5	10								
	T5	20								
	T5	30								
	T5	40								
	T5	50								
	T5	60								
	T5	70								
	T5	80								
	T5	90								
	T5	100								
	T5	110								
	T5	120								
	T5	130								
	T5	140								
	T5	150								
	T5	160								
	T5	170								
	T5	180								

[illegible]

## **Appendix 3 – Documentation of Consultation**



# United States Department of the Interior

National Park Service  
St. Croix National Scenic Riverway  
401 N. Hamilton Street  
St. Croix Falls, Wisconsin 54024



IN REPLY REFER TO:  
I.A.1

March 4, 2022

Mr. Shawn Puzen  
[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)  
Mead & Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: Hayward and Trego Hydroelectric Projects Draft Study Plans for Mussels, Water Quality, and Wood and Blanding's Turtle Nesting Habitat, FERC Nos. p-2417 and p-2711, Namekagon River

Dear Mr. Puzen:

The National Park Service (NPS) is consolidating our comments for the three aforementioned studies received by email dated February 2 and 3, 2022.

The NPS reiterates our request for information reflected in our original study requests on April 27, 2021 for shoreline surveys and hydraulics, sedimentation, and channel change, and our August 31, 2021 comments on your draft Study Summary and Responses. The study plans reviewed here have components that would contribute important information relating to our original study requests.

The NPS administers the Namekagon River as part of the National Wild and Scenic Rivers System (NWSRS) and the National Park System, as established by Congress in 1968 (Public Law 90-542). Under this law, the NPS is required by the Wild and Scenic Rivers Act to preserve the St. Croix River and its tributary, the Namekagon River, in a natural condition; to protect and enhance the exceptional natural, scenic, and cultural resources of the Riverway; and to provide high-quality recreational opportunities. River values identified in the hydropower project areas include aquatic, cultural, recreation, and scenic/aesthetic resources. The Namekagon River is managed as part of the St. Croix National Scenic Riverway and is protected under the Organic Act.

Prior to the FERC issuing a new license, the NPS will need to evaluate the proposed license under Section 7(a) of the Wild and Scenic Rivers Act and to determine whether it will have direct and adverse effects on the values for which the river was designated. If the NPS identifies direct and adverse effects, the license/project will need to be modified to ensure that park resources are protected. The NPS study requests are needed to provide information to enable timely completion of this NPS review as well as the FERC NEPA analysis. Continuing impacts on resource values must be identified so that protection and enhancement measures can be incorporated into a new license.

## Comments on Draft Study Plans

Please contact Caitlin Nagorka, natural resources program manager, St. Croix National Scenic Riverway at [caitlin\\_nagorka@nps.gov](mailto:caitlin_nagorka@nps.gov) to obtain all required NPS scientific research and collecting permits prior to implementing the study plans.

## 1. Mussels

- Mussels are a significant component of the aquatic resources Outstandingly Remarkable Value (ORV) for the Wild and Scenic River designation. It is our agency's understanding that drawdowns may be necessary during the proposed forty-year license period for maintenance and other purposes. Drawdowns have the potential to affect mussels that are present in the portion of riverbed that emerges during the drawdown. To better understand potential effects to mussels, additional reaches will need to be included within the impoundments, especially in the areas near the shoreline that would become exposed during a drawdown event. The study area as currently proposed includes only two riverine reaches at either end of the Project boundaries, which is inadequate to understand the presence, species, and density of mussels in the areas of the impoundments that would be most affected by a drawdown. Please add additional reaches within each impoundment to the study area. The NPS is available to consult further on identifying and prioritizing additional reaches for the purposes of this study.
- The NPS concurs with the use of WDNR guidelines.
- On page 3, include the NPS in the notification list, along with WDNR and USFWS, if any federally or state-listed species is observed, dead or alive. This will also be specified within the required NPS research and collecting permits.
- When assessing and characterizing mussel habitat, researchers should reference *Aquatic Habitat Classification on the St. Croix National Scenic Riverway* by Haibo Wan et al.

## 2. Water Quality Study

- Water quality is a significant component of the aquatic resources Outstandingly Remarkable Value (ORV) for the Wild and Scenic River designation. The Wild and Scenic Rivers Act directs the NPS to protect water quality of the Namekagon (Sec. 1(b)) and work with the Environmental Protection Agency and the WDNR to eliminate or diminish water pollution of the river (Sec. 12(c)).
- The NPS concurs with the use of WDNR protocols and the rationale for not monitoring cyanobacteria.
- The NPS requests that sediment accumulation also be monitored. Results would provide needful baseline information and facilitate better understanding of sedimentation within the project boundaries.

## 3. Wood and Blanding's Turtle Nesting Habitat Study

- This is another example, like the Aquatic and Terrestrial Invasive Plant study, where the effort that goes into the study could provide shoreline survey information outlined in the NPS study request; however, the draft plan does not provide enough detail on shoreline survey methods to determine if NPS needs would be met through this work.
- The NPS-requested shoreline study would provide current information on the status of the shoreline and identify problem areas and the need for potential management attention. It would provide a baseline for monitoring conditions and change over the life of the license. The NPS has responsibility to review shoreline alteration activities such as bank stabilization and small boat docks as water resources projects under Section 7 of the Wild and Scenic Rivers Act.
- The NPS Shoreline Survey request Method 1<sup>1</sup> recommended a longitudinal survey of the river and its banks, using georeferenced photographic equipment (video or still) and cited the High-

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<sup>1</sup> NPS comments on the Pre-Application Document and Study Requests, dated 4/28/21, <https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020CF9CB-66E2-5005-8110-C31FAFC91712>

Definition Stream Survey (HDSS) method ([Trutta, 2019](#))<sup>2</sup> used in recent FERC hydropower licensing proceedings, which enables mapping, a visual record of stream and shoreline characteristics, and data collection from multiple sensors. For any planned boat surveys of the shoreline (e.g., turtle, cultural resources, vegetation), please reconsider adopting study Method 1 proposed in the NPS shoreline survey study request to systematically evaluate, quantify, and photograph shoreline conditions including streambank conditions, bank stabilization types and conditions, docks/piers, and public access locations.

### Outstanding Study Requests

Our agency requests that the Licensee reconsider the additional study requests outlined in our April 27, 2021 letter, including the shoreline survey and hydraulics, sedimentation, and channel change. As previously described, the proposed license will require a Section 7(a) evaluation by the NPS under the Wild and Scenic Rivers Act. These studies are necessary to the timely completion of our agency's review. They are also needed to satisfy Section 4(e) of the Federal Power Act, which directs FERC to "give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality." Equal consideration is not possible without adequate information on these important and relevant topics.

### Conclusion

Thank you for your consideration of our agency's comments as you develop your final study plan. The NPS looks forward to the results of the three studies reviewed in this letter, as well as the opportunity to continue to collaborate with you throughout the licensing process. Please distribute future communications through Lisa Yager, chief of resource stewardship and education at the St. Croix National Scenic Riverway. Information will be distributed to the NPS team as appropriate through Lisa.

If you have any questions about our response, please contact Lisa Yager at [lisa\\_yager@nps.gov](mailto:lisa_yager@nps.gov).

Sincerely,

**CRAIG**  
**HANSEN**

Digitally signed by  
CRAIG HANSEN  
Date: 2022.03.04  
13:13:56 -06'00'

Craig Hansen  
Superintendent

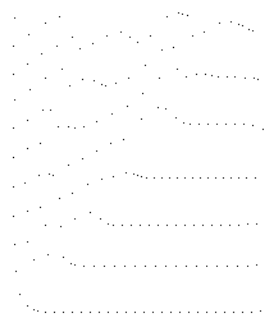
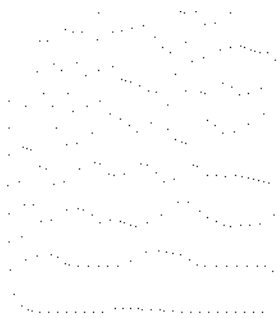
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<sup>2</sup> Trutta Environmental Solutions, *Tallapoosa River High Definition Stream Survey Final Report*, December 2019, included in Alabama Power filing, draft Erosion and Sedimentation Study Report for the R.L. Harris Project under P-2628-065, December 2020. Last accessed 3/31/2021:

[https://elibrary.ferc.gov/eLibrary/filelist?document\\_id=14850582&accessionnumber=20200410-5091](https://elibrary.ferc.gov/eLibrary/filelist?document_id=14850582&accessionnumber=20200410-5091)

Document Content(s)

NPSCommentsProposedMusselsWQTurtles03042022.pdf.....1



## Darrin Johnson

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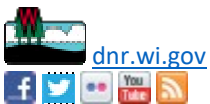
**From:** Laatsch, Cheryl - DNR <Cheryl.Laatsch@wisconsin.gov>  
**Sent:** Wednesday, February 16, 2022 12:16 PM  
**To:** Darrin Johnson; Shawn Puzen  
**Cc:** Miller, Matthew J  
**Subject:** FW: Hayward and Trego Mussel DRAFT Monitoring Plan

See comments below. I confirmed to Jesse that all study reports will be provided to the DNR.

**We are committed to service excellence.**

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Cheryl Laatsch  
Statewide FERC Coordinator  
Bureau of Environmental Analysis and Sustainability  
Wisconsin Dept of Natural Resources  
N7725 Hwy 28  
Horicon WI 53032  
(T) 920-387-7869 (Fax) 920-387-7888  
[Cheryl.laatsch@wisconsin.gov](mailto:Cheryl.laatsch@wisconsin.gov)



---

**From:** Weinzinger, Jesse J - DNR <Jesse.Weinzinger@wisconsin.gov>  
**Sent:** Wednesday, February 16, 2022 12:10 PM  
**To:** Laatsch, Cheryl - DNR <Cheryl.Laatsch@wisconsin.gov>; Kitchel, Lisie E - DNR <Lisie.Kitchel@wisconsin.gov>  
**Subject:** RE: Hayward and Trego Mussel DRAFT Monitoring Plan

Overall, I fully support the study plan and have two comments:

1. Can the author briefly describe what happens at individual 10-meter segments where no evidence of mussels occur. Are segments omitted from semi-quantitative searches?
2. We'd like to obtain a copy of the completed datasheets for use in comparing the current mussel bed to an historical dataset (Heath & Rasmussen 1990). Author mentions, *"The report, including completed survey sheets, will be summarized and appended to the DLA."* So I just want to clarify these datasheets will be available.

**We are committed to service excellence.**

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Jesse Weinzinger  
Conservation Biologist - NHC  
Wisconsin Mussel Monitoring Program  
Wisconsin Department of Natural Resources  
Phone: (608) 576-8631 **(New)**  
[Jesse.Weinzinger@Wisconsin.gov](mailto:Jesse.Weinzinger@Wisconsin.gov)

---

**From:** Laatsch, Cheryl - DNR <[Cheryl.Laatsch@wisconsin.gov](mailto:Cheryl.Laatsch@wisconsin.gov)>  
**Sent:** Wednesday, February 02, 2022 2:58 PM  
**To:** Kitchel, Lisie E - DNR <[Lisie.Kitchel@wisconsin.gov](mailto:Lisie.Kitchel@wisconsin.gov)>; Weinzinger, Jesse J - DNR <[Jesse.Weinzinger@wisconsin.gov](mailto:Jesse.Weinzinger@wisconsin.gov)>

**Subject:** FW: Hayward and Trego Mussel DRAFT Monitoring Plan

**Importance:** High

Please review and let me know if you have comments or we need to set up a conf call.

**We are committed to service excellence.**

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Cheryl Laatsch  
Statewide FERC Coordinator  
Bureau of Environmental Analysis and Sustainability  
Wisconsin Dept of Natural Resources  
N7725 Hwy 28  
Horicon WI 53032  
(T) 920-387-7869 (Fax) 920-387-7888  
[Cheryl.laatsch@wisconsin.gov](mailto:Cheryl.laatsch@wisconsin.gov)



---

**From:** Shawn Puzen <[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)>

**Sent:** Wednesday, February 2, 2022 2:55 PM

**To:** Laatsch, Cheryl - DNR <[Cheryl.Laatsch@wisconsin.gov](mailto:Cheryl.Laatsch@wisconsin.gov)>; [angietornes@gmail.com](mailto:angietornes@gmail.com); [susan\\_rosebrough@nps.gov](mailto:susan_rosebrough@nps.gov); [Lisa\\_Yager@nps.gov](mailto:Lisa_Yager@nps.gov); Joan Harn <[jharn.nps@gmail.com](mailto:jharn.nps@gmail.com)>

**Cc:** Darrin Johnson <[Darrin.Johnson@meadhunt.com](mailto:Darrin.Johnson@meadhunt.com)>; Miller, Matthew J <[Matthew.j.miller@xcelenergy.com](mailto:Matthew.j.miller@xcelenergy.com)>; Shawn Puzen <[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)>; [brey.j.maurer@xcelenergy.com](mailto:brey.j.maurer@xcelenergy.com); Crotty, Scott A <[scott.a.crotty@xcelenergy.com](mailto:scott.a.crotty@xcelenergy.com)>

**Subject:** Hayward and Trego Mussel DRAFT Monitoring Plan

**CAUTION: This email originated from outside the organization.  
Do not click links or open attachments unless you recognize the sender and know the content is safe.**

Good Afternoon,

Attached is a draft Hayward and Trego Mussel Monitoring Plan for your review and comment. The intent is to complete this study during this field season.

By your initial comments on the relicensing of the Hayward and Trego Hydroelectric Project, you requested NSPW complete a mussel survey.

Prior to executing the study, NSPW is requesting your comments on the enclosed draft study plan.

Please provide your comments as soon as possible, but no later than March 4, 2022.

Please feel free to contact me if you have any questions.

Thanks,

---

**SHAWN PUZEN**

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER

Mead & Hunt

Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



120 YEARS OF SHAPING THE FUTURE

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## Turtle Study Plan Consultation

## Darrin Johnson

---

**From:** Shawn Puzen  
**Sent:** Thursday, February 3, 2022 10:45 AM  
**To:** cheryl.laatsch@wisconsin.gov; angietornes@gmail.com; susan\_rosebrough@nps.gov; Lisa\_Yager@nps.gov; Joan Harn  
**Cc:** Darrin Johnson; Miller, Matthew J; Shawn Puzen; brey.j.maurer@xcelenergy.com; Crotty, Scott A  
**Subject:** Hayward and Trego DRAFT Wood and Blanding's Turtle Nesting Habitat Study Plan  
**Attachments:** 20220203 Hayward-Trego Wood-Blandings Nesting Habitat DRAFT sent to Agencies.pdf

Good Morning,

Attached is a draft Hayward and Trego Wood and Blanding's Turtle Nesting Habitat Monitoring Plan for your review and comment. The intent is to complete this study during this field season.

By your initial comments on the relicensing of the Hayward and Trego Hydroelectric Project, you requested NSPW complete Wood and Blanding's Turtle Nesting Habitat monitoring.

Prior to executing the study, NSPW is requesting your comments on the enclosed draft study plan.

Please provide your comments as soon as possible, but no later than March 7, 2022.

Please feel free to contact me if you have any questions.

Thanks,

---

### SHAWN PUZEN

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt

Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



120 YEARS OF SHAPING THE FUTURE

**Hayward and Trego  
Hydroelectric Projects  
FERC Nos. 2417 and 2711**

**Study Plan**

**Wood and Blanding's Turtle Nesting Habitat Study**

**Prepared for**

**Northern States Power Company,  
a Wisconsin corporation**

**Prepared by**

**Mead  
& Hunt**

meadhunt.com

**February 2022**

## 1. Introduction

Northern States Power Company, a Wisconsin corporation (NSPW or Licensee), currently holds licenses issued by the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Hayward and Trego Hydroelectric Projects (Project or Projects). The current licenses, which designate the Projects as FERC Nos. P-2417 and P-2711, respectively, expire on November 30, 2025. To obtain subsequent licenses, the Licensee must submit a final license application to FERC no later than November 30, 2025. The final license application, in part, must include an evaluation of rare species within the Project vicinity.

On March 11, 2021, the Licensee held a Joint Agency Meeting to present information about the Projects. At the meeting, and during the 60-day comment period immediately following, the Licensee received comments and study requests from several entities. The Wisconsin Department of Natural Resources (WDNR) requested that the Licensee conduct wood turtle and Blanding's turtle studies as part of the relicensing process.

The WDNR requested that a wood turtle study be conducted to "determine whether any wood turtle nest sites occur within the Project boundary at either Hayward or Trego (WDNR, 2021)". The WDNR requested that a Blanding's turtle study be conducted to "...determine whether any Blanding's turtle nest sites occur within the Project boundaries (WDNR, 2021)".

Licensee is proposing to conduct a Wood and Blanding's Turtle Nesting Habitat Study to identify areas with suitable wood and Blanding's turtle nesting habitat within the existing and proposed Project boundaries for both Projects.

## 2. Study Plan Elements

### 2.1 Study Goals and Objectives

The objective of this study is to identify areas with suitable wood and Blanding's turtle nesting habitat within the existing and proposed Project boundaries.

### 2.2 Resource Management Goals

The resource management goal is to ensure compliance with Wisconsin Endangered Species Act of 1972 and the federal Endangered Species Act of 1973.

### 2.3 Public Interest

WDNR expressed interest in this study.

### 2.4 Background and Existing Information

WDNR indicated in their wood turtle study request that wood turtles are "known to be present within this Project boundary, however survey data is limited". WDNR indicated in their Blanding's turtle study request that Blanding's turtles were "known to be present near these Project boundaries but that survey data is limited (WDNR, 2021)".

The WDNR issued ER Review Log # 20-683 (ER Review) for the Hayward Project vicinity on September 10, 2020. The ER Review indicated that there was suitable habitat for state-threatened wood turtle and state special concerned Blanding's turtle in the Project vicinity (WDNR, 2020a).

The WDNR issued ER Review Log # 20-684 for the Trego Project vicinity on September 10, 2020. The ER Review indicated that there was suitable habitat for the wood turtle and Blanding's turtle in the Project vicinity (WDNR 2020b).

## 2.5 Project Nexus

The operations of the Hayward and Trego Dams may affect nesting wood and Blanding's turtles in areas with suitable habitat. Identifying areas with suitable wood and Blanding's turtle nesting habitat will help determine whether mitigation measures are necessary as part of relicensing.

## 2.6 Study Area

The study area will include all shorelines upstream and downstream of the Hayward and Trego Dams within both the existing and proposed Project boundaries as shown in Appendix 1.

Study results will be filed as privileged information as requested by WDNR to avoid disclosing specific threatened or endangered species location information.

## 2.7 Methodology

### 2.7.1 Nesting Habitat Survey, Nesting Survey & Presence/Absence Surveys

NSPW will survey all shorelines for the presence of wood and Blanding's turtle nesting habitat within the existing and proposed Project boundaries as shown in Appendix 1. The reservoir shoreline will be surveyed by boat. The bypassed reach (at Hayward) and Namekagon River downstream of both dams will be surveyed by boat, or on foot for those areas not accessible by boat. The surveys will take place during the month of June (preferably on a sunny day) when the air temperature is between 50-80 degrees Fahrenheit.

The surveyors will identify all areas with suitable nesting habitat. Suitable nesting habitat for both turtle species includes areas with a sand or gravel substrate that is either unvegetated or sparsely vegetated, receives sun exposure for most of the day during late spring or summer, and is within 200 feet of the river's edge. Note that this can include gravel parking areas, roads, or shoulders of paved roads. GIS locations of all suitable nesting habitat identified will be collected to develop a map of suitable nesting sites within the study area.

In addition to identifying areas with suitable nesting habitat, the surveyors will conduct visual searches for the presence of any basking wood or Blanding's turtles or evidence of wood or Blanding's turtle nesting activity within the survey area. GIS locations of any basking or nesting wood or Blanding's turtles or evidence of wood or Blanding's turtle nesting sites identified will also be recorded.

Since the wood and Blanding's turtles are known to be present within the vicinity of both Projects, it is assumed that the species are also present within the Project boundaries. Therefore, the presence/absence surveys (identifying individual turtles) and nesting surveys (identifying evidence of turtle nesting) will only be conducted once, concurrent with the nesting habitat surveys.

The information provided by the study will help inform FERC in identifying any enhancement and mitigation measures necessary to minimize or avoid impacts to the species. The study also meets the WDNR's goals of determining whether there are suitable wood and Blanding's turtle nesting sites within the Project boundaries.

### **2.7.2 Personnel Qualifications**

All surveys will be conducted by individuals qualified and approved by WDNR to identify wood and Blanding's turtles and their nesting habitat. The survey may require special permits from the WDNR and the National Park Service (NPS).

## **2.8 Consistency with Generally Accepted Scientific Practice**

This Wood and Blanding's Turtle Nesting Habitat Study follows generally accepted scientific practice regarding field data collection and reporting.

## **2.9 Project Schedule and Deliverables**

Results of this study will be summarized in a study report. The report will include the following elements:

- Project Information and Background
- Study Area
- Methodology
- Study Results
- Mapping
- Analysis and Discussion
- Agency Correspondence and/or Consultation
- Literature Cited

NSPW anticipates that field work will be completed in June 2022. The draft study report will be completed by August 30, 2022. Any information identifying the specific locations of wood and Blanding's turtles will be filed as privileged, non-public information per WDNR guidelines.

### 3. Consultation

Wood and Blanding's turtle studies were requested by the WDNR. As a result, the Licensee consulted with the WDNR and the NPS as discussed below.

#### 3.1 Wisconsin Department of Natural Resources

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Wood and Blanding's Turtle Study plan to the WDNR for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED**. Documentation of Consultation is included in Appendix 2.

#### 3.1 National Park Service

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Wood and Blanding's Turtle Study plan to the NPS for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED**. Documentation of Consultation is included in Appendix 2.

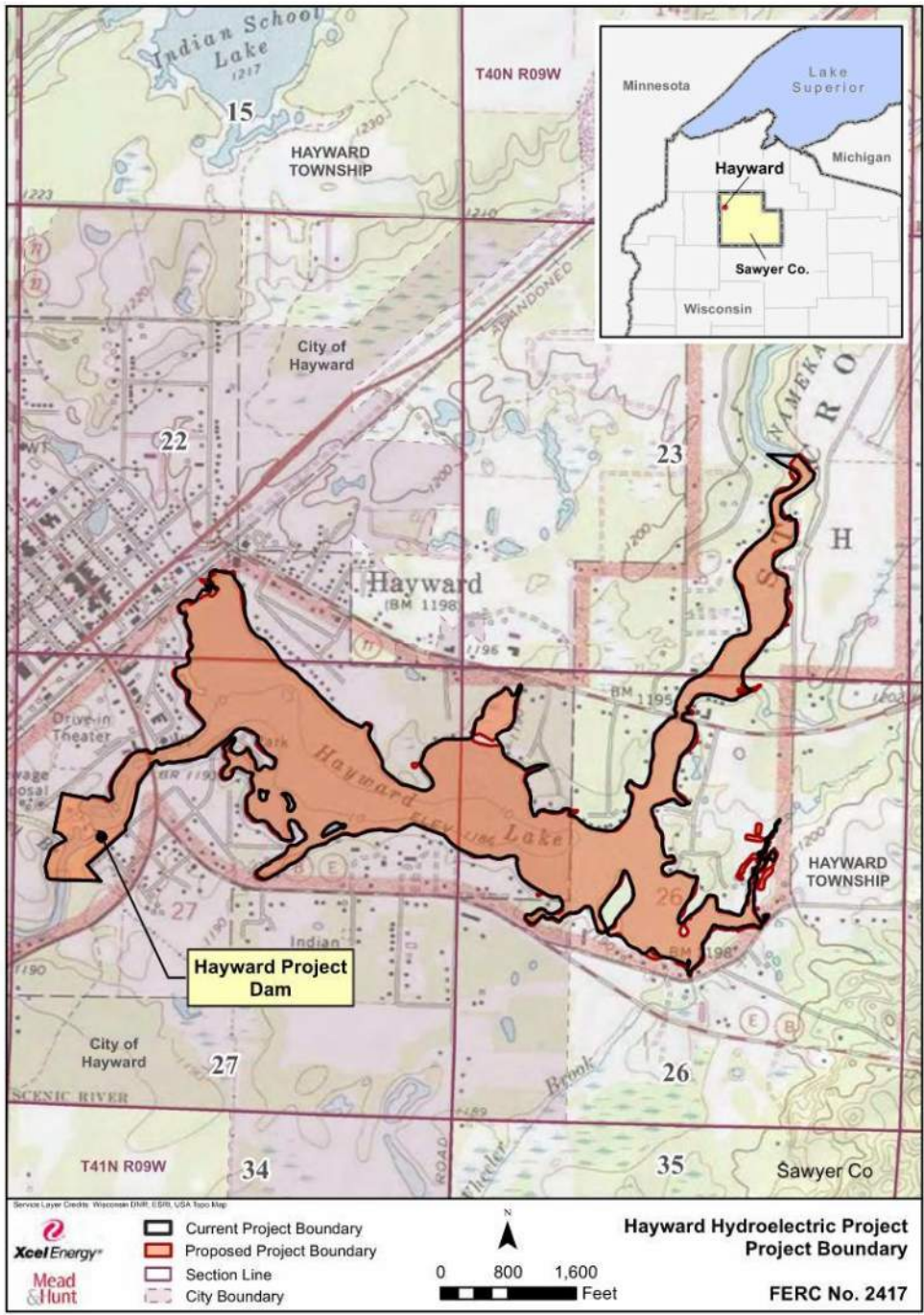
### 4. References

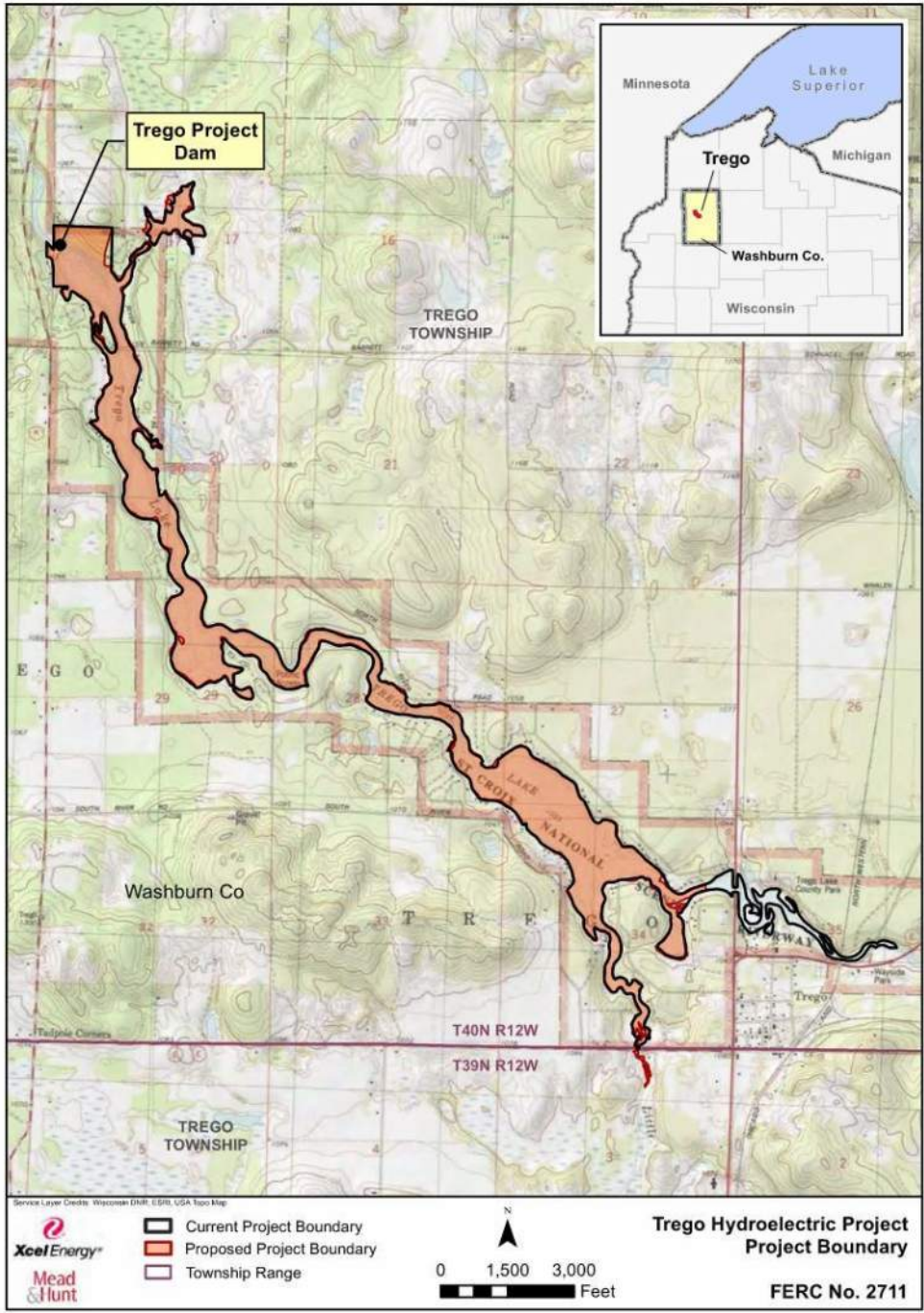
Endangered Resources Review (ERR Log # 20-683). 2020a. Proposed Hayward Hydroelectric Project Relicensing, Sawyer County, WI (ER Log # 20-683). September 10, 2020.

Endangered Resources Review (ERR Log # 20-684). 2020b. Proposed Trego Hydroelectric Project Relicensing, Washburn County, WI (ER Log # 20-683). September 10, 2020.

Wisconsin Department of Natural Resources. 2021. Study Requests- Relicensing of Hayward (P-2417) and Trego (P-2711) Projects. May 7, 2021

## **Appendix 1 – Wood Turtle Survey Area**





## **Appendix 2 – Documentation of Consultation**





# United States Department of the Interior

National Park Service  
St. Croix National Scenic Riverway  
401 N. Hamilton Street  
St. Croix Falls, Wisconsin 54024



IN REPLY REFER TO:  
I.A.1

March 4, 2022

Mr. Shawn Puzen  
[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)  
Mead & Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: Hayward and Trego Hydroelectric Projects Draft Study Plans for Mussels, Water Quality, and Wood and Blanding's Turtle Nesting Habitat, FERC Nos. p-2417 and p-2711, Namekagon River

Dear Mr. Puzen:

The National Park Service (NPS) is consolidating our comments for the three aforementioned studies received by email dated February 2 and 3, 2022.

The NPS reiterates our request for information reflected in our original study requests on April 27, 2021 for shoreline surveys and hydraulics, sedimentation, and channel change, and our August 31, 2021 comments on your draft Study Summary and Responses. The study plans reviewed here have components that would contribute important information relating to our original study requests.

The NPS administers the Namekagon River as part of the National Wild and Scenic Rivers System (NWSRS) and the National Park System, as established by Congress in 1968 (Public Law 90-542). Under this law, the NPS is required by the Wild and Scenic Rivers Act to preserve the St. Croix River and its tributary, the Namekagon River, in a natural condition; to protect and enhance the exceptional natural, scenic, and cultural resources of the Riverway; and to provide high-quality recreational opportunities. River values identified in the hydropower project areas include aquatic, cultural, recreation, and scenic/aesthetic resources. The Namekagon River is managed as part of the St. Croix National Scenic Riverway and is protected under the Organic Act.

Prior to the FERC issuing a new license, the NPS will need to evaluate the proposed license under Section 7(a) of the Wild and Scenic Rivers Act and to determine whether it will have direct and adverse effects on the values for which the river was designated. If the NPS identifies direct and adverse effects, the license/project will need to be modified to ensure that park resources are protected. The NPS study requests are needed to provide information to enable timely completion of this NPS review as well as the FERC NEPA analysis. Continuing impacts on resource values must be identified so that protection and enhancement measures can be incorporated into a new license.

## Comments on Draft Study Plans

Please contact Caitlin Nagorka, natural resources program manager, St. Croix National Scenic Riverway at [caitlin\\_nagorka@nps.gov](mailto:caitlin_nagorka@nps.gov) to obtain all required NPS scientific research and collecting permits prior to implementing the study plans.

## 1. Mussels

- Mussels are a significant component of the aquatic resources Outstandingly Remarkable Value (ORV) for the Wild and Scenic River designation. It is our agency's understanding that drawdowns may be necessary during the proposed forty-year license period for maintenance and other purposes. Drawdowns have the potential to affect mussels that are present in the portion of riverbed that emerges during the drawdown. To better understand potential effects to mussels, additional reaches will need to be included within the impoundments, especially in the areas near the shoreline that would become exposed during a drawdown event. The study area as currently proposed includes only two riverine reaches at either end of the Project boundaries, which is inadequate to understand the presence, species, and density of mussels in the areas of the impoundments that would be most affected by a drawdown. Please add additional reaches within each impoundment to the study area. The NPS is available to consult further on identifying and prioritizing additional reaches for the purposes of this study.
- The NPS concurs with the use of WDNR guidelines.
- On page 3, include the NPS in the notification list, along with WDNR and USFWS, if any federally or state-listed species is observed, dead or alive. This will also be specified within the required NPS research and collecting permits.
- When assessing and characterizing mussel habitat, researchers should reference *Aquatic Habitat Classification on the St. Croix National Scenic Riverway* by Haibo Wan et al.

## 2. Water Quality Study

- Water quality is a significant component of the aquatic resources Outstandingly Remarkable Value (ORV) for the Wild and Scenic River designation. The Wild and Scenic Rivers Act directs the NPS to protect water quality of the Namekagon (Sec. 1(b)) and work with the Environmental Protection Agency and the WDNR to eliminate or diminish water pollution of the river (Sec. 12(c)).
- The NPS concurs with the use of WDNR protocols and the rationale for not monitoring cyanobacteria.
- The NPS requests that sediment accumulation also be monitored. Results would provide needful baseline information and facilitate better understanding of sedimentation within the project boundaries.

## 3. Wood and Blanding's Turtle Nesting Habitat Study

- This is another example, like the Aquatic and Terrestrial Invasive Plant study, where the effort that goes into the study could provide shoreline survey information outlined in the NPS study request; however, the draft plan does not provide enough detail on shoreline survey methods to determine if NPS needs would be met through this work.
- The NPS-requested shoreline study would provide current information on the status of the shoreline and identify problem areas and the need for potential management attention. It would provide a baseline for monitoring conditions and change over the life of the license. The NPS has responsibility to review shoreline alteration activities such as bank stabilization and small boat docks as water resources projects under Section 7 of the Wild and Scenic Rivers Act.
- The NPS Shoreline Survey request Method 1<sup>1</sup> recommended a longitudinal survey of the river and its banks, using georeferenced photographic equipment (video or still) and cited the High-

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<sup>1</sup> NPS comments on the Pre-Application Document and Study Requests, dated 4/28/21, <https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020CF9CB-66E2-5005-8110-C31FAFC91712>

Definition Stream Survey (HDSS) method ([Trutta, 2019](#))<sup>2</sup> used in recent FERC hydropower licensing proceedings, which enables mapping, a visual record of stream and shoreline characteristics, and data collection from multiple sensors. For any planned boat surveys of the shoreline (e.g., turtle, cultural resources, vegetation), please reconsider adopting study Method 1 proposed in the NPS shoreline survey study request to systematically evaluate, quantify, and photograph shoreline conditions including streambank conditions, bank stabilization types and conditions, docks/piers, and public access locations.

### Outstanding Study Requests

Our agency requests that the Licensee reconsider the additional study requests outlined in our April 27, 2021 letter, including the shoreline survey and hydraulics, sedimentation, and channel change. As previously described, the proposed license will require a Section 7(a) evaluation by the NPS under the Wild and Scenic Rivers Act. These studies are necessary to the timely completion of our agency's review. They are also needed to satisfy Section 4(e) of the Federal Power Act, which directs FERC to "give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality." Equal consideration is not possible without adequate information on these important and relevant topics.

### Conclusion

Thank you for your consideration of our agency's comments as you develop your final study plan. The NPS looks forward to the results of the three studies reviewed in this letter, as well as the opportunity to continue to collaborate with you throughout the licensing process. Please distribute future communications through Lisa Yager, chief of resource stewardship and education at the St. Croix National Scenic Riverway. Information will be distributed to the NPS team as appropriate through Lisa.

If you have any questions about our response, please contact Lisa Yager at [lisa\\_yager@nps.gov](mailto:lisa_yager@nps.gov).

Sincerely,

**CRAIG**

**HANSEN**

Digitally signed by  
CRAIG HANSEN  
Date: 2022.03.04  
13:13:56 -06'00'

Craig Hansen  
Superintendent

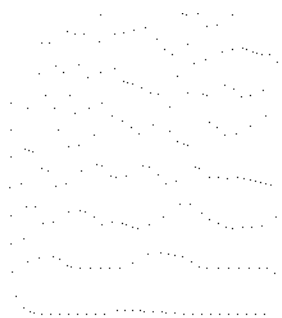
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<sup>2</sup> Trutta Environmental Solutions, *Tallapoosa River High Definition Stream Survey Final Report*, December 2019, included in Alabama Power filing, draft Erosion and Sedimentation Study Report for the R.L. Harris Project under P-2628-065, December 2020. Last accessed 3/31/2021:

[https://elibrary.ferc.gov/eLibrary/filelist?document\\_id=14850582&accessionnumber=20200410-5091](https://elibrary.ferc.gov/eLibrary/filelist?document_id=14850582&accessionnumber=20200410-5091)

Document Content(s)

NPSCommentsProposedMusselsWQTurtles03042022.pdf.....1



WDNR provided verbal comments on 2/21/2022

## Water Quality Study Plan Consultation

## Darrin Johnson

---

**From:** Shawn Puzen  
**Sent:** Thursday, February 3, 2022 9:52 AM  
**To:** cheryl.laatsch@wisconsin.gov; angietornes@gmail.com; susan\_rosebrough@nps.gov; Lisa\_Yager@nps.gov; Joan Harn  
**Cc:** Darrin Johnson; Miller, Matthew J; Shawn Puzen; brey.j.maurer@xcelenergy.com; Crotty, Scott A  
**Subject:** Hayward and Trego WQ DRAFT Monitoring Plan  
**Attachments:** 20220203 Hayward-Trego WQ DRAFT Study Sent to Agencies.pdf

Good Morning,

Attached is a draft Hayward and Trego WQ Monitoring Plan for your review and comment. The intent is to complete this study during this field season.

By your initial comments on the relicensing of the Hayward and Trego Hydroelectric Project, you requested NSPW complete WQ monitoring.

Prior to executing the study, NSPW is requesting your comments on the enclosed draft study plan.

Please provide your comments as soon as possible, but no later than March 7, 2022.

Please feel free to contact me if you have any questions.

Thanks,

---

### SHAWN PUZEN

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt

Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



120 YEARS OF SHAPING THE FUTURE

**Hayward and Trego  
Hydroelectric Projects  
FERC Nos. 2417 and 2711**

**Draft Study Plan**

**Water Quality Monitoring Study**

**Prepared for**

**Northern States Power Company,  
a Wisconsin Corporation**

**Prepared by**



meadhunt.com

**February 2022**

## 1. Introduction

Northern States Power Company, a Wisconsin corporation (NSPW or Licensee), currently holds licenses issued by the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the Hayward and Trego Hydroelectric Projects (Project or Projects). The Projects are owned, operated, and maintained by the Licensee. The current licenses, which designate the Projects as FERC Nos. 2417 and 2711 respectively, expire on November 30, 2025. To obtain new licenses, the Licensee must submit a final license application to FERC no later than November 30, 2023. The final license application, in part, must include an evaluation of the existing water quality associated with the Project.

On March 11, 2021, the Licensee held a Joint Agency Meeting to present information about the Project. At the meeting, and during the 60-day comment period immediately following, the Licensee received comments and study requests from several entities. The Wisconsin Department of Natural Resources (WDNR) requested that a water quality monitoring study be completed at both projects. More specifically, the WDNR requested that the following water quality parameters be assessed and monitored:

- Ammonia
- Alkalinity
- Bacteria
- Chloride
- Chlorophyll-a
- Color
- Conductivity
- Cyanobacteria
- Dissolved Oxygen (DO)
- Dissolved Phosphorus
- Iron, Manganese, and Sulfide
- Methyl Mercury
- Nitrate (plus nitrite)
- pH
- Secchi Depth
- Sediment Accumulation
- Sulfate
- Temperature
- Total Mercury
- Total Nitrogen
- Total Phosphorus
- Total Suspended Solids

WDNR indicated that the data should be collected and/or analyzed using river monitoring protocols upstream of the impoundments and downstream of the dams. Lake protocols should be applied within the deep hole of the impoundment. The Licensee has developed this study plan to include monitoring for all parameters requested by WDNR with the exception of cyanobacteria, methyl mercury, and sediment accumulation. The study plan is otherwise consistent with the WDNR request.

## 2. Study Plan Elements

## 2.1 Study Goals and Objectives

The objective of this water quality monitoring study is to determine if the Project meets current state water quality standards.

## 2.2 Background and Existing Information

Limited information is available on water quality data within the Project boundaries. Water clarity from satellite imagery has been performed annually from 2010-2017 at Hayward and in 2015 at Trego. Most of the water quality parameters identified in WDNR's study request were also monitored at the Trego Project from 2010-2014 and 2016-2020 (WDNR, 2021).

## 2.3 Nexus between project operations and effects on resources

The operations of the dam(s) affect the water quality of the impoundment(s) and downstream resources. The overall goal of the request is to further understand the current water quality conditions of the reservoir and river resources which will help inform management decisions in the future (WDNR, 2021).

## 2.4 Study Area

The study includes water quality monitoring at three locations for each Project. One site will be located downstream of the powerhouse outside of the mixing zone, one will be located in the deep hole within the reservoir, and one will be located upstream of the main impoundment in a riverine area.

At the Hayward Project, site 1 is located approximately 3,600 feet upstream of the Highway 77 bridge, site 2 is located in the deep hole at existing WDNR Monitoring Station 83131, and site 3 is located near the canoe portage put-in at existing WDNR Monitoring Station 583001. At the Trego Project, site 1 is located just upstream of the Highway 53 bridge at existing WDNR Monitoring Station 10022021, site 2 is located in the deep hole at existing WDNR Monitoring Station 663162, and site 3 is located approximately 250 feet downstream of the Trego Dam. Maps showing the location of each monitoring site and their coordinates are included in Appendix 1.

## 2.5 Methodology

### 2.5.1 Upstream and Downstream Monitoring

Since Hayward Lake and Trego Lake are classified as impounded flowing waters with a residence time of less than 14 days, river monitoring protocols should be applied at the upstream and downstream monitoring locations (WDNR, 2021).

The parameters to be monitored, type of sampling, and sampling frequency are detailed in Table 2.5.1-1 below. Each sampling event should occur near the middle of the sampling month.

Table 2.5.1-1 Upstream and Downstream Monitoring Parameters and Frequency

Parameter	Samples	Type of Sampling	Sampling Frequency					
			May	June	July	Aug.	Sept.	Oct.
Ammonia	6 total	Lab	X	X	X	X	X	X
Bacteria	6 total	Lab	X	X	X	X	X	X
Chloride	6 total	Lab	X	X	X	X	X	X
Chlorophyll-a	3 total	Lab			X	X	X	
Conductivity	Continuous Jul-Sept	Field Measurement			X	X	X	
DO	Continuous Jul-Sept	Field Measurement			X	X	X	
Dissolved Phosphorus	6 total	Lab	X	X	X	X	X	X
Nitrate (plus nitrite)	6 total	Lab	X	X	X	X	X	X
pH	Continuous Jul-Sept	Field Measurement			X	X	X	
Sulfate	1 total	Lab	X					
Total Mercury	1 total	Lab	X					
Temperature <sup>1</sup>	Continuous May-Oct	Field Measurement	X	X	X	X	X	X
Total Nitrogen	6 total	Lab	X	X	X	X	X	X
Total Phosphorus	6 total	Lab	X	X	X	X	X	X
Total Suspended Solids	6 total	Lab	X	X	X	X	X	X

Data should be collected or analyzed using the *WDNR Wisconsin Consolidated Assessment and Listing Methodology (WisCALM Guidance)* located online at the following web address:

<https://dnr.wisconsin.gov/topic/SurfaceWater/WisCALM.html>. A list of standard operating procedures can be found in the Appendix of the *WisCALM Guidance*.

*WDNR Nutrient Grab Sample Protocols* located online at

<https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=114118765> should be used for the following parameters:

Ammonia, dissolved phosphorus, sulfate, total mercury, total suspended solids, and nitrate (plus nitrite)

The procedures listed in the *Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)* located online at

<https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/CLMN/ChemistryMan.pdf> should be used for the following parameters:

Chlorophyll a, Chloride

<sup>1</sup> WDNR recommended year-round continuous temperature monitoring. It is extremely unlikely that temperature standards will be exceeded between the months of November and April and any data collected during this timeframe would likely not help inform FERC in developing license conditions. NSPW has restricted continuous temperature monitoring to the same timeframe as other monitoring commitments (i.e., May-Oct.).

The procedures identified in the publication *Citizens Monitoring Bacteria: A training manual for monitoring E. coli* located in Appendix 2 should be used for monitoring bacteria.

### 2.5.2 Deep Hole Monitoring

Since Hayward Lake and Trego Lake are classified as impounded flowing waters with a residence time of less than 14 days, river monitoring protocols should be applied at the upstream and downstream monitoring locations and lake monitoring protocols should be applied within the deep hole of the impounded area (WDNR, 2021).

The deep hole parameters to be monitored, type of sampling, and sampling frequency are detailed in Table 2.5.2-1 below. Each sampling event should occur near the middle of the sampling month.

Table 2.5.2-1 Deep Hole Monitoring Parameters and Frequency

Parameter	Samples	Type of Sampling	Sampling Frequency			
			May	July	Aug.	Sept.
Ammonia	1 total	Lab		X		
Bacteria <sup>2</sup>	4 total	Lab	X	X	X	X
Chloride	4 total	Lab	X	X	X	X
Chlorophyll-a	3 total	Lab		X	X	X
Conductivity	4 total	Field Profile	X	X	X	X
Color	1 total	Lab		X		
DO	4 total	Field Profile	X	X	X	X
Dissolved Phosphorus	4 total	Lab	X	X	X	X
Iron	4 total	Lab	X	X	X	X
Manganese	4 total	Lab	X	X	X	X
Sulfide	4 total	Lab	X	X	X	X
Nitrate (plus nitrite)	1 total	Lab		X		
pH	4 total	Field Profile	X	X	X	X
Secchi depth	4 total	Field	X	X	X	X
Sulfate	1 total	Lab	X			
Total Mercury	1 total	Lab	X			
Temperature	4 total	Field Profile	X	X	X	X
Total Nitrogen	1 total	Field Fixed		X		
Total Phosphorus	4 total	Field Fixed	X	X	X	X
Total Suspended Solids	4 total	Lab	X	X	X	X

The procedures listed in the *Wisconsin Citizen Lake Monitoring Training Manual (Chemistry Procedures)* located online at

<sup>2</sup> The WDNR requested monitoring of cyanobacteria. NSPW is not proposing to monitor for cyanobacteria because other bacteria monitoring will provide similar information and there are no standards for cyanobacteria. The Commission concurred with a similar approach for the Gile Flowage Storage Reservoir P-15055 in their study plan determination dated September 24, 2021.

<https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs/CLMN/ChemistryMan.pdf>

should be used for the following parameters:

Ammonia, chloride, chlorophyll a, chloride, conductivity, color, DO, dissolved phosphorus, iron, manganese, nitrate (plus nitrite), pH, sulfate, sulfide, total mercury, temperature, total nitrogen, total phosphorus, and total suspended solids.

The procedures listed in the *Wisconsin Citizen Lake Monitoring Training Manual (Secchi Disk Procedures)* located online at <https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/programs?CLMN/SecchiMan.pdf> should be used for the Secchi depth parameter.

The procedures identified in the publication *Citizen's Monitoring Bacteria: A training manual for monitoring E. coli* located in Appendix 2 should be used for the bacteria parameter.

For parameters that are labeled as field profiles, a hydrographic profile should be conducted with samples beginning at the water surface and sampled at 1-meter intervals until the reservoir bed is reached. These profiles will help evaluate whether the reservoir is stratified.

### 2.5.3 Personnel Qualifications

All surveys will be conducted by individuals with prior water quality monitoring training and experience.<sup>3</sup>

## 2.6 Consistency with generally accepted scientific practice

The Water Quality Monitoring Study follows generally accepted scientific practice regarding field data collection and reporting. Similar protocols have been used in other relicensing studies.

## 2.7 Project Schedule and Deliverables

Results of the study will be summarized in a final study report. The report will include the following elements:

- Project Information and Background
- Study Area
- Methodology
- Study Results
- Analysis and Discussion
- Agency Correspondence and Consultation
- Literature Cited

NSPW anticipates that field work will be completed between mid-May and mid-October 2022 and the study report is expected to be completed by November 30, 2022.

---

<sup>3</sup> The Consultant(s) selected to complete the work are responsible to obtain any required scientific collection permits required by NPS, WDNR, or other entities.

### 3. Consultation

The Water Quality Study was requested by WDNR. As a result, the Licensee consulted with WDNR as discussed below.

#### 3.1 National Park Service

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Water Quality Monitoring Study plan to the National Park Service for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED**. Documentation of Consultation is included in Appendix 3.

#### 3.2 Wisconsin Department of Natural Resources

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Water Quality Monitoring Study plan to the WDNR for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED**. Documentation of Consultation is included in Appendix 3.

### 4. References

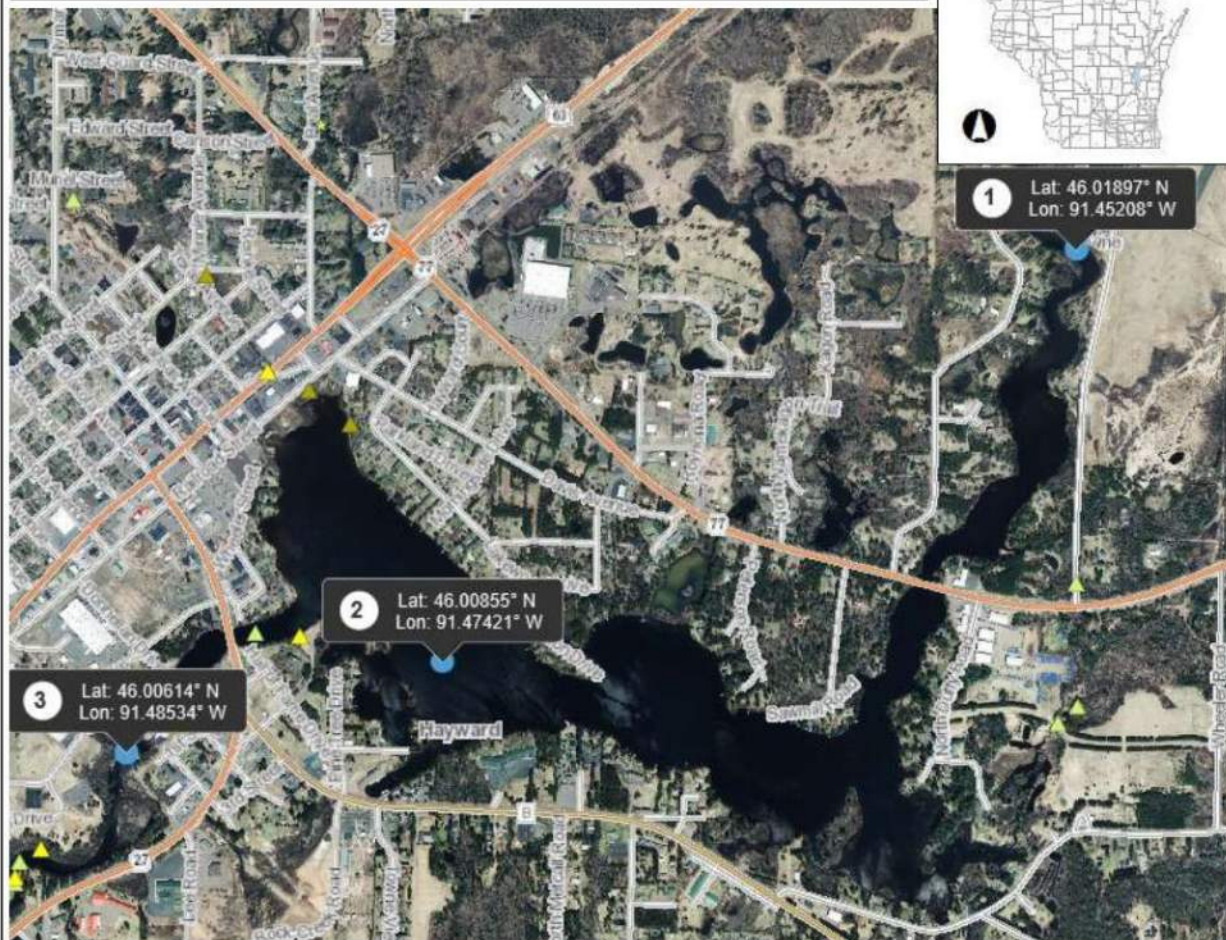
Bruhm, Laura, and Lois Wolfson. 2007. Citizens Monitoring Bacteria: A training manual for monitoring E. coli. Michigan State University. East Lansing, Michigan. 49pp.

Wisconsin Department of Natural Resources. 2020. Study Requests Relicensing of Hayward (P-2417) and Trego (P-2711) Projects. May 7, 2021.

## **Appendix 1 – Water Quality Monitoring Study Area**



## Hayward Water Quality Monitoring Locations



1 Lat: 46.01897° N  
Lon: 91.45208° W

2 Lat: 46.00855° N  
Lon: 91.47421° W

3 Lat: 46.00614° N  
Lon: 91.48534° W

### Legend

- ▲ Station Points with Historic Data
- ▲ Station Points with Recent Data (10 years)
- ▲ Station Points without Data (Active, Usable)
- ★ Station Points without Data (New Station, Pending)
- Municipality
- State Boundaries
- County Boundaries
- Major Roads**
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads**
  - County HWY
  - Local Road
- Railroads
- Tribal Lands
- Index to EN\_Image\_Basemap\_Leaf\_Off

### Notes

0.5 0 0.25 0.5 Miles

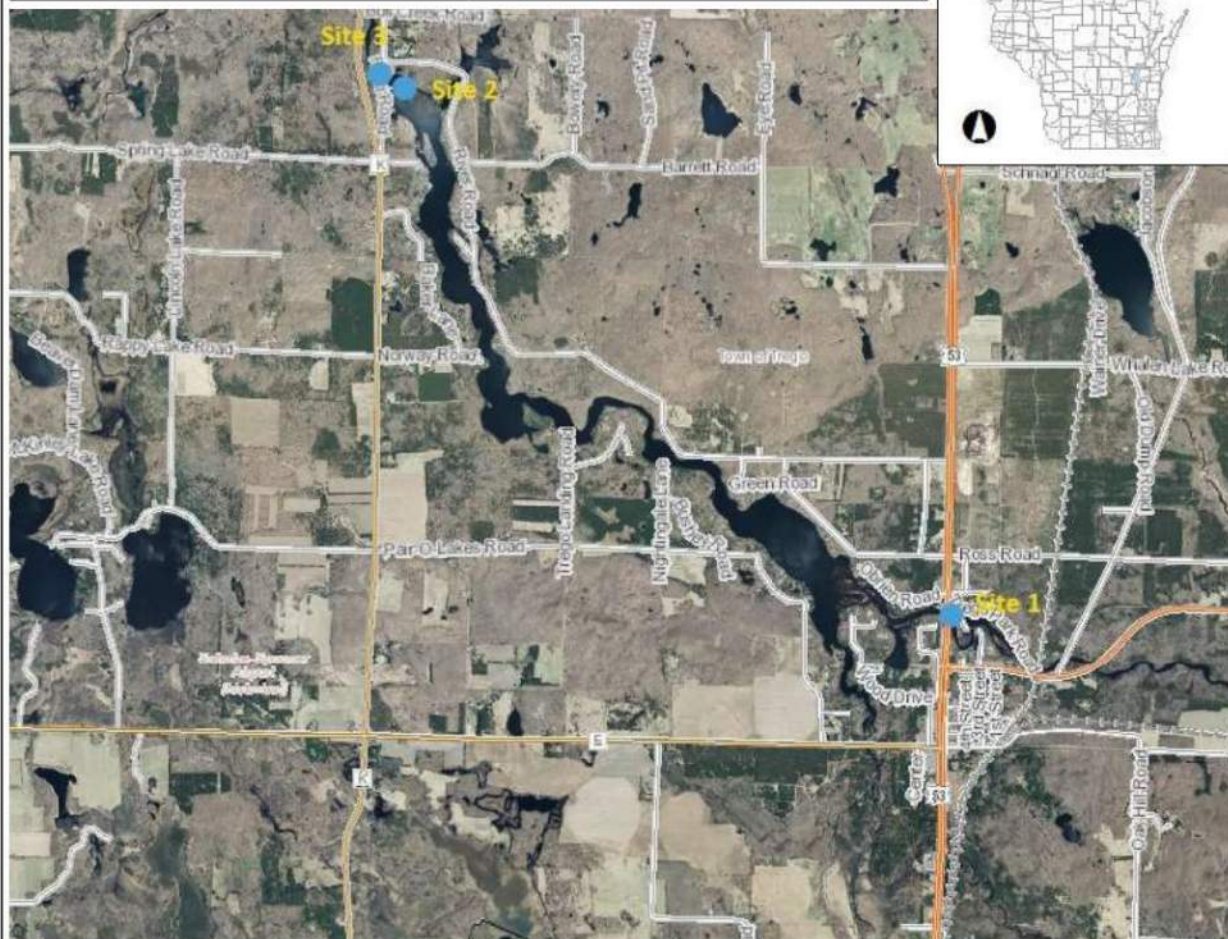
NAD\_1983\_HARN\_Wisconsin\_TM

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## Trego Water Quality Monitoring Locations



### Legend

- Municipality
- State Boundaries
- County Boundaries
- Major Roads**
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads**
  - County HWY
  - Local Road
- Railroads
- Tribal Lands
- Index to  
EN\_Image\_Basemap\_Leaf\_  
Off

1.5 0 0.75 1.5 Miles

NAD\_1983\_HARN\_Wisconsin\_TM

1: 47,520

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### Notes



## Trego Water Quality Monitoring Locations



1 Lat: 45.90951° N  
Lon: 91.82713° W

### Legend

- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads
- Tribal Lands
- Index to EN\_Image\_Basemap\_Leaf\_Off

### Notes

0.1 0 0.06 0.1 Miles

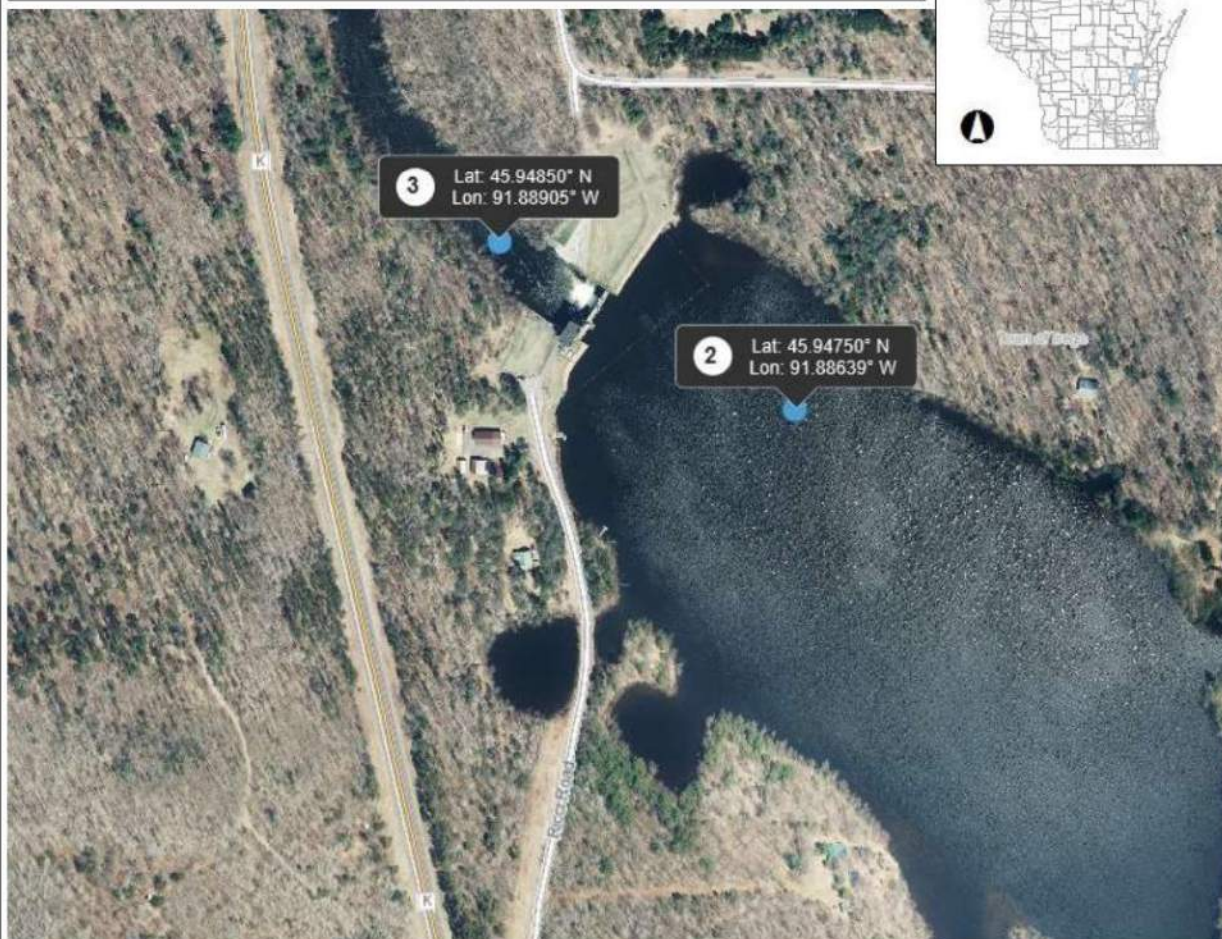
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## Trego Water Quality Monitoring Locations



### Legend

- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads
- Tribal Lands
- Index to EN\_Image\_Basemap\_Leaf\_Off

### Notes

0.1 0 0.06 0.1 Miles

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## **Appendix 2 – Citizens Monitoring Bacteria: A training manual for monitoring E. coli**

# Citizens Monitoring Bacteria:

A training manual for monitoring *E. coli*



2nd Edition



A regional partnership between IN, IA, MI, MN, OH and WI





# Citizens Monitoring Bacteria:

## A training manual for monitoring *E. coli*

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[http://www.uwex.edu/ces/csreesvolmon/EColi/  
ProjectVolunteers.htm](http://www.uwex.edu/ces/csreesvolmon/EColi/ProjectVolunteers.htm)

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# Preface

**T***his manual is a result of a joint project to enhance citizen *E. coli* monitoring in streams of the upper Midwest. The partners involved in this project include the Iowa Department of Natural Resources IOWATER, Purdue University, the Indiana Department of Natural Resources, Hoosier Riverwatch, Michigan State University, the Ohio State University, the University of Minnesota Extension Service, Minnesota Water Resources Center, the Volunteer Stream Monitoring Partnership, the University of Wisconsin Extension, the Wisconsin Department of Natural Resources, and the Water Action Volunteers Program. Others who have lent support to this manual include local units of government, citizen leaders, and all the volunteers who have helped throughout this project.*

Funding for this Citizens Monitoring Bacteria (CMB) project was granted from the U.S. Department of Agriculture's Cooperative State Research, Education, and Extension Service (CSREES) 406 Water Quality program. Additional funding was provided by the CSREES Great Lakes Regional Water Program.

Several excellent training manuals already exist that instruct citizens on monitoring various parameters of water quality in streams, and several are cited at the end of this manual. The content of this training manual will not provide a comprehensive approach to stream monitoring methods but will instead supplement other training manuals by focusing on the single parameter, *E. coli*, and provide detailed information on methods and analyses for *E. coli* stream monitoring.

# Chapter 1: Introduction: Stream Monitoring

## Why monitor streams?

**S**treams have been referred to as the arteries of the earth since they carry and transport the water that supports aquatic life. Humans also depend on this water for a multitude of activities including irrigation, drinking supply, energy production, recreation, industry, and aesthetics. Clean water is important to the health and livelihood of all people, and many groups and stakeholders are working together to protect water resources. However, 39% of the rivers and streams assessed in the United States in 2000 were polluted or had degraded habitat. According to the USEPA's 2000 National Water Quality Inventory, polluted water runoff from the land was the leading cause of water quality problems nationwide (USEPA, 2002a). Major pollutant sources were sediment, bacteria, heavy metals and nutrients. Stream monitoring programs can be invaluable in assessing current conditions and tracking changes in water quality over time to determine if remediation or protection actions have been successful.



## Volunteer programs

State and regional agency staff as well as funds are often limited, yet stream monitoring needs can be vast. Volunteer monitoring programs can be an extremely valuable asset to states' water quality monitoring programs by expanding data collection efforts and resource assessment opportunities. Volunteer-collected data can provide important baseline information to assist with decision-making and resource assessment.

Volunteer monitoring programs are also a way to tap the expertise of volunteer monitors on local water quality conditions and history. Volunteer monitoring teams are often more "in-touch" with local settings and events and can be available to respond quickly when a pressing need for monitoring arises.

Volunteer monitoring programs are also a great opportunity for citizens of various backgrounds to become more involved in and to gain greater understanding of water quality issues. The training for and involvement in monitoring programs can empower citizens to become involved in informed debate, taking action, and making an impact in their



community. In fact, a study in Wisconsin found that experienced volunteer monitors are more active politically in their communities (Overdevest et al, 2004).

## Goals of *E. coli* bacteria monitoring

Many parameters can be monitored to help assess a stream's condition or to follow trends in water quality. One that has received increasing attention as an important water quality indicator is *E. coli* bacteria. While other factors may be just as important to monitor, this training manual focuses on *E. coli* monitoring.

### Citizens Monitoring Bacteria Program Goals:

- ◆ Build the capacity of volunteer monitoring programs to understand and use the most appropriate *E. coli* testing protocols (test kits, laboratory analysis, etc.) and watershed-based sampling strategies with their volunteers
- ◆ Enhance the public's understanding about the role of bacteria in water quality
- ◆ Increase awareness and acceptance of the use of volunteer-collected water quality data in various watershed programs, including watershed assessments and TMDL development and implementation
- ◆ Share results with other states across the country, primarily via the National Volunteer Monitoring Facilitation Project
- ◆ Demonstrate how to set up an appropriate watershed-based *E. coli* sampling strategy utilizing volunteer networks and begin collecting usable data

## Setting goals and designing a sampling program

The objectives of this program are to provide citizens involved in *E. coli* monitoring programs with the scientific background, practical applicability, and tools needed to develop an understanding of the role of bacteria in stream water quality.

Before embarking on a bacteria monitoring program, it is suggested that your group first review and determine your own goals in terms of data collection and use. Where, when, and how often you sample will depend on these set goals. A reference you may wish to use is the Volunteer Water Quality Monitoring National Facilitation project website's Guide for Growing Programs. In the "Designing Your Monitoring Strategy," groups are introduced to goal-setting processes, and also referred to a number of valuable resources for working towards step-by-step goal making ([www.usawaterquality.org/volunteer/](http://www.usawaterquality.org/volunteer/)).



The time involved with volunteer monitoring can be demanding, but rewarding. First assess how often your group is prepared to monitor. The amount of time allocated to volunteer monitoring depends on your group's goals. For example, one goal may be to conduct baseline monitoring. This plan would involve monitoring every few weeks over many years. You may also choose to monitor your selected stream to see if it is meeting water quality standards. This plan may call for more frequent monitoring but not necessarily for years and years. A short-term, intensive study, such as monitoring the effects of storm water runoff, is another option which may involve daily sampling. All these monitoring plans are not necessarily mutually exclusive.

If your group has the time and has set goals to monitor more frequently, such a plan will provide you with additional data. For example, many states have an active beach monitoring program because of the high level of full-contact recreational use of beaches. Standards have been developed by state and local agencies that indicate the level of risk to human health by swimming in beach waters. According to USEPA standards, when a one-time high count is reached (235 colony forming units (cfu)/100 milliliters (ml)) or a 30-day geometric mean (with a sample size of at least 5 samples per 30-day period or the total number of samples collected over the specified monitoring period) is exceeded (126 cfu/100 ml), the beach is closed until levels decrease (see Chapter 7 for a description of a geometric mean and how it is calculated). If your group has set a goal to determine a 30-day geometric mean, it is recommended that you monitor at least once a week.



Another group goal may include collecting data to further watershed management plans that will develop from coordination with other water quality monitoring programs. You may also want to work on fostering connections and partnerships with state agencies and other groups that promote sound land and watershed management.

In general, the time involved will include driving to and from the selected sites, taking water samples at these sites, and returning to your home or designated laboratory space to process and incubate the samples. You also must be available 24 to 48 hours later (depending on the test) to read the plates after incubation. Counting the *E. coli* colonies and recording them on a data sheet could take up to an hour.

Finally, remember that good sampling plans are flexible and can be updated and refined according to goals and objectives. You can visit the CSREES Best Education Practices (BEP) website for further information on this process (<http://wateroutreach.uwex.edu/>).

## Other important water quality indicators



Bacteria monitoring, while an important and valuable water quality indicator, is only one part of total stream water quality. A comprehensive assessment program of stream water quality should consider monitoring for other water quality indicators.

Biologically and chemically, water quality is defined by a number of factors, and these parameters can generally indicate if a water body is degraded or polluted. How the water will be used may influence which or how many characteristics are used to determine water quality. In addition to bacteria, other common water quality measurements include clarity,

conductivity, dissolved oxygen, hardness, nutrients (particularly nitrogen and phosphorus), pH, temperature, total suspended solids, and biological communities (see box, next page).

Various water quality standards exist based on many of these parameters, however the standards may vary depending on the use of the water. For example, drinking water and irrigation water have different standards for bacteria. Zero levels of *E. coli* are required in drinking water, but the presence of some *E. coli* are a tolerated risk in irrigation or swimming waters.

## Other Important Water Quality Parameters

### Temperature

Temperature varies depending on time of day, season, and vegetation along the stream. Temperature affects the oxygen content of the water since colder water can hold more dissolved oxygen than warmer water. Temperature also affects the rate of photosynthesis by aquatic plants, metabolic rates of aquatic organisms, and the sensitivity of organisms to toxic wastes and diseases.

### Dissolved oxygen (DO)

Dissolved oxygen (DO) is necessary for the maintenance of a healthy aquatic ecosystem. Aquatic organisms differ in the amount of oxygen they require for survival. For example, fish such as trout and pike require higher concentrations of DO for survival, while carp and catfish are able to survive at much lower concentrations (less than 5 mg/L). Dissolved oxygen is supplied to a water body through the atmosphere where oxygen mixes with water through wind and wave action, and through photosynthesis by algae and other aquatic plants. Oxygen is more easily dissolved in cold water than in warm water; therefore, the amount of oxygen that water will hold increases as the temperature decreases. Low DO levels can have negative impacts on biota causing stress and sometimes death if levels fall below tolerance values for organisms.

### pH

The pH is a measure of the acidity or the alkaline (basic) nature of the water. Since the scale is logarithmic, a drop in the pH by 1 unit is equivalent to a 10-fold increase in acidity. A pH of 7 is neutral. Thus a pH of 5 is 10 times more acidic than a pH of 6 and 100 times more

acidic than a pH of 7. pH affects many chemical and biological processes in the water. Different organisms do well or poorly within different ranges of pH. The majority of aquatic animals prefer a pH range from 6.0-8.0. Outside this range reduces the diversity in the stream because it stresses the physiological systems of most organisms and can reduce reproduction. Low pH can also allow toxic elements and compounds to become mobile and “available” for uptake by aquatic plants and animals. This can produce conditions that are toxic to aquatic life, particularly to sensitive species such as salmon and trout. Changes in acidity can be caused by atmospheric deposition (acid rain), surrounding rock, and certain wastewater discharges.

### Nutrients

Excess nutrients such as nitrogen and phosphorus can accelerate eutrophication in surface waters, a condition that often results in excessive plant growth, declining oxygen levels and changes in the aquatic community. Often, phosphorus is the nutrient in the shortest supply relative to the organisms’ needs in fresh water systems, and even a modest increase in phosphorus can set off a chain of undesirable events. This includes accelerated plant growth, algal blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals. Sources of nutrients can be both natural and human. Natural sources include soil and rocks. Human sources include discharge from wastewater treatment plants, runoff from fertilized lawns and cropland, failing septic systems, animal manure inputs, storm water runoff and disturbed land areas.

## Other Important Water Quality Parameters (continued)

### Transparency/Water Clarity

Transparency or water clarity is a measure of how well light passes through the water column. Transparency is usually measured with a Secchi disk (for lakes) or transparency tube (for streams), although it can be measured in the field with a light meter. Secchi disk readings are probably the most commonly collected water quality data across the U.S. Transparency measurements are typically made *in situ* (on site) and can be affected by suspended sediment, by algae, and by the color of the water (i.e., humic acids that stain the water red or brownish).

### Turbidity

Turbidity is a measure of how much light is scattered by particles in the water. Algal blooms or suspended sediment can increase turbidity because light is scattered by particles in the water, whether those particles are sediment or algae. Other sources contributing to turbidity include soil erosion, runoff from urban and agricultural areas, wastewater and storm water inputs, plant materials and sediment being stirred up by bottom feeders. Materials causing turbidity may also be responsible for clogging fish gills, reducing available habitat, interfering with egg and larvae development, smothering fish eggs and aquatic insect larvae, and suffocating newly-hatched insect larvae. Turbidity is most commonly reported in NTUs (Nephelometric Turbidity Units) and is most accurately measured with a nephelometer which may cost several hundred dollars.

### Total Solids

Total solids consist of dissolved and suspended materials in water. Dissolved solids, or those particles that will pass through a filter with pores of around 2 microns (0.002 cm) in size,

include calcium, chlorides, nitrate, phosphorus, iron, and sulfur. Total suspended solids (TSS) will not pass through a 2-micron filter and are a direct measurement of the particles suspended in the water - by weight. That means you must collect a sample and take it back to the lab where the water is filtered and dried in an oven, before being weighed. Suspended solids include silt and clay particles, algae, fine organic debris, and other particulate matter. Sediment weighs more than algae, so TSS is a more accurate measurement of how much sediment is in the water, whereas turbidity is affected equally by sediment or algae.

If you collect samples for turbidity or TSS, be sure to shake the container thoroughly before taking a measurement, so whatever has settled out is re-suspended. Neither TSS nor turbidity measurements are affected by colored water.

### Biological Communities

Various biological communities can be used to assess stream ecosystem health. Aquatic macroinvertebrates, the animals without a backbone but larger than microscopic organisms, include the aquatic insects, mollusks, crustaceans, and aquatic worms.

Macroinvertebrates often are used as indicators of water quality since their tolerance range to pollution varies among species, they are easy and inexpensive to collect, and many are sensitive to both physical and chemical changes in the water. Since they cannot easily escape pollution once it enters, they can be valuable in detecting pollution even after it is no longer detected by chemical methods. Fish may also be used as indicator species. Many fish cannot tolerate low dissolved oxygen concentrations or low pH. Others have narrow temperature tolerances. Some are also sensitive to high turbidity levels, which can clog their gills or interfere with their ability to see their prey.

# Chapter 2: Bacteria and Water Quality

## What are bacteria?

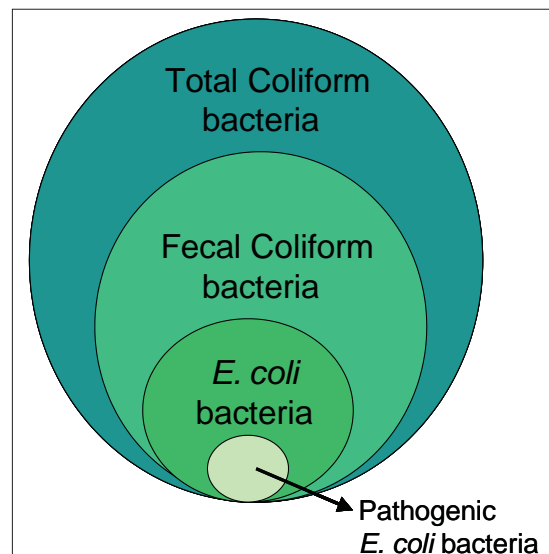
**B**acteria are microscopic, single-celled organisms that are the most numerous organisms on earth. They are so small that over five million could be placed on the head of a pin. Bacteria can live in numerous environments and perform many complex actions, some of which are beneficial and some harmful. Most bacteria, however, are not harmful and do not cause human health problems. Those that are disease producing are referred to as pathogenic. Viruses and some protozoans can also be pathogenic.

Coliform bacteria are part of the Enterobacteriaceae family and individual cells cannot be seen with the naked eye due to their small size (but colonies can be seen.) While some coliform bacteria can be naturally found in soil, the type of coliform bacteria that lives in the intestinal tract of warm-blooded animals and originates from animal and human waste is called fecal coliform bacteria.

*Escherichia coli* (*E. coli*) is one subgroup of fecal coliform bacteria. Even within this species, there are numerous different strains, some of which can be harmful. However, the release of these naturally-occurring organisms into the environment is generally not a cause for alarm. But, other disease causing bacteria, which can include some pathogenic strains of *E. coli*, or viruses may also be present in these wastes and pose a health threat.

## What are indicator bacteria?

The use of an organism that can serve as a surrogate for another is called an indicator organism. Trying to detect disease-causing bacteria and other pathogens in water is expensive and may pose potential health hazards. Further, testing for pathogens requires large volumes of water, and the pathogens can often be difficult to grow in the laboratory and isolate. *E. coli* bacteria are good indicator organisms of fecal contamination because they generally live longer than pathogens, are found in greater numbers, and are less risky to collect or culture



*Fecal coliform bacteria which include E. coli are part of a larger group of coliform bacteria.*



in a laboratory than pathogens. However, their presence does not necessarily mean that pathogens are present, but rather indicates a potential health hazard.

The EPA has determined that *E. coli* are one of the best indicators for the presence of potentially pathogenic bacteria (EPA, 2002b). Because *E. coli* monitoring does not measure the actual pathogens, the assessment is not foolproof, however, it is a good approach for assessing the likelihood of risks to human health. Monitoring for these indicator organisms is an easy and economical method for

citizens or professionals to assess health risks due to bacterial contamination of surface waters.

## Common sources of *E. coli*

Bacteria in water can originate from the intestinal tracts of both humans and other warm-blooded animals, such as pets, livestock and wildlife. Human sources include failing septic tanks, leaking sewer lines, wastewater treatment plants, combined sewer overflow (CSOs), boat discharges, swimming “accidents” and urban storm water runoff. In urban watersheds, fecal indicator bacteria are significantly correlated with human density (Frenzel and Couvillion, 2002).

Animal sources of fecal coliform bacteria include manure spread on land, livestock in runoff or in streams, improperly disposed farm animal wastes, pet wastes (dogs, cats), wildlife (deer, elk, raccoons, etc.), and birds (geese, pigeons, ducks, gulls, etc.). If you are sampling in a watershed area without significant human impact and are finding *E. coli*, the source may be birds or wildlife. In a study comparing *E. coli* concentrations in waters from agricultural and “pristine” sites, contamination was found in both settings. The researchers deduced that the levels of *E. coli* at the pristine site likely came from wildlife, such as deer and elk, living the area (Niemi and Niemi, 1991).



## Common routes of bacteria to streams

How does *E. coli* bacteria get into streams and rivers? Polluted water runoff from the land is the leading cause of water quality problems nationwide (USEPA, 2002a). Fecal material as well as other pollutants can be transported to waterways through runoff. How quickly they are transported partially depends on the type of land use. Non-developed lands including grasses and other vegetation tend to soak up rainfall, thereby increasing infiltration into the ground and reducing runoff to waterways. Developed lands such as streets, rooftops, sidewalks, parking lots, driveways, and other hard surfaces tend to create more impervious surfaces, and runoff increases. Lands that support domesticated animals, such as cattle, hogs, or horses, can also be a source of bacteria, particularly if animals enter the water for drinking or if heavy rains wash manure from the land into receiving waters.



Top: Cattle crossing on a stream in northeast Iowa.  
Bottom: The crossing keeps the cattle out of the stream. (Photos courtesy USDA NRCS)



Another source of bacteria pollution to stream waters comes from Combined Sewer Overflows (CSOs). Some sewer and storm water pipes are not separated. When a large storm event occurs, the wastewater treatment plants cannot handle the excess volume of water being pumped to them. As a result, untreated sewage along with storm water is dumped directly into rivers and streams.

The presence and levels of *E. coli* in a stream do not give an indication of the source of the contamination. However, it can be a good first step in investigating the watershed for potential sources.

## Risks to human health

Most people are concerned about the risk that bacteria may pose to human health. When numbers are above health standards, people exposed to water that contain bacteria may exhibit fever, diarrhea and abdominal cramps, chest pain, or hepatitis. While *E. coli* by itself is not generally a cause for alarm, other pathogens of fecal origin that are health threats include *Salmonella*, *Shigella*, and *Pseudomonas aeruginosa*.

Non-bacterial pathogens that may be present with fecal material include protozoans, such as *Cryptosporidium* and *Giardia*, and viruses.

There are some strains of *E. coli* that are pathogenic themselves. One that has received much attention is the *E. coli* strain named 0157:H7 that lives in the

intestinal tract of cattle. This strain is primarily spread to people by eating contaminated, undercooked beef or drinking unpasteurized milk and is not generally found in surface waters.

## Examples of at-risk concentration levels

Criteria for concentrations of indicator bacteria in recreational waters (USEPA 1986) have been developed by the USEPA. Initially, total coliform bacteria were used as the benchmark. However, because it was shown that *E. coli* were more closely correlated with swimming-related illnesses, the USEPA later recommended that *E. coli* be used as the indicator in freshwater recreational areas (USEPA 2002b).

Many states have since adopted this recommendation, however, some still use total fecal coliform bacteria when determining concentrations. The acceptable risk level for total body contact recreation, which involves activities such as swimming or water skiing, is 126 colonies of organisms (referred to as colony forming units or cfu) per 100 milliliters (ml) of water or less based on a geometric mean (calculated over 30 days with at least 5 samples) or a one-time concentration of 235 cfu/100 ml. The risk of getting sick increases as total numbers of colonies are exceeded.

The number of colony forming units of *E. coli* organisms per 100 ml of water and the method of determination may vary slightly by state based on State Public Health Codes and Water Quality Standards (See Chapter 7). The USEPA recommends a set of standards for *E. coli* in fresh water bodies as a single maximum allowable count. These rates correspond to an acceptable risk level of 8 people out of 1000 getting sick.

	Designated swimming	Moderate swimming area	Light swimming area	Infrequent swimming area
<i>E. coli</i> (colony forming units/100 ml of water)	235	298	410	576

(from USEPA 1986, 2002b)

Even with good watershed management measures, there will always be fecal material in the environment. If you repeatedly find unusually high levels of *E. coli* on a long-term, regular basis in your stream samples, you should alert and work with your local health agency.

### Weather and seasonal influences

The number of bacteria colonies can be influenced by weather and seasonal effects. This variability makes the bacterial concentrations in natural water difficult to predict at any one time. Bacteria numbers often increase following a heavy storm, snow melt or other excessive runoff. *E. coli* bacteria are often more prevalent in turbid waters because they live in soil and can attach to sediment particles. Bacteria can also remain in streambed sediments for long periods of time. If the streambed has been stirred up by increased flow or rainfall, your sample could have elevated bacteria levels. This is why you should avoid disturbing the streambed as you wade out into the stream. You should also collect the water sample upstream from you. If you are collecting at several sites within the stream, collect the furthest downstream sample first and proceed upstream.

A number of other weather influences may affect bacteria levels in the stream. Higher *E. coli* counts may be found in warmer waters because they survive more easily in these waters. (*E. coli* are used to living in the warm environment of the intestines of warm-blooded animals). Ultraviolet rays of sunlight, however, can also kill bacteria, so a warm sunny day may produce numbers lower than expected.

# Chapter 3: Preparation for Sampling

## Selecting your equipment and supplies

**T**here are several containers that can be used to collect your water sample. One recommended type is the pre-sterilized and disposable Whirl-pak® bags. These plastic self-seal bags are easy to use, carry, and transport. Because they are used only once, they are not re-sterilized.

However, sterilized plastic bottles are also acceptable. They can be reused, and they're much sturdier than the bags. However, if bottles are re-used, then both the bottles and lids must be sterilized and sealed before collection. The sterilization procedure calls for the use of an autoclave for 15 minutes at 121°C (USEPA, 1997), which may require assistance from a professional laboratory.

## Equipment and supplies checklist

Before going out to a stream, refer to the check-list of the items needed, and make sure you bring them with you.

- ✓ Waders and/or rubber boots (depending on water depth)
- ✓ Bucket with rope or grab sample pole (if sampling from a bridge or water is too deep to enter)
- ✓ Sealed, sterilized, wide mouth bottles (plastic or glass) or Whirl-pak® bags
- ✓ Labels & clear tape to cover them
- ✓ Long rubber/latex gloves—elbow length if possible
- ✓ Clipboard and field data sheets
- ✓ Pencil and Sharpie® marking pen
- ✓ Cooler with frozen ice packs (or ice)
- ✓ Shipping containers
- ✓ First aid kit
- ✓ Personal flotation device (PFD)
- ✓ Monitoring reference sheet
- ✓ Chain of custody record
- ✓ Weather gear: sun-screen and hat for sun protection, rain gear, or cold weather gear
- ✓ Towel for drying off after sampling, if necessary
- ✓ Disinfectant hand wipes, antibacterial lotion or gel



Once you return from the field trip, you will need the following:

- ✓ Space for sample processing with good lighting
- ✓ Incubator or heating lamp and thermometer (if the sample requires incubation)
- ✓ Sterilized laboratory supplies
- ✓ Paper towels or Kimwipes
- ✓ Isopropyl alcohol
- ✓ Latex gloves
- ✓ Bleach and water-tight bag for sample disposal



*A temperature-controlled egg incubator can be used for incubating the samples.*

## Use of an incubator

Several kits require that the sample be incubated. If this is the method you are using, you will need to either make or purchase an incubator to help the *E. coli* colonies grow once you have collected the water samples and plated them. You can buy an egg incubator for about \$40 to \$50. Use a small cup or tray to add water (deionized if possible) to keep the Petri plates/films from drying out. Incubation time will generally run 24 hours to 48 hours for *E. coli*, depending on the type of kit used.

## Labeling and identification of bottles

It is advisable to use a specific system to assign a site number to your sampling locations. One option is to begin with the two-character abbreviation for your state. Next, use the assigned two digit county code that is pre-assigned for each county in a state. Follow this number with a sequential site number. For example, if Iowa's volunteers will be monitoring Prairie Creek in Boone

County (county code 08) at 2 locations, the first site would be IA0801 and the second site would be IA0802. Organizations may have their own system of labeling.

When preparing the bottles:

- ✓ Stick tape over the lid to indicate that it has been sterilized
- ✓ Prior to collecting the sample, label each bottle with the location/sample number, time and date of sampling, initials of sample collector and type of sample
- ✓ Cover label with tape for water-proofing
- ✓ Wrap labeling tape around the circumference of the bottle. This will prevent the tape from coming off when the bottle gets wet. Do not, however, cover the lid with the tape
- ✓ Mark replicate samples with an "R" or appropriate marking
- ✓ Label 10% of your bottles as field blanks. Only distilled water will be added to these bottles



## Safety is most important!

When sampling in a stream, always bring along a partner. It's also recommended that you inform people of where you are going and when you plan to return. It is advisable to carry a cellular phone with you in case of an emergency.

Other important tips include:

- ✓ Obtaining permission from the landowner, if needed
- ✓ Listening to weather reports prior to leaving and rescheduling the sampling if severe weather or temperatures are on the way. (Try [www.weather.com](http://www.weather.com) for current weather conditions)
- ✓ Dressing appropriately for the weather conditions
- ✓ Bringing a first aid kit with you
- ✓ Parking your vehicle in a safe location so that you do not block traffic. Keep your keys in a safe and secure location
- ✓ Avoiding sampling in areas with very steep or unstable banks and making sure you can access the stream safely while wearing waders
- ✓ Wearing waders or rubber boots to help protect you from cold water and sharp rocks or surfaces in the streambed
- ✓ Making sure the water depth is not so deep nor the stream flow so swift that you risk losing your footing and being carried downstream
- ✓ Wearing a personal flotation device (PFD) while wading in the stream, if needed
- ✓ NOT entering the stream if you observe chemical, oil, or other hazardous substances in or discharging to the water



Once you return to your vehicle and/or home, wash your hands and be careful not to touch your eyes or mouth when processing your water samples.

You should consider reviewing the safety section of the USEPA's *Volunteer Stream Monitoring: A Methods Manual* (see Chapter 9) prior to field sampling.

## Site selection

Your selected site should align with the goals of the study. When determining where you should sample, start with a USGS topographic map or similar map of your watershed and determine the extent of the stream and its tributaries (other streams entering the stream in question). If you have Internet access, several online sites listed at the end of this manual provide online maps that can give you latitude/longitude or other locational information. Sampling near a USGS gauging station will help with site identification and allow you to assess *E. coli* results with stream flow data ([waterdata.usgs.gov/nwis/rt](http://waterdata.usgs.gov/nwis/rt)).

If your stream has many tributaries feeding into it, a site both upstream and downstream of the incoming water can help you determine if a specific tributary or sub-watershed is contributing more *E. coli* than another. If you are doing an impact assessment of a particular activity, you may also want to select sites

above and below the suspected area. However, try to select far enough downstream from stream convergences to allow even mixing of the waters.

As stated in your checklist, if the site is on private land, be sure to obtain written permission to sample prior to going on-site, or find a publicly accessible site instead.

## When to sample

The number of times that you'll need to sample varies and depends on what you want to know. The more you sample, however, the better information you'll have when interpreting your data. At a minimum, it is recommended that you sample one time per month between May and September. You should also try to be consistent as to the time of day you sample and the interval of time between sampling. These factors help in the comparison of your data over time. If you have the opportunity to do so, also try to sample just after a relatively heavy storm. Remember that when and how often you sample will depend on the goals of your local program.

Wet versus dry weather sampling may help you identify general sources of the bacteria. For example, if you sample during dry weather, continuous sources will be more easily detected, such as leaking septic tanks or wildlife. If you sample after wet weather, sources that would increase in-stream bacteria levels due to runoff, such as storm water outfalls or field runoff, may be easier to identify.



## Quality assurance/Quality control

You've likely heard the term QA/QC. It stands for Quality Assurance/Quality Control. Quality assurance is a method of maintaining quality in all practices and procedures used during your project. Quality control procedures assure that samples are being collected in a consistent and accurate manner at all sites and from all volunteer monitors.

### Quality assurance measures include:

- ☐ Assigning responsibilities to volunteer members
- ☐ Training volunteers in collection techniques, handling of equipment, and analysis of samples
- ☐ Calibrating instruments
- ☐ Specifying procedures for field analyses
- ☐ Keeping accurate records of all procedures and conditions.
- ☐ Following chain of custody procedures or tracking samples from their collection in the field to final analyses or destination

### Quality control measures include:

- ❑ Blank samples in the field: sampler fills a bottle at the bank of the stream with distilled water at 10% of your sampling sites or 10% of the times you sample. (This sample is plated as usual with the rest of your samples and helps identify contamination errors in the field)
- ❑ Field replicates: taking additional samples with another bottle(s) at 5-10% of your monitoring sites. (This method helps assess variability in the stream)
- ❑ Control plates: plating with distilled water to assure no lab contamination, or plating with a known quantity of sample
- ❑ Split samples: two different analyses from the same sample. In this case, it could involve sending the same sample to another lab for independent analysis
- ❑ Lab replicates: plating two or more separate plates from 1 bottle. (This technique helps assess the variability of the techniques of the person doing the plating and reading)
- ❑ Regular inspection of equipment, growth media, and other items being used

It is important that all volunteers use the same procedures so that samples within and between streams can be compared to each other. Consistency and keeping good field notes is key! Occasionally you may have staff from your local health agency taking side-by-side samples and readings with you to compare results.

The closer you adhere to QA/QC measures, the more confident you and others can be about your data results. Recognition of the importance and continued use of QA/QC protocols are good ways to assure agencies and the public that your data are worth considering.

The USEPA discusses the five key components of QA/QC:

- ◆ **Accuracy:** how similar your results are to a true or expected value.
- ◆ **Comparability:** the degree that data can be compared between sampling sites or across time.
- ◆ **Completeness:** how much data you planned to gather versus how much you actually were able to collect.
- ◆ **Precision:** how reproducible your results are, the level of consensus between repeated measurements.
- ◆ **Representativeness:** how much your data characterize the true environmental condition when the sample was collected (USEPA, 1996).

## Why use replicates?

In the stream, bacteria concentrations can be highly variable since they often grow in clumps, so taking several samples can be very important. Variability can also occur during the transfer of water from one bottle or bucket to another bottle, during plating and culturing the bacteria, and in counting the colonies. Replicates (in duplicates or triplicates) help identify and minimize variability in the sample. Replicates can be two or more samples taken from the same collection bottle or bucket and transferred to other collection bottles or be two separate samples with separate containers taken at the same time at the same place. Split samples always come from the same collection bottle. When sending a replicate to a laboratory for verification, you should use a split sample. As a general rule, replicate samples should be taken at 10% of your monitoring sites or 10% of the time you sample.

# Chapter 4: Field Sampling

## Site assessment - Choosing a site within a stretch of stream

**S**afety should be a priority when selecting a sampling site. First make sure the stream has flowing water and that you can reach the site without difficulty. Look for uniform flow across the main streambed. Walk about 60-100 feet upstream and downstream to assess each site and conditions of the bank. Check for any obvious pollutant sources, such as storm water outfalls, lake/pond outflows, or sewage input. If the source is too close to your sampling site, your bacteria samples may not be representative of the stream overall. If the site is acceptable, take pictures, if possible, and be sure to thoroughly describe the site on your datasheet. Identify landmark features, such as crossroads and bridges or unique vegetation, that will help you or another person find your site again.



## In-stream field collection

Once you're in the field, it is important to record all information. Forms may include a bacteria data sheet and site description form.

There are several methods for obtaining a sample from the stream depending on stream access, the depth of water, and safety. If you can safely enter the stream, you should obtain your sample where the main current is flowing. As you are wading into the water, try to disturb as little sediment as possible so that the sample is not contaminated by bacteria attached to or living in the soil. You should position yourself downstream of the sampling point (i.e. hold the bottle upstream of your body) so that if sediments are stirred up they won't affect your sample. If a stream site is curved, sample near the outside of the curve. Before entering the water, make sure your sample bottles are labeled correctly and completely.

If you cannot safely access the water, you should sample from a bridge following the procedures at the end of this section. If conditions are safe and you are a skilled boater, you may also sample from a canoe in the stream. If possible, do not take the sample at the stream bank's edge since the water may be stagnant or not well mixed with the rest of the water.

**If sampling within the stream, follow these steps:**

- ☐ Take 1-2 steps upstream, reach out your arm, and collect the sample upstream from where you are standing. It is recommended that you wear rubber gloves.
- ☐ Open the bottle and remember to not touch the inside of the bottle or the cap with your hands.
- ☐ Rinse the bottle and lid three times.
- ☐ Hold the bottle near its base and plunge it with the top facing downwards into the water to 3-5 inches below the surface or at approximately wrist level. Don't worry if you cannot get the bottle to this exact distance. Just try to avoid sampling water from the surface.
- ☐ Turn the bottle into the current (upstream) and wait for it to fill.
- ☐ Bring the bottle up, pour out some water so that there is 1 inch of air space and close and tighten the bottle with its lid or cap.
- ☐ Place the sample in a cooler with ice packs to be transported back to your house or wherever the tests will be done.
- ☐ Be sure to record all necessary information on field data sheets.



**If Whirl-pak® bags are being used instead of bottles, follow these steps:**



- ☐ Correctly label the Whirl-pak® bag with indelible marker.
- ☐ Remove the perforated seal from edge of Whirl-pak® bag.
- ☐ Use the two small white tabs to open the bag.
- ☐ Place the bag in the water below the surface and allow the water to flow into the bag.
- ☐ Grab the ends of the twist ties and “whirl” the bag shut.
- ☐ Make sure the bag is securely closed by testing the seal.
- ☐ Place the Whirl-pak® bag in a cooler with frozen ice packs.

**If you are collecting your sample with a bucket or other container from a bridge, the following steps are recommended:**

- ☐ Attach the bucket/container to a secure rope and lower it into a fast flowing section of the stream.
- ☐ Rinse the bucket/container three times with the stream water.



- ☐ Rinse the sample bottle three times.
- ☐ Do not let the rope, bucket/container or bottle touch the ground.

To minimize exposure to potential pathogens in the water, use disinfectant wipes or gel to wash up after sampling, as a preventive measure.



**If you are taking a pipette sample directly from the water, you should:**

- ☐ Unwrap the sterile pipette and do not touch its tip
- ☐ Squeeze the bulb of the pipette, lower it into the water to wrist level, and then release the bulb while the pipette is under water
- ☐ Remove the pipette from the water and adjust water volume in the pipette to the exact marking (1 ml)
- ☐ Squirt the water from the pipette into the collection bottle

## **Packaging your water samples for shipping**

All samples taken should be analyzed within 24 hours. So, if you need to ship your water samples to an analytical lab, try to collect them in the early part of the week and no later than a Wednesday to allow time for the lab to process them prior to the weekend. Make arrangements with your mail carrier prior to sampling to make sure the samples will be collected promptly and delivered within 24 hours. On the day of sampling, you will need to sample early in the day so the samples can be shipped out the afternoon of the same day.

When shipping, make sure the bottles are secure, cold, and not going to leak. You should consider:

- ✓ Using a plastic garbage bag to line the shipping container to prevent leaks of water.
- ✓ Sealing each sample in its own plastic bag to prevent any cross-contamination and to contain the sample in case of leaks or breakage.
- ✓ Packing the samples with ice or ice packs.
- ✓ Using a Styrofoam container, cooler, cardboard box, or specialized water sample shipping container.

Be sure to fill out the sampling form completely, the chain of custody form, and any other paperwork, and place them on the top of the container before sealing the box. You may want to first seal the paperwork in a large zippered storage bag. Finally, attach the provided pre-addressed, pre-paid mailing label and ship overnight.

# Chapter 5: Use of Kits

## Value of volunteer analyses

**T**he expense of sending *E. coli* samples to a commercial laboratory for analysis can be costly over time. Completing the analyses at your “home lab” is one way to determine *E. coli* levels in your stream without excessive costs. Through your work, you also help extend limited agency resources for water quality assessments.

## General methods and procedures with kits

For the most reliable results, USEPA recommends that you should prepare your sample for analysis within 6 hours of taking it (USEPA, 1997). In many cases it is not possible to meet this recommendation, but samples should not be held longer than 24 hours. In all cases, you should store your samples on ice before lab analysis, and the quicker you get your sample processed the less chance there is for variability. Make sure you indicate on the data sheet the length of time between collecting and processing.

Regardless of the kit used, it is essential that you maintain sterile conditions while filtering and plating, since this is the time with the greatest potential for external contamination of the samples. Thus, it is recommended that you do your plating all at once in the lab and not at the field site. Sanitize your working surface by spraying or wiping it with a 70% isopropyl alcohol solution or with bleach.



You should also:

- ✓ Wash your hands thoroughly with soap
- ✓ Have the following with you: paper towels or wipes; isopropyl alcohol, distilled water, waste container, permanent marker and gloves
- ✓ Label both your bottles and plates/films with the date, time, sampling site number, and replicate number (if applicable). For the petri dishes, make sure the written information does not interfere with your ability to read the plate.
- ✓ Always shake your sample bottle before drawing a sample with a pipette

There are many kits on the market that are being used for determining *E. coli* numbers in water. During the research phase of this project, five kits and variations within the kits were tested by volunteers. Their results were compared with laboratory results. Four of the five methods were found to be acceptable. However, when ease of use, volunteer preference, and economics were added to the equation, one kit, 3M<sup>TM</sup> Petrifilm<sup>TM</sup>, stood out over the others.

## Methods and procedures using Coliscan<sup>®</sup> Easy Gel<sup>®</sup> (incubated)

The following information comes from the Indiana Hoosier Riverwatch Program and the Iowa IOWATER program.

Coliscan media incorporates a patented combination of color-producing chemicals and nutrients that make *E. coli* colonies appear blue, coliform bacteria that are not *E. coli* as a pink magenta and non coliforms as white or teal-green colonies. Coliscan<sup>®</sup> Easygel<sup>®</sup> employs a pour plate technique, where a liquid media is inoculated with a sample and poured into a Petri dish to solidify.

### Preparation and Setup

1. Thaw Coliscan<sup>®</sup> Easygel<sup>®</sup> at room temperature by removing from freezer before sampling.
2. Label the bottom of Petri dishes using a permanent marker. This label should include site ID, date and time of sample collection, volume of water collected, and sample number.

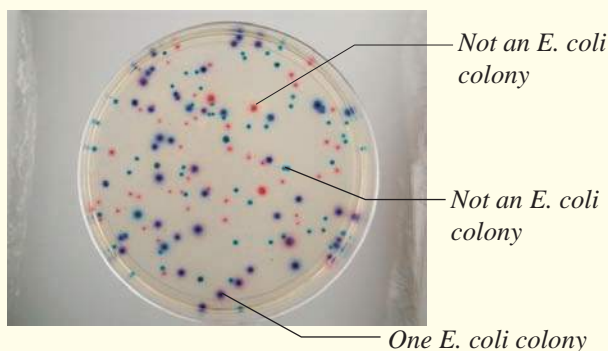
### Preparing the Sample

1. Always SHAKE sample collection bottle before drawing a sample with a pipette!
2. Using a sterile pipette, transfer 0.5 – 5 mL of stream sample directly into the Easygel bottle.
3. Swirl the Coliscan<sup>®</sup> Easygel<sup>®</sup> bottles to mix the contents and pour each bottle into the already labeled Petri dishes. Gently swirl the mixture in the Petri dish making a figure eight on the tabletop with the dish until the mixture is evenly distributed, being careful not to splash over the side or on the lid.
4. Place the Petri dishes on a level location out of direct sunlight for 45 minutes to 1 hour. The mixture will solidify on the bottom of Petri dish.



### Incubation and Interpretation

Invert the Petri dish(es) and incubate at 35 degrees Celsius for 24 hours. After incubation is complete, count the colonies. Do not count “pin-point” sized colonies. *E. coli* colonies appear blue, dark blue, or purple. Other coliforms appear pink/magenta, and non-coliforms appear white or teal green.



### Sample Disposal

1. Carefully place about a teaspoon of household bleach onto the surface of the Coliscan<sup>®</sup> Easygel<sup>®</sup> of each plate.
2. Allow to sit at least five minutes.
3. Place in watertight bag and discard in normal trash.

## Methods and procedures using 3M™ Petrifilm™

The following information comes from the Indiana Hoosier Riverwatch Program and the Iowa IOWATER program.

### Storage and Disposal

Store unopened Petrifilm plate pouches at temperatures <8°C (46°F) – REFRIGERATE!

### Official 3M Instructions

Return unused plates to pouch. To prevent exposure to moisture, do not refrigerate opened pouches. Store resealed pouches in a cool, dry place for no longer than one month. Exposure of Petrifilm plates to temperatures greater than 25°C (77°F), and/or humidity greater or equal to 50% relative humidity can affect the performance of the plates.

### Citizens Monitoring Bacteria Research Project Instructions

Store plates from opened packages in sets of no more than 8 in a small “snack-size” ziplock or similar type storage bag. Place a weight on top of the package to keep it from curling. Plates may be stored for up to a year.

Allow pouches to come to room temperature before opening – at least 10-15 minutes.

Do not use plates that show orange or brown discoloration.

Expiration date and lot number are noted on each package. (Example expiration date: 2007-10, would expire in the 10th month (October) of the year 2007. The lot number is also printed on individual plates.

### Plating

Inoculate and spread one Petrifilm plate before inoculating the next plate.

1. Place a Petrifilm plate on a level surface.
2. Lift the top film and dispense 1 ml of sample or diluted sample on the center bottom film.
3. Slowly roll the top film down onto the sample to prevent trapping air bubbles.
4. With the smooth side down, place the plastic spreader near the top of the plate.
5. If necessary, distribute sample evenly using gentle downward pressure on the center of the plastic spreader.
6. Remove the spreader and leave plate undisturbed for at least one minute to permit the gel to solidify. Incubate plates in a horizontal position, with the clear side up in stacks of up to 20 plates. Incubator should be humidified with distilled water. Incubate 24 hours at 35°C.



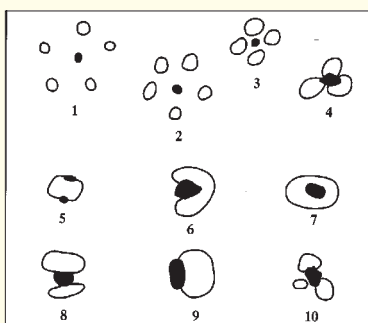
**Count blue colonies with gas bubble(s) after 24 hours at 35°C**

## Interpretation

1. Petrifilm *E. coli* plates can be counted on a standard colony counter or other magnified light source. Only count colonies within circle. Do not count artifact bubbles. Approximately 95% of *E. coli* produce gas.

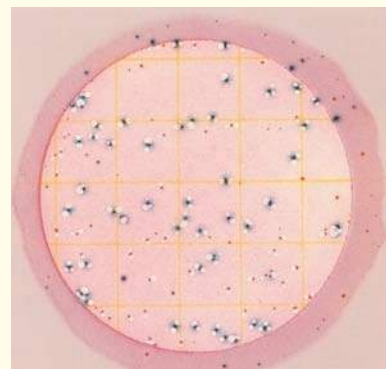
2. In general, *E. coli* colonies are blue to blue-purple and closely associated (approximately one colony diameter) with entrapped gas. General coliform colonies are bright red and closely associated (approximately one colony diameter) with entrapped gas (figure below). **Only count colonies that have one or more associated gas bubbles!**

3. The circular growth area is approximately 20 cm<sup>2</sup>. Estimates can be made on plates containing greater than 150 colonies by



All 10 examples depict various bubble patterns associated with gas producing colonies. Each numbered picture would be counted as one colony. (From 3M™ Petrifilm™ interpretation guide)

counting the number of colonies in one or more representative squares and determining the average number per square. Multiply the average number by 20 to determine total count per plate.



This plate has 49 *E. coli* colonies as depicted by blue colonies with gas. (From 3M™ Petrifilm™ interpretation guide)

4. Petrifilm *E. coli* plates with colonies that are too numerous to count (TNTC) have one or more of the following characteristics: many small colonies, many gas bubbles, and deepening of the gel color. High concentrations of *E. coli* will cause the growth area to turn blue while high concentrations of coliforms (non-*E. coli*) will cause the growth area to turn dark red. When any of these occur, you will not be able to count the sample – and should write TNTC on the data sheet. Next time, you may want to use less sample if the stream is under similar conditions.

## Disposal

Place the Petrifilm plate in a sealed Ziplock or similar type bag with the Easygel plates that have already been treated with bleach. The excess bleach will spill out and disinfect the Petrifilm plates, too. Discard with regular trash.

## Further Information

[http://solutions.3m.com/wps/portal/3M/en\\_US/Microbiology/FoodSafety/products/petrifilm-plates/](http://solutions.3m.com/wps/portal/3M/en_US/Microbiology/FoodSafety/products/petrifilm-plates/)

## Other Kits

Other kits on the market are being used for *E. coli* analysis. Appendix D (beginning on page 45) provides information on three additional kits. Further information on these and other kits can be obtained from the manufacturer or on various web sites.

# Chapter 6: Sampling Results

## Reading the Results

**A**fter removal from the incubation unit, colonies of bacteria with a particular color are counted. The normal incubation time is 24 hours, but if the colonies are not developed enough, wait a total of 48 hours. The *E. coli* colonies will stand out from general coliforms because they will turn a distinct color. The exact color depends on the test method used. Place the plate on a grid and place a white sheet of paper as a background. Count colonies that are visible to the naked eye. Be sure to have adequate lighting. Sometime it helps to use a pen to mark on the outside of the plate the colonies you have already counted. If there are more than 200 colonies per plate, report this as “too numerous to count” (TNTC) since the colonies are not considered distinct enough for an accurate reading.



The standard reporting unit is colony forming units per 100 ml of water sample (cfu/100ml). To determine the number of colony forming units (cfu) per 100 ml of water sample, the following steps should be taken:

<b>STEP I.</b> Count the number of colonies of the color specified in the test kits you are using and record that number:	Let's assume you counted 6 colonies
<b>STEP II.</b> Take the amount of sample water used and divide it into 100 since you want to report your sample per 100 ml of water:	Assume you used a 5 ml sample Thus, $100 / 5 = 20$
<b>STEP III.</b> Now, multiply the number of colonies you counted in step #1 by the number you obtained in step #2:	$6 \times 20 = 120$
<b>STEP IV.</b> You have now determined the number of colony forming units per 100 ml of sample:	120 cfu / 100 ml

## Averaging Samples

If you want to obtain an average of replicate samples, and the amount of sample used varies in each replicate, you must first count the total number of colonies in each sample, add them together, and then divide by the total milliliters of sample. Then, multiply both numerator and denominator by 100 to obtain total number of colonies per 100 ml. In the example below if you simply took an average of the three replicate sample totals  $(1200 + 1100 + 900)/3$ , your answer would be 1066.6 colonies/100ml which would be incorrect.

Sample Number	Number of ml Used	Colonies Counted	Total # / 100 ml	Average # / 100ml
1	1	12	1200 / 100 ml	<b><math>12 + 33 + 45 / 1 + 3 + 5 = 90</math> colonies / 9ml or 10 colonies / ml</b>  <b>Thus, the average equals 1000 colonies / 100 ml</b>
2	3	33	1100 / 100 ml	
3	5	45	900 / 100ml	

## Disposal safety

After counting the colonies of bacteria on the plates, add ¼ teaspoon of household bleach using either a dropper or other dispensing unit to each plate. Be careful not to get the bleach on your hands or clothes. Place the plates in an airtight ziplock or sealable plastic bag and seal it shut. Finally, dispose of the bag in the trash. Do not be overly apprehensive with this step, since in general, *E. coli* do not pose a huge health risk.

# Chapter 7: Interpreting Results

## State standards

Using guidance provided by the USEPA, states have developed standards for fecal coliform bacteria and/or *E. coli*. Compliance is often based on the arithmetic mean of three or more samples taken during the same sampling event at representative locations within a defined sampling area or on the geometric mean based on at least five samples taken over a 30-day period or a total number of samples collected over a specified monitoring period.

State	<i>E. coli</i> or Fecal coliform	Water Use	One-time Standard	30-day Geometric Mean
Indiana	<i>E. coli</i>	Primary bathing contact. This standard only applies April to October (the recreation season). From November to March, there is no standard.	235 colony forming units (cfu)/100ml	125cfu/100ml
Iowa	<i>E. coli</i>	Full contact recreation	235 cfu/100ml	126cfu/100ml
Michigan	<i>E. coli</i>	Full body contact recreation	300 cfu/100ml (3 or more samples)	130cfu/100ml
Minnesota	<i>E. coli</i> *	Full body contact recreation	1260 cfu/100ml	126cfu/100ml
Ohio	<i>E. coli</i>	Primary bathing contact	298 cfu/100ml (not exceeded in more than 10% of samples)	126cfu/100ml
Wisconsin	Fecal coliform	Recreational Waters	400 cfu/100ml (not exceeded in more than 10% of samples)	200cfu/100 ml
	<i>E. coli</i> **	Beach Closures	235 cfu/100ml	126 cfu/100ml
YOUR STATE				

\*Proposed in September 2007

\*\*EPA Guidelines (see page 10 for other *E. coli* standards in fresh water bodies)

## Determining the geometric mean

*E. coli* concentrations are reported as colony forming units (cfu) per 100 ml of water sample. When measuring *E. coli* concentrations over time, using the geometric mean is a useful reporting tool. The geometric mean takes into account that a few extreme counts may be found among many more closely grouped values. Calculating a geometric mean provides a number that is more representative of the median (or that number where half the samples are higher and half are lower) and helps reduce the effect of a few extreme values. Also, use of a geometric mean over time (often 30 days) minimizes fluctuations in the levels of bacteria in the water or one-time high counts. The 30-day geometric mean helps determine if a stream has a continually high level of *E. coli*.

The geometric mean (GM) can be calculated as follows:

$$GM = (s_1 \times s_2 \times s_3 \times s_n)^{1/N}$$

Where “s” is the number of *E. coli* colonies per 100 mls for samples 1, 2, 3, through the  $n^{\text{th}}$  sample, and N is the number of samples collected.

For example, let's say you have 5 samples and your counts of cfu/100ml at one site over a 30-day period were:

**5, 10, 120, 20, 2600**

The geometric mean would be determined by taking the 5th root of the product of the 5 readings:

$$(5 \times 10 \times 120 \times 20 \times 2600)^{1/5} = 50$$

If you had just taken an average of the five samples for the 30-day period, your answer would be:

$$(5 + 10 + 120 + 20 + 2600) = 2755$$

and

$$2755/5 = 551$$

The simple average does not reflect the typical value of the set of numbers as well as the geometric mean does, nor does it take into account the one result that is much higher than the others.

**Note:** The geometric mean can only be used with positive numbers greater than zero.

## Getting “high” bacteria counts

If you find a “high” bacteria count (over your state’s standard for a one-time sampling), it may be a one-time event or occurrence. This information is useful, but before taking further action, you should return to the site to take more samples. When you return, pay careful attention to anything out of the ordinary at the site. Look for the presence of animals and be alert for any unusual odors. Walk the banks again to look for obvious sources of pollution (see Chapter 2), and note past and current weather conditions. Continue to sample and contact your local health agency if numbers remain high. Be sure to wear long rubber gloves while sampling and wash your hands carefully afterwards.

If you do find a high *E. coli* count what steps should you take? Generally, you should:

- ☐ Continue to monitor the site. This will help identify if there is a chronic bacteria problem or a high count resulting from a one-time event.
- ☐ If you continue to find a high count, work through your volunteer monitoring program to alert your local agency.

You may wish to alert your local watershed group or local agency about your monitoring efforts and the results so far. These groups will likely have an interest in your results regardless of whether or not you have detected a problem. They may be able to work with you on determining the possible sources of *E. coli* pollution if a problem does exist.

## Tracking, storing and retrieval of data

Keep track of your *E. coli* data on a spreadsheet (electronic, if possible) or data form (see Appendix B for a sample data sheet). An electronic spreadsheet may be advantageous in that it allows for easy calculations to show ranges, pollutant loads, or to make graphs. After entering the results on your data sheet, mail or fax this to your program leader as promptly as possible.

Alternatively, you can enter the data on the *E. coli* electronic database website developed as a part of this project. It can be accessed at [www.iwr.msu.edu/cmb](http://www.iwr.msu.edu/cmb). The site is password protected; however, the password can be obtained by emailing any of the contacts listed near the beginning of this manual.

## Source tracking

One method for determining sources of *E. coli* is called bacterial source tracking. Bacterial Source Tracking (BST) is a collective group of new methodologies being developed to determine sources of fecal pollution in environmental samples. Sources of fecal pollution may come from domestic pets, cows, deer, geese, hogs, other wild animals, and humans.

If used successfully, BST methodologies have the potential to turn nonpoint (diffuse) sources into point sources. Current BST research is being driven by the recent implementation of the Total Maximum Daily Load (TMDL) concept by EPA. BST methods represent the best tools available for determining sources of fecal pollution in water and should be an integral part of any project that involves TMDL development for fecal coliform. BST methods can also be used in the design and

implementation of Best Management Practices to reduce fecal loading in water.

Currently, both molecular (genotypic) and biochemical (phenotype) BST methods are under development. DNA fingerprinting has received the greatest publicity, but numerous methods show potential. Most researchers believe that some combination of BST methods will be needed to provide the most accurate and reliable source identification answers. It is doubtful that any one BST method will emerge as the “best” method for all situations.

While this is not a procedure that the volunteers will be conducting, it is a procedure to be aware of, and a possible step that state agencies might take. At this point, it is still an emerging and costly technology, even for agencies, so it is not used routinely.

## Pollution prevention actions you can take

Our valued streams and rivers are subject to pollution stress from land uses in the watershed. These pollutants come from many sources, including those around our own homes. You can practice certain activities that can help reduce water pollution risks from bacteria. Some examples may include:

- ◆ Planting any bare soil with native grasses, shrubs, or other plants. The roots of these plants will help contain the soil from running off into the nearest stream.
- ◆ Cleaning up after your pet. Pet wastes can be a source of *E. coli* and excess nutrient contamination in our waterways. Pet wastes can make their way from the lawn to a river, so dispose of wastes in the toilet or trash.
- ◆ Draining roof downspouts onto vegetated areas, not on the street or pavement, so that water can soak into the ground.
- ◆ Limiting paved surfaces; landscape with rocks, plants, or gravel.
- ◆ Supporting active interaction, communication, and education between technical advisors and land users.
- ◆ Encouraging community appreciation of watershed health through community events, e.g. outdoor sports, river cleaning, and other events.

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# Chapter 8: Conclusions

**T**he purpose of this training manual is to discuss sampling and monitoring techniques for *E. coli* and to highlight the test kits that are reliable, economical and usable by volunteers. However, it is important to keep in mind that bacteria monitoring is only one component of water quality monitoring, and that *E. coli* data alone do not indicate the ecological health of your stream. They do, however, provide valuable information that can be used in concert with other monitoring data to help assess overall ecosystem health.

Volunteer time is valuable, and the remarkable power of your efforts is your positive impact on the environment and the enthusiasm and commitment of your teams. By using standardized sampling and analysis procedures along with acceptable test kits, the *E. coli* data you collect as a volunteer can be very useful and utilized in various watershed programs. The bacteria monitoring data you collect and disseminate will help determine baseline conditions, provide continued data on your stream, and assist in assessing future water quality trends. It can help build partnerships with agencies and other groups from the local to federal level.

By remaining vigilant in your monitoring efforts, water quality problems can often be targeted and addressed before they become major.

## Notes

# Chapter 9: Resources for Further Information

## Internet sites

**Center for Disease Control's** information on the pathogenic *E. coli* 0157:H7  
[www.cdc.gov/ncidod/dbmd/diseaseinfo/escherichiacoli\\_g.htm](http://www.cdc.gov/ncidod/dbmd/diseaseinfo/escherichiacoli_g.htm)

The **Center for Watershed Protection** provides local governments, activists, and watershed organizations around the country with the technical tools for protecting our streams, lakes and rivers.  
[www.cwp.org/](http://www.cwp.org/)

**Volunteer Water Quality Monitoring National Facilitation Project** is designed to expand and strengthen the capacity of existing Extension volunteer monitoring programs and support development of new groups. [www.usawaterquality.org/volunteer/](http://www.usawaterquality.org/volunteer/)

**Building Capacity of *E. coli* Monitoring By Volunteers: A Multi-State Effort** is the web site that complements this training manual. [www.uwex.edu/ces/csreesvolmon/EColi/index.html](http://www.uwex.edu/ces/csreesvolmon/EColi/index.html)

EPA: **Microbiology** homepage: [www.epa.gov/nerlcwww/](http://www.epa.gov/nerlcwww/)

EPA: **National Newsletter of Volunteer Water Quality Monitoring**  
[www.epa.gov/owow/monitoring/volunteer/issues.htm](http://www.epa.gov/owow/monitoring/volunteer/issues.htm)

EPA: **STORET** (short for STOrage and RETrieval) is a repository for water quality, biological, and physical data. [www.epa.gov/storet/](http://www.epa.gov/storet/)

EPA: The **Volunteer Monitor's Guide To Quality Assurance Project Plans**  
[www.epa.gov/owow/monitoring/volunteer/qappcovr.htm](http://www.epa.gov/owow/monitoring/volunteer/qappcovr.htm)

Michigan State University's **Digital Watershed**: Type in any address and obtain an aerial photograph as well as data on the watershed. [www.iwr.msu.edu/dw](http://www.iwr.msu.edu/dw)

Purdue University's **stream delineation** site: Pick your stream from an interactive map. Click on a portion of the stream and the tool delineates the watershed of the stream from that point to upstream.  
[pasture.ecn.purdue.edu/~watergen/owls/htmls/select\\_your\\_state.htm](http://pasture.ecn.purdue.edu/~watergen/owls/htmls/select_your_state.htm)

U.S. Geological Survey's **Water Science Glossary** of Terms.  
[ga.water.usgs.gov/edu/dictionary.html](http://ga.water.usgs.gov/edu/dictionary.html)

**Water Resources of the United States** (U.S. Geological Survey) Access to water-resources data.  
[water.usgs.gov/](http://water.usgs.gov/)

## Volunteer stream monitoring manuals

Volunteer Stream Monitoring: A Methods Manual, US Environmental Protection Agency  
[www.epa.gov/volunteer/stream/stream.pdf](http://www.epa.gov/volunteer/stream/stream.pdf)

Volunteer Stream Monitoring Training Manual, Hoosier Riverwatch, Indiana Department of Natural Resources - <http://www.in.gov/dnr/riverwatch/trainingmanual/>

Volunteer Surface Water Monitoring Guide, Minnesota Pollution Control Agency  
<http://www.pca.state.mn.us/water/monitoring-guide.html>

Vermont Citizen's Guide to Bacteria Monitoring in Vermont Waters, Department of Environmental Conservation - [http://www.anr.state.vt.us/dec//waterq/lakes/docs/lp\\_citbactmonguide.pdf](http://www.anr.state.vt.us/dec//waterq/lakes/docs/lp_citbactmonguide.pdf)

Washington State's Department of Ecology, A Citizen's Guide to Understanding and Monitoring Lakes and Streams - <http://www.ecy.wa.gov/programs/wq/plants/management/joysmanual/>

Watershed Watch (University of Rhode Island) - <http://www.uri.edu/ce/wq/ww/Manuals.htm>

Wisconsin Water Action Volunteers Citizen Stream Monitoring  
<http://watermonitoring.uwex.edu/wav/monitoring/methods.html>

Other Guides to Volunteer Monitoring can be found on the National Volunteer Monitoring website at:  
<http://www.uwex.edu/ces/csreesvolmon/links.html>

## Watershed and stream management guides

**A Beginner's Guide to Water Management - Bacteria**, University of Florida  
[edis.ifas.ufl.edu/FA103](http://edis.ifas.ufl.edu/FA103)

**Developing a Watershed Plan for Water Quality: An Introductory Guide** (Michigan)  
[www.deq.state.mi.us/documents/deq-swq-nps-Watershe.pdf](http://www.deq.state.mi.us/documents/deq-swq-nps-Watershe.pdf)

**Getting to Know Your Local Watershed - A Guide for Watershed Partnerships**  
[www.ctic.purdue.edu/KYW/Brochures/GetToKnow.html](http://www.ctic.purdue.edu/KYW/Brochures/GetToKnow.html)

**Indiana Watershed Planning Guide** from the Indiana Department of Environmental Management, August 2003. <http://www.in.gov/idem/catalog/documents/water/iwpg.pdf>

Michigan Department of Environmental Quality's **Stormwater Management Guidebook**  
[http://www.deq.state.mi.us/documents/deq-water-sw-links-SW\\_Management\\_Guidebook.pdf](http://www.deq.state.mi.us/documents/deq-water-sw-links-SW_Management_Guidebook.pdf)

**Minnesota Shoreland Management** Resource Guide - [www.shorelandmanagement.org/quick/](http://www.shorelandmanagement.org/quick/)

**Ohio Stream Management Guide** fact sheets - [www.dnr.state.oh.us/water/pubs/fs\\_st/streamfs.htm](http://www.dnr.state.oh.us/water/pubs/fs_st/streamfs.htm)

**Rapid Watershed Planning Handbook: A Comprehensive Guide for Managing Urbanizing Watersheds.** 1999. Center for Watershed Protection. Ellicott City, MD

U.S. Geological Survey: **National Field Manual** for the collection of water-quality data  
[water.usgs.gov/owq/FieldManual/](http://water.usgs.gov/owq/FieldManual/)

Wisconsin Department of Natural Resources **Runoff Management**  
<http://www.dnr.state.wi.us/runoff/about.htm>

# Chapter 10: References

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<http://photogallery.nrcs.usda.gov>
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- USEPA (2002a). Water Quality Conditions in the United States: 2000 National Water Quality Inventory. EPA-841-R-02-001. August 2002.
- USEPA (2002b). Implementation Guidance for Ambient Water Quality Criteria for Bacteria (Draft). May 2002 ([www.epa.gov/waterscience/standards/bacteria/bacteria.pdf](http://www.epa.gov/waterscience/standards/bacteria/bacteria.pdf)).
- United States Geological Survey (2004). National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9  
<http://pubs.usgs.gov/twri>



# ppendix A: Glossary of Terms

**Agar** - A gelatinous medium on which to grow *E. coli* colonies.

**CFU** - Colony Forming Units (bacteria colonies).

**Colony** – Visible growth of microorganisms.

**Culture** - Growing microorganisms (i.e., *E. coli*) in a nutrient medium that encourages their growth.

**Delineate** - To define or portray, often by drawing.

***E. coli*** - A species of fecal bacteria that lives in the intestinal tract of warm-blooded animals and is essential in digestion.

**EPA** - The U.S. Environmental Protection Agency, a government agency whose mission is “...to protect human health and the environment.”

**Gastroenteritis** - Irritation of the digestive tract, often resulting in abdominal pain, vomiting and/ or diarrhea.

**GIS** - Geographic Information Systems. A software program that combines different layers of information (streams, land use, cities, counties, elevation, etc.) for analyses.

**GPS** - Global Positioning System. Hand-held or larger devices that triangulate your position on earth from satellites in orbit. One can take reading(s) at a sampling site, and later download this data into a software program.

**Imperviousness** - Impenetrable surfaces such as driveways, roads, etc.

**Pathogen** – A disease-causing life form such as a virus, bacterium, or other microorganism.

**Replicate** – Samples collected in the field in duplicate, triplicate, or more. Or samples plated in the lab in duplicate, triplicate, or more. Replicates help identify any variability in the stream or lab procedures.

**TMDL** - Total Maximum Daily Load. A TMDL is a regulation that specifies the sum of the pollutant contributions from point source discharges, *non-point* (diffuse) sources, and natural background levels that a water body can process and still meet water quality standards.

**TNTC** - Too Numerous To Count. If there are too many *E. coli* colonies on a plate, they are considered as too many or numerous to count.

**Tributary** - Smaller streams that feed into a larger portion of the main stream or river.

**Watershed** - The area of land that drains to a common water body.



# ppendix B: Forms

Survey tools and other forms have been developed to help in the implementation of a volunteer monitoring program. These include: pre-post knowledge surveys given to volunteers at the start and end of the training sessions, to assessments done following the training, to those following a season of monitoring to assess user preferences in regards to using the test methods. These tools are available at [www.uwex.edu/ces/csreesvolmon/EColi/SurveyTools.htm](http://www.uwex.edu/ces/csreesvolmon/EColi/SurveyTools.htm) as pdf files.

Various forms have been developed for recording data, gathering information about your volunteer samplers, and keeping track of sites to be sampled and the data collected from these sites. A summary sheet that provides a step-by-step approach for sampling has also been developed. An example Data Sheet to record site conditions and bacteria data, and a Sampling Plan Summary are included beginning on the following page.

## Citizens Monitoring Bacteria Data Sheet

Date \_\_\_\_/\_\_\_\_/\_\_\_\_ Volunteer ID \_\_\_\_\_  
 Collection Time \_\_\_\_:\_\_\_\_ (am/pm) Site ID \_\_\_\_\_  
 Monitor's Name \_\_\_\_\_  
 Stream/River Name \_\_\_\_\_  
 Stream Flow \_\_\_\_\_  
☐ High ☐ Normal ☐ Low Air Temp \_\_\_\_\_ (°C)  
 Water Temp \_\_\_\_\_ (°C)  
 Transparency \_\_\_\_\_ (cm) or \_\_\_\_\_ (NTU) (optional)  
 Current Weather  
☐ Clear/Sunny ☐ Overcast ☐ Showers ☐ Rain (Steady) ☐ Storm  
 Worst Weather in Past 48 hrs.  
☐ Clear/Sunny ☐ Overcast ☐ Showers ☐ Rain (Steady) ☐ Storm

Stream assessment comments and observations:

For each method, record the volume of water (in mL) used when plating the Easygel samples. Note the incubation temperature and the time samples were placed in the incubator. After incubating for 24 hours, count how many colonies you see on the plate. Repeat after 48 hours. To calculate the number of *E. coli* colony forming units (CFUs) per 100 mL, divide 100 by the number of mL of sample you used and multiply that result by the number of colonies you counted. You now have the estimated number of CFUs in 100 mL of sample. To properly average your replicates, see page 26.

Test Method	Sample Volume (mL)	Number <i>E. coli</i> colonies counted @ 24 hours	Number <i>E. coli</i> (calculated) CFU /100mL @ 24 hours	Number <i>E. coli</i> colonies counted @ 48 hours	Number <i>E. coli</i> (calculated) CFU /100mL @ 48 hours	Incubation Temperature _____ °C
EASYGEL – Sample 1		A		A		
EASYGEL – Replicate 2		A		A		
EASYGEL – Replicate 3		A		A		
3M Petrifilm – Sample 1	1 mL	B		B		
3M Petrifilm – Replicate 2	1 mL	B		B		
3M Petrifilm – Replicate 3	1 mL	B		B		

**A** = count dark blue and purple colonies; **B** = count blue (or blue-purple) colonies with gas bubbles

Comments, observations and concerns about the sample prep or the analysis (include the time samples were counted if different from 24 or 48 hours):



## Citizens Monitoring Bacteria Sampling Plan

**Note:** This sampling plan includes steps for both Easygel and Petrifilm tests. Volunteers may decide to just use one of the tests. The sampling plan also includes steps to take if you are sending split samples to a laboratory for comparison of results. Depending on your location, you may need to sample on Monday, Tuesday, or Wednesday to get samples shipped overnight to the lab in time for them to complete the tests.

### **Before You Go Out to Sample**

1. Take 3 bottles of Easygel per each site out of freezer to thaw – if rapid thawing is required, they may be rinsed in warm water.
2. Take 3M™ Petrifilm™ out of the refrigerator – 3 for each site.
3. Turn on incubator – be sure the lid is tight and that it's the correct temperature (35°C) Fill appropriate channels in plastic tray with distilled water and set in bottom of incubator. Place wire tray on top.

### **Take to the Sampling Site**

- |  |  |
|--|--|
| <input type="checkbox"/> soap, antibacterial lotion or wipes             | <input type="checkbox"/> sterile collection containers (one per site)        |
| <input type="checkbox"/> plastic gloves                                  | <input type="checkbox"/> sterile lab sample bottles (one per site)           |
| <input type="checkbox"/> waders  | <input type="checkbox"/> 2-3 data sheets (one per site) on clipboard         |
| <input type="checkbox"/> cooler with ice                                 | <input type="checkbox"/> 1 or 2 thermometers                                 |
| <input type="checkbox"/> Sharpie® or permanent marker (to label bottles) | <input type="checkbox"/> transparency tube                                   |
| <input type="checkbox"/> shipping containers/ice packs and forms         | <input type="checkbox"/> sampling device with rope (if sampling from bridge) |

### **At the Site**

1. Hang thermometer where it is not in direct wind or sunlight (for air temperature reading) – it may take about 5 minutes to stabilize
2. Complete top of data sheet, stream flow stage, and stream assessment comments
3. Take water temperature (hold approximately 2 minutes in main stream flow) – record on data sheet
4. Rinse labeled sterile collection bottle (500mL bottle) three times with sample water using proper sample collection technique – lower in upside down position to a depth of 3-5 inches below the water's surface (or approximately up to your wrist), fill at an angle facing upstream – be sure your hand and or fingers are not in front of the mouth of the bottle
  - ☐ If sampling from a bridge – rinse sampling device with stream water 3 times, then collect a sample and rinse the collection bottle three times – then fill collection bottle (be sure the bucket and rope do not come into contact with the ground during this process)
5. After rinsing the bottle 3 times, collect sample and top with lid after removing from stream – place collection bottle in cooler with ice for transporting
  - ☐ If shipping samples to lab before returning home/office, SHAKE COLLECTION BOTTLE TO MIX THE SAMPLE, then fill the lab sample bottle to its shoulder from the collection bottle (DO NOT rinse the laboratory sample bottle; it may be filled with a preservative) – also put this bottle in cooler on ice.
6. Record air temperature reading on data sheet

7. Take transparency reading and record on data sheet
8. Wash hands when finished

### **Tips for Preparing/Plating the Samples**

1. Prepare table by cleaning with bleach or isopropyl alcohol
2. Wash hands thoroughly with soap
3. Items to have at home/office "lab" station
 

<input type="checkbox"/> paper towels or Kimwipes	<input type="checkbox"/> Sharpie® or permanent marker
<input type="checkbox"/> isopropyl alcohol/bleach	<input type="checkbox"/> gloves
<input type="checkbox"/> distilled water	<input type="checkbox"/> pipettes
<input type="checkbox"/> rinse/waste container	<input type="checkbox"/> Petrifilm spreader
4. Set up stations for each site you sample:
  - ✓ You should have one collection bottle and one lab sample bottle **per site**
  - ✓ You should have 3 Petrifilm plates and/or 3 Easygel bottles and 3 Easygel petri dishes, and 1 pipette **per site**
  - ✓ Label Easygel bottles with site #s; label bottom of petri dishes and Petrifilm plates with site #, replicate number, date, and volume (mL) of sample to be used.
5. ALWAYS SHAKE SAMPLE BOTTLE BEFORE DRAWING A SAMPLE WITH A PIPETTE!
6. Add an appropriate volume of sample water (using a sterile pipette and drawing from the collection bottle) to the three duplicate Petrifilm plates and/or Easygel bottles. You will always use 1mL for the Petrifilm. You can choose between 0.5 mL up to 5 mL for the Easygel bottles. (Note: you can use the same pipette to transfer the sample water to each of the appropriate tests if you use sterile technique.). Each site you sample requires using a new sterile pipette.
7. Complete the Petrifilm test by using the spreader as described on page 23.
8. Complete the Easygel tests by inverting each bottle, pouring each into a separate petri dish and swirling each as described on page 22.

### **Incubation (Remember to write down what time incubation begins!)**

- ✓ Place plated samples in incubator: Easygel petri dish (upside down) and 3M™ Petrifilm™ (right side up) – three per site. **Remember:** Easygel needs to sit for at least 45 minutes to gel before placed in incubator upside down
- ✓ After 24 hours, count *E.coli* colonies on the Petrifilm plates and Easygel petri dishes
- ✓ After 48 hours, count *E.coli* colonies on Petrifilm plates and Easygel petri dishes (*optional*)
- ✓ After use, rinse incubator with dilute bleach or distilled water and let it dry
- ✓ Dispose of petri dishes and plates in a ziplock bag with a teaspoon of bleach added

### **Which items need to be sterile?**

- ✓ Collection bottles and any bottle sent to the lab for confirmation
- ✓ Pipettes

Don't forget to **take photos** (or have someone take photos of you) at your site and while performing the methods – these can be used for a variety of purposes!



# ppendix C: Sample Training Agenda

Below is a recommended agenda for an *E. coli* volunteer monitoring workshop. We recommend that you cover these essential topics, but you may wish to add additional information of your own.

1. Introduction
2. What the Citizen Monitoring Bacteria Project is
3. Implementation of the Pre-Test Survey and Demographics Survey; Liability and Photo Release Forms
4. Bacteria 101 – What is bacteria, why should we monitor for it, what do we know about bacteria, and how do we monitor for bacteria?
5. Site selection – how to pick a site to monitor (where, how, why). Sampling frequency
6. Safety
7. How to collect a field sample – hands on; QA/QC, field replicates
8. Lab protocol – how to collect a lab sample, how to ship the sample FedEx, chain of custody, shipping instructions
9. Field parameter instructions
10. How to use the kits – hands on
11. How to use the incubator and other bacteria equipment
12. Practice reading the plates
13. Data sheets
14. Disposal of kits
15. What does the data mean – interpretation of results
16. Post-Test Survey; End of Training Volunteer Assessment; End of Training Staff Assessment
17. Contact information for questions; wrap up; hand out kits and supplies

# Appendix D: Other Methods

## IDEXX Colisure

Because of the equipment costs associated with the IDEXX Colisure, it was not selected for use by volunteers. However, its accuracy when compared with laboratory analyses was as good as the two methods selected.

### Preparation and Setup

1. Turn on IDEXX Quanti-Tray® Sealer.
2. Label Quanti-Trays using a permanent marker. This label should include site ID, date and time of sample collection, and sample number.

### Preparing the Sample

1. Water samples are collected in 100 ml plastic IDEXX bottles by filling the bottles up to the 100 ml graduation.
2. Add Colisure reagent and two drops of anti-foam solution into sample.
3. Mix thoroughly until reagent is dissolved.
4. Pour sample into Quanti-Tray.
5. Place Quanti-Tray on rubber insert, and seal with Quanti-Tray Sealer.
6. Remove from back of sealer as soon as sealing is completed.

### Incubation and Interpretation

Incubate at 35 degrees Celsius for 24-48 hours. After incubation is complete, read results. Wells containing total coliforms will turn from yellow to magenta. Wells containing *E. coli* will turn from yellow to magenta and fluoresce under UV radiation. If wells appear pink or orange, return tray to incubator and reexamine in 4 hours.

After all positive wells are counted, refer to a table of Most Probable Numbers (MPN) to determine total coliform MPN and *E. coli* MPN.

### Sample Disposal

Because Quanti-Trays need to be sterilized by autoclaving, used trays are stored in large Ziplock bags and returned for disposal during each subsequent sample transfer.



## IDEXX Colilert

Because of the equipment costs associated with the IDEXX Colilert, it was not selected for use by volunteers. However, its accuracy when compared with laboratory analyses was as good as the two methods selected.

### Preparation and Setup

1. Turn on IDEXX Quanti-Tray® Sealer.
2. Label Quanti-Trays using a permanent marker. This label should include site ID, date and time of sample collection, and sample number.

### Preparing the Sample

1. Water samples are collected in 100 ml plastic IDEXX bottles by filling the bottles up to the 100 ml graduation.
2. Add Colilert reagent and two drops of anti-foam solution into sample.
3. Mix thoroughly until reagent is dissolved.
4. Pour sample into Quanti-Tray.
5. Place Quanti-Tray on rubber insert, and seal with Quanti-Tray Sealer.
6. Remove from back of sealer as soon as sealing is completed.

### Incubation and Interpretation

Incubate at 35 degrees Celsius for 24. After incubation is complete, read results. Wells containing total coliforms will turn from clear to yellow. Wells containing *E. coli* will turn from clear to yellow and fluoresce under UV radiation.

After all positive wells are counted, refer to a table of Most Probable Numbers (MPN) to determine total coliform MPN and *E. coli* MPN.

### Sample Disposal

Because Quanti-Trays need to be sterilized by autoclaving, used trays are stored in large Ziplock bags and returned for disposal during each subsequent sample transfer.

## Coliscan Membrane Filtration

Coliscan media incorporate a patented combination of color-producing chemicals and nutrients that make *E. coli* colonies appear blue, coliform bacteria that are not *E. coli* as a pink magenta and non coliforms as white or teal-green colonies.

There are two methods of Coliscan® : Coliscan-MF (membrane filter) and Coliscan® Easygel®. Coliscan-MF uses a sterile soaked pad in Coliscan medium as platform growth. Coliscan® Easygel® forms a gelled surface on which bacteria grows.

The Coliscan-MF method can be used when the water being tested has very few coliforms and/or *E. coli*. About a half cup (115 ml) of sample water is drawn through a membrane filter apparatus that traps bacteria on the surface of the filter. The filter is placed within a small petri dish on a sterile pad saturated with Coliscan-MF. The incubated colonies grow on the surface of the filter and are then counted.

### Equipment

- ✓ 1.8 - 2 ml Coliscan-MF from a 20 ml bottle
- ✓ Membrane filter apparatus with holding pad
- ✓ 1 sterile dropper
- ✓ membrane filter with grid
- ✓ 2 inch petri dish with sterile pad
- ✓ forceps or tweezers (alcohol for sterilizing)



### How To Use Coliscan-MF

#### Preparation and Setup

1. Thaw Coliscan-MF at room temperature by removing from freezer the night before sampling. (Note: Unused MF medium may be refrozen.)
2. Carefully open petri dish and use a sterile dropper to add less than 2 ml (1.8 ml) Coliscan-MF to soak the pad in the petri dish. Replace lid. (Note: the same pipette may be used to transfer the MF medium to each petri dish – one per site – if all are done at the same time following sterile technique.)
3. Twist the funnel to remove it from the collection container. Place a sterile holding pad on the top blue circle of the container. (Note: This pad does not have to be sterile, but should be clean. Store in Gelman plastic container or Ziplock bag. Use tweezers to transfer to the blue filter top. Only one pad will be used for each day's sampling. The same pad can be used for different sites because only sterile water is passed through the membrane filter. Discard holding pad after one day's use.)
4. Wipe forceps with alcohol to sterilize. Open a sterile filter envelope and remove the membrane filter with clean forceps. Be sure to separate the filter from the 2 blue protective backings when taking the filter from the filter envelope. Handle the filter carefully with tweezers or forceps so the filter does not tear. Place the filter grid-side up on top of the holding pad on the collection container. Be sure there are no air spaces between filter and pad.
5. Firmly push the funnel back down onto the filtering device bottom to hold the membrane filter in place and to create a seal. Double check that the funnel is securely against the blue filtering plate, over the red "O" ring, and touching the bottom vessel before filtering the water. Press down firmly.
6. Attach the hose to the collection container by pushing the end of the hose onto the side port of the container. Be sure the syringe plunger is pushed in.

### Preparing the Sample

1. ALWAYS SHAKE SAMPLE COLLECTION BOTTLE BEFORE DRAWING A SAMPLE WITH A PIPETTE!

Option 2a.) Using a sterile pipette, transfer 0.25 – 5 mL of stream sample to the filter funnel, then add distilled water (about 10-15 mL) to the filter funnel and gently swirl to mix.

Option 2b.) Using a sterile pipette, transfer 0.25 – 5 mL of water sample to a pre-labeled bottle of diluent (sterile water) and shake vigorously to mix well. Mixing the sample with 10 – 99 mL of diluent helps distribute the colonies over the membrane filter more evenly. (Note: You will calculate the number of colonies/100 ml using the original sample size, disregarding the added volume of sterile water.)

### Filtering the Water

1. Create a vacuum by pulling out the plunger of the syringe or by squeezing the handle of the pump.

The water will be pulled through the filter, depositing any microorganisms present onto the filter. If all of the sample water is not drawn through the filter after the plunger has been pulled out, remove the plunger hose from the collection container, push the plunger back in, reattach the plunger hose and pull the plunger out again

2. When the water sample has been completely passed through the filter, disconnect the syringe and remove the funnel. With clean tweezers, remove the filter (grab near the edge) and place it grid-size up directly on top of the pad in the dish which was soaked with 2 ml of Coliscan-MF earlier. Place the lid on the dish, and place the dish in the incubator.
3. The filtered water in the collection container should be emptied and the filter apparatus prepared for repeat use by sterilization.

**<You now need to sterilize the filter funnel for use during your next sampling event.>**

*Option 1.* Rinse the funnel with isopropyl alcohol and let air dry

*Option 2.* Immerse in boiling water for at least 5 minutes and let dry

Place caps on funnels and store filtering device in plastic bag or sealed container until next use.

### Incubation and Interpretation

Incubate the prepared dish (do not turn upside down) at 35°C for 48 hours. After incubation is complete, count the colonies. *E. coli* colonies appear blue, dark blue, or purple. Other coliforms appear pink/magenta and non-coliforms appear white or teal green.

### Confirmation Media Double Checks for Presence of *E. coli*

When using the Coliscan MF method, if the color of a colony is in question, you can add a drop of Kovac's reagent on or at the edge of the colony in question. A bright red zone will develop within 5 seconds if the colony is *E. coli*. An unused toothpick, plastic loop or small wire may be used to transfer the drop. The red color must be observed within the first minute after transferring the drop.

**Funding for this manual has been provided by:**

- ◆ CSREES 406 National Integrated Water Quality Program
- ◆ CSREES Great Lakes Regional Water Project



*With support from:*



*This material is based upon work supported by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, Agreement number 2003-51130-01787. "Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture."*

## **Appendix 3 – Documentation of Consultation**





# United States Department of the Interior

National Park Service  
St. Croix National Scenic Riverway  
401 N. Hamilton Street  
St. Croix Falls, Wisconsin 54024



IN REPLY REFER TO:  
I.A.1

March 4, 2022

Mr. Shawn Puzen  
[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)  
Mead & Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: Hayward and Trego Hydroelectric Projects Draft Study Plans for Mussels, Water Quality, and Wood and Blanding's Turtle Nesting Habitat, FERC Nos. p-2417 and p-2711, Namekagon River

Dear Mr. Puzen:

The National Park Service (NPS) is consolidating our comments for the three aforementioned studies received by email dated February 2 and 3, 2022.

The NPS reiterates our request for information reflected in our original study requests on April 27, 2021 for shoreline surveys and hydraulics, sedimentation, and channel change, and our August 31, 2021 comments on your draft Study Summary and Responses. The study plans reviewed here have components that would contribute important information relating to our original study requests.

The NPS administers the Namekagon River as part of the National Wild and Scenic Rivers System (NWSRS) and the National Park System, as established by Congress in 1968 (Public Law 90-542). Under this law, the NPS is required by the Wild and Scenic Rivers Act to preserve the St. Croix River and its tributary, the Namekagon River, in a natural condition; to protect and enhance the exceptional natural, scenic, and cultural resources of the Riverway; and to provide high-quality recreational opportunities. River values identified in the hydropower project areas include aquatic, cultural, recreation, and scenic/aesthetic resources. The Namekagon River is managed as part of the St. Croix National Scenic Riverway and is protected under the Organic Act.

Prior to the FERC issuing a new license, the NPS will need to evaluate the proposed license under Section 7(a) of the Wild and Scenic Rivers Act and to determine whether it will have direct and adverse effects on the values for which the river was designated. If the NPS identifies direct and adverse effects, the license/project will need to be modified to ensure that park resources are protected. The NPS study requests are needed to provide information to enable timely completion of this NPS review as well as the FERC NEPA analysis. Continuing impacts on resource values must be identified so that protection and enhancement measures can be incorporated into a new license.

## Comments on Draft Study Plans

Please contact Caitlin Nagorka, natural resources program manager, St. Croix National Scenic Riverway at [caitlin\\_nagorka@nps.gov](mailto:caitlin_nagorka@nps.gov) to obtain all required NPS scientific research and collecting permits prior to implementing the study plans.

## 1. Mussels

- Mussels are a significant component of the aquatic resources Outstandingly Remarkable Value (ORV) for the Wild and Scenic River designation. It is our agency's understanding that drawdowns may be necessary during the proposed forty-year license period for maintenance and other purposes. Drawdowns have the potential to affect mussels that are present in the portion of riverbed that emerges during the drawdown. To better understand potential effects to mussels, additional reaches will need to be included within the impoundments, especially in the areas near the shoreline that would become exposed during a drawdown event. The study area as currently proposed includes only two riverine reaches at either end of the Project boundaries, which is inadequate to understand the presence, species, and density of mussels in the areas of the impoundments that would be most affected by a drawdown. Please add additional reaches within each impoundment to the study area. The NPS is available to consult further on identifying and prioritizing additional reaches for the purposes of this study.
- The NPS concurs with the use of WDNR guidelines.
- On page 3, include the NPS in the notification list, along with WDNR and USFWS, if any federally or state-listed species is observed, dead or alive. This will also be specified within the required NPS research and collecting permits.
- When assessing and characterizing mussel habitat, researchers should reference *Aquatic Habitat Classification on the St. Croix National Scenic Riverway* by Haibo Wan et al.

## 2. Water Quality Study

- Water quality is a significant component of the aquatic resources Outstandingly Remarkable Value (ORV) for the Wild and Scenic River designation. The Wild and Scenic Rivers Act directs the NPS to protect water quality of the Namekagon (Sec. 1(b)) and work with the Environmental Protection Agency and the WDNR to eliminate or diminish water pollution of the river (Sec. 12(c)).
- The NPS concurs with the use of WDNR protocols and the rationale for not monitoring cyanobacteria.
- The NPS requests that sediment accumulation also be monitored. Results would provide needful baseline information and facilitate better understanding of sedimentation within the project boundaries.

## 3. Wood and Blanding's Turtle Nesting Habitat Study

- This is another example, like the Aquatic and Terrestrial Invasive Plant study, where the effort that goes into the study could provide shoreline survey information outlined in the NPS study request; however, the draft plan does not provide enough detail on shoreline survey methods to determine if NPS needs would be met through this work.
- The NPS-requested shoreline study would provide current information on the status of the shoreline and identify problem areas and the need for potential management attention. It would provide a baseline for monitoring conditions and change over the life of the license. The NPS has responsibility to review shoreline alteration activities such as bank stabilization and small boat docks as water resources projects under Section 7 of the Wild and Scenic Rivers Act.
- The NPS Shoreline Survey request Method 1<sup>1</sup> recommended a longitudinal survey of the river and its banks, using georeferenced photographic equipment (video or still) and cited the High-

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<sup>1</sup> NPS comments on the Pre-Application Document and Study Requests, dated 4/28/21, <https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020CF9CB-66E2-5005-8110-C31FAFC91712>

Definition Stream Survey (HDSS) method ([Trutta, 2019](#))<sup>2</sup> used in recent FERC hydropower licensing proceedings, which enables mapping, a visual record of stream and shoreline characteristics, and data collection from multiple sensors. For any planned boat surveys of the shoreline (e.g., turtle, cultural resources, vegetation), please reconsider adopting study Method 1 proposed in the NPS shoreline survey study request to systematically evaluate, quantify, and photograph shoreline conditions including streambank conditions, bank stabilization types and conditions, docks/piers, and public access locations.

### Outstanding Study Requests

Our agency requests that the Licensee reconsider the additional study requests outlined in our April 27, 2021 letter, including the shoreline survey and hydraulics, sedimentation, and channel change. As previously described, the proposed license will require a Section 7(a) evaluation by the NPS under the Wild and Scenic Rivers Act. These studies are necessary to the timely completion of our agency's review. They are also needed to satisfy Section 4(e) of the Federal Power Act, which directs FERC to "give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality." Equal consideration is not possible without adequate information on these important and relevant topics.

### Conclusion

Thank you for your consideration of our agency's comments as you develop your final study plan. The NPS looks forward to the results of the three studies reviewed in this letter, as well as the opportunity to continue to collaborate with you throughout the licensing process. Please distribute future communications through Lisa Yager, chief of resource stewardship and education at the St. Croix National Scenic Riverway. Information will be distributed to the NPS team as appropriate through Lisa.

If you have any questions about our response, please contact Lisa Yager at [lisa\\_yager@nps.gov](mailto:lisa_yager@nps.gov).

Sincerely,

**CRAIG**  
**HANSEN**

Digitally signed by  
CRAIG HANSEN  
Date: 2022.03.04  
13:13:56 -06'00'

Craig Hansen  
Superintendent

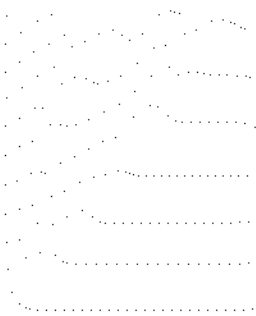
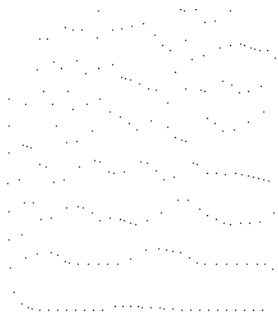
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<sup>2</sup> Trutta Environmental Solutions, *Tallapoosa River High Definition Stream Survey Final Report*, December 2019, included in Alabama Power filing, draft Erosion and Sedimentation Study Report for the R.L. Harris Project under P-2628-065, December 2020. Last accessed 3/31/2021:

[https://elibrary.ferc.gov/eLibrary/filelist?document\\_id=14850582&accessionnumber=20200410-5091](https://elibrary.ferc.gov/eLibrary/filelist?document_id=14850582&accessionnumber=20200410-5091)

Document Content(s)

NPSCommentsProposedMusselsWQTurtles03042022.pdf.....1



WDNR did not provide comments on the Water Quality Study  
Plan



1414 West Hamilton Avenue  
PO Box 8  
Eau Claire, WI 54702-0008

April 21, 2022

VIA Electronic Filing

Ms. Kimberly D. Bose, Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, DC 20426

Subject: **Study Plans for Relicensing**  
**Hayward (P-2417) and Trego (P-2711) Hydroelectric Projects**

Dear Secretary Bose:

Per the request of the relicensing participants that requested studies, Northern States Power Company, a Wisconsin corporation (NSPW), developed draft study plans which are being pursued as part of the relicensing process for the Hayward (P-2417) and Trego (P-2711) Hydroelectric Projects. The draft study plans were provided to the requesting party for their comments prior to finalizing the plans and conducting the studies.

The final study plans, summarized in the table below, are attached herein and include the stakeholders' comments along with NSPW's responses to said comments. They are attached to notify each requestor what studies will be implemented during the relicensing process.

Final Study Plans for Relicensing the Hayward and Trego Hydroelectric Projects

Study Name	Requesting Entities	Attachment Name
Aquatic and Terrestrial Invasive Species Study (includes substrate and bathymetric data collection)	Wisconsin Department of Natural Resources, National Park Service, and Trego Lake District	Attachment A
Mussel Study	Wisconsin Department of Natural Resources	Attachment B
Recreation Study	Wisconsin Department of Natural Resources and National Park Service	Attachment C
Water Quality Monitoring Study	Wisconsin Department of Natural Resources	Attachment D
Wood and Blanding's Turtle Nesting Habitat Study	Wisconsin Department of Natural Resources	Attachment E

Should you have any questions, please contact Matthew Miller at 715-737-1353 or [matthew.j.miller@xcelenergy.com](mailto:matthew.j.miller@xcelenergy.com).

Sincerely,

**Scott Crotty**  
Digitally signed  
by Scott Crotty  
Date: 2022.04.21  
15:23:26 -05'00'  
Scott A. Crotty  
Senior Hydro Operations Manager

Attachments: A through E

cc: Ms. Cheryl Laatsch - WDNR (via e-mail)  
Ms. Lisa Yager – NPS (via email)  
Mr. Charlie Petersen – Trego Lake District (via email at [tld@trego.net](mailto:tld@trego.net))

Attachment A

Aquatic and Terrestrial Invasive Species Study  
(submitted as a separate file)

Attachment B

Mussel Study (submitted as a separate file)

Attachment C

Recreation Study (submitted as a separate file)

## Attachment D

Water Quality Monitoring Study (submitted as a separate file)

Attachment E

Wood and Blanding's Turtle Nesting Habitat Study  
(submitted as a separate file)

**Hayward and Trego  
Hydroelectric Projects  
FERC Nos. 2417 and 2711**

**Final Study Plan  
Work Scope 22 IHT  
Aquatic and Terrestrial Invasive Species Study**

**Prepared for**

**Northern States Power Company,  
a Wisconsin corporation**

**Prepared by**



**March 2022**

## 1. Introduction

Northern States Power Company, a Wisconsin corporation (NSPW or Licensee), currently holds licenses issued by the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the Hayward and Trego Hydroelectric Projects (Project or Projects). The Projects are owned, operated, and maintained by the Licensee. The current licenses, which designate the Projects as FERC Nos. 2417 and 2711 respectively, expire on November 30, 2025. To obtain subsequent licenses, the Licensee must submit a Final License Application (FLA) to FERC no later than November 30, 2023. The FLA, in part, must include an evaluation of the existing botanical resources (including invasive species) and potential impacts to botanical resources associated with continued Project operations.

On March 11, 2021, the Licensee held a Joint Agency Meeting to present information about the Projects. At the meeting, and during the 60-day comment period immediately following, the Licensee received comments and study requests from several entities. The Wisconsin Department of Natural Resources (WDNR) requested that the Licensee complete an invasive species study as part of the relicensing process.

The WDNR recommended that the Licensee conduct an aquatic and terrestrial invasive species study using the WDNR Early Detection Early Response Protocols. The WDNR also noted that additional methodology may be needed for terrestrial species, and other methodologies such as point-intercept, may be appropriate if combined with other studies. The WDNR also requested in-water plant community data within the project boundaries of each Project to provide baseline information on the condition of the aquatic plant community.

## 2. Study Plan Elements

### 2.1 Study Goals and Objectives

The objective of this aquatic and terrestrial invasive species (ATIS) study is to provide baseline data on native and invasive aquatic and terrestrial species. The study also provides a method for identifying newly established invading species early enough to increase chances of control and will help prevent the spread of other nearby invasive species.

### 2.2 Background and Existing Information

There is limited information available regarding invasive species within the Project boundaries. WDNR Lake Facts and Figures webpage identified four invasive species within the Hayward Project, including Chinese mystery snail (*Cipangopaludina chinensis*), curly-leaf pondweed (*Potamogeton crispus*), Eurasian watermilfoil (*Myriophyllum spicatum*), and hybrid Eurasian/northern watermilfoil (*Myriophyllum spicatum* x *Myriophyllum sibiricum*) are present within the Project reservoir (WDNR 2020a). NSPW has also identified purple loosestrife (*Lythrum salicaria*) within the Project reservoir during annual purple loosestrife surveys.

The WDNR Lake Facts and Figures webpage identified four known invasive species within the Trego Project including Chinese mystery snails, curly-leaf pondweed, Eurasian water milfoil and Japanese mystery snails (*Cipangopaludina japonica*).

## 2.3 Nexus between project operations and effects on resources

Invasive species can be introduced to Project waters and lands through recreational activities such as boating, bank fishing, and hiking. These species, once established within the Project boundary, can be transferred downstream through water releases or to areas outside of the Project boundary by recreationists.

## 2.4 Study Area

The ATIS Study will encompass the upstream and downstream areas inundated by the Namekagon River that are contained within the existing and proposed Project boundaries as outlined in the Pre-Application Document (PAD). It will also encompass upland areas owned in fee by the Licensee within the Project boundary, two recreation sites owned by the City of Hayward and two recreation sites owned by the Town of Trego. The study area is depicted in Appendix 1.

## 2.5 Methodology

### 2.5.1 Upstream and Downstream Inundated Areas

Samples will be collected in locations outlined in a point intercept grid provided by the WDNR<sup>1</sup>. Sampling will be conducted completed once in June and once in late July or early August of 2022 to account for both early season and late season species. The sampling will be conducted completed by boat using either a pole-mounted or rope-mounted rake. The methods will be similar to approximating the protocol found in the WDNR Recommended Baseline Monitoring of Aquatic Plants in Wisconsin protocol (point-intercept protocol), including the voucher collection (see Appendix 2). The methodology will also incorporate as many parameters as applicable of those listed in Table 1, page 31 of the protocol.

One rake sample per collection site will be taken by lowering the rake to the bottom and slowly drawing it up to the surface. The sample will be inspected for the presence of invasive species as included in NR40<sup>2</sup>. Their presence and percentage of abundance within the sample will be recorded on a field data sheet accordingly along with the presence and percentage of abundance of native species.

Any areas that are not safely accessible will be noted in the report with one of the following reasons:

- Non-navigable (due to thick emergent plant growth or shallow water);
- Terrestrial (point intercept located in an upland area not owned by Licensee);
- Obstacle (rocks, dock, swim area);
- Temporary obstacle (temporary obstacle should be noted);
- No information (accidentally missed or inaccessible, state reason); and
- Other (provide brief description).

<sup>1</sup>

<sup>2</sup> <https://dnr.wi.gov/topic/invasives/documents/NR40plantlist.pdf>.

Vouchers shall be collected for all NR40 listed aquatic and terrestrial invasive species not currently verified within each Project. Steps for vouchering invasive plant species are listed as follows:

- Take a digital photo(s) of the plant in the setting where it was found. Try to capture details such as flowers, leaf shape, leaf and stem arrangement, and fruits. Include a common object in the photo such as a dollar bill, coin or pencil for a size scale, or stand next to tall plants.
- If possible, collect 5-10 intact specimens to ensure precise identification. Try to get the root system and all leaves, as well as seed heads and flowers when present. Place in a zip-lock bag with a damp paper towel. Place on ice and store in a refrigerator as soon as possible.
- Note the location of the plant you found. If using a GPS device please note the datum being used (e.g., WGS 84 {preferred}, UTM, WI Transverse Mercator, etc.).
- Notify Applicant Representative and then complete the WDNR Form 3200-125 – Aquatic Invasive Plant Incident Report and deliver it, your photo(s), and specimens to your WDNR AIS regional coordinator as soon as possible. See: <https://dnr.wisconsin.gov/topic/Invasives/report>.

In the event wild rice is encountered as part of the survey, additional effort will be required to determine the extent of the wild rice beds. Additional information on bed substrates will be collected at each sample point in water depths up to 15 feet deep. Under normal point-intercept protocols, the bed substrate is classified into one of three types; muck, sand, or rock. To assist in determining habitat within the littoral zone, bed substrates will be classified into one of the following nine substrate types: clay, silt, sand, gravel, cobble, boulder, bedrock, wood, or organic. The presence of woody debris on the bottom will also be identified during the rake sampling. Water depth information collected for all survey points during the survey will be used to develop a bathymetric map of each reservoir.

Areas not included in the point intercept grid will be monitored for the aquatic invasive rapid response species identified in the **Wisconsin Aquatic Invasive Species Early Detector Handbook** which is included in Appendix 3. If any rapid response species are identified in any of the surveying efforts, WDNR notification as described in Section 2.5.5 below will occur.

In addition to the rake sampling, one water sample will be collected in both the reservoir and the tailwater during the July/August survey period. The water samples will be provided to the WDNR invasive species coordinator who will then analyze them for the presence of spiny water flea (*Bythotrephes longimanus*), fishhook water flea (*Cercopagis pengoi*), and zebra mussel (*Dreissena polymorpha*).

In order to determine the presence/absence of Asian clam and other invasive macroinvertebrates, the Licensee will conduct sediment samples at all existing public boat landings. The sampling

method will involve using a shovel to scoop approximately 6 inches of sediment into a net with a maximum 3/8-inch mesh. Fine sediment will be flushed out of the net and the remaining materials will be examined for Asian clam and other invasive macroinvertebrates.

### 2.5.2 Upland Shorelines Not Owned by the Licensee

Upland shoreline areas not owned by the Licensee will be surveyed from a boat (or on foot from the water where the use of a boat is not feasible, i.e., shallow areas) while moving slowly along the shoreline. During the survey, the locations of coarse woody habitat (greater than 4 inches in diameter and five feet in length) that is in the water and/or below the high-water line will be noted for future mapping. An overall characterization of the terrestrial plant community will also be made. Invasive terrestrial plants listed in NR40 will be noted and their locations on the shoreline identified by latitude and longitude. If any terrestrial invasive plants listed in NR40 are observed, their location will be recorded via Global Positioning System (GPS). An estimate of relative abundance and the extent of the area where the species is present will be recorded for future mapping. The route traveled during the boat-based surveys will also be recorded for future mapping.

### 2.5.3 Upland Shorelines Owned by the Licensee and Recreation Sites

At both Projects, an “on the ground” meander survey will be conducted on upland areas within the Project boundary owned by Licensee. At the Hayward Project, a meander survey will also take place at the Hayward City Boat Landing and the Hayward City Beach recreation sites. At the Trego Project, a meander survey will also take place at the Town of Trego Boat Landing and the Town of Trego Park Boat Landing.

In addition to surveying for terrestrial invasive species, an overall characterization of the terrestrial plant community will be made. If any terrestrial invasive plants listed in NR40 are observed, their location will be recorded via Global Positioning System (GPS). An estimate of each species relative abundance and areal coverage will be recorded for future mapping. The route traveled during the meander surveys will also be recorded for future mapping.

### 2.5.4 Personnel Qualifications

All surveys will be conducted by an individual with prior aquatic plant identification training and experience with aquatic and terrestrial invasive species monitoring<sup>3</sup>.

### 2.5.5 Information Reporting

Should monitoring reveal a new occurrence of an invasive species listed in the **Wisconsin Aquatic Invasive Species Early Detector Handbook**, contained in Appendix 3, the WDNR shall be notified at [invasive.species@wisconsin.gov](mailto:invasive.species@wisconsin.gov) as soon as possible, but no later than five working days after its discovery<sup>4</sup>. The notification shall include photographs and the online WDNR Early Detection Form.

<sup>3</sup> The consultant(s) selected to complete the work are responsible for obtaining all NPS and WDNR Scientific collector or other permits necessary to complete the work. Contact Caitlin Nagorka at [Caitlin\\_Nagorka@nps.gov](mailto:Caitlin_Nagorka@nps.gov).

<sup>4</sup> In addition to notifying the WDNR, the consultant shall notify the Licensee representative.

Information collected during the study will be summarized in a final report. Completed survey sheets will be appended to the report. Based upon the data collected, additional invasive species mitigation and enhancement recommendations (if any) may be included in the FLA.

## 2.6 Consistency with generally accepted scientific practice

The ATIS Survey follows generally accepted scientific practice regarding field data collection and reporting. Similar protocols have been approved by the Commission in post-licensing compliance plans.

## 2.7 Project Schedule and Deliverables

Results from this study will be summarized in an ATIS Study Report. The study report will include the following elements:

- Project information and background
- Study Area
- Methodology
- Study Results
- Analysis and Discussion
- Agency correspondence and/or consultation
- Literature cited

The written report will summarize the monitoring results including the location of each species observed and their relative abundance. The information will be provided in an Excel spreadsheet format following the point-intercept protocol. The survey locations depicting the presence of aquatic invasive species listed in NR 40 will be differentiated from the locations with negative sample results. The report will also include all field sheets and completed forms for any observed new occurrences of aquatic or terrestrial species as identified in the ***Wisconsin Aquatic Species Invasive Species Early Detector Handbook***, including the verification photographs.

Several maps will be developed and presented in the report including:

- 1) a map showing the overall predominant species along shoreline areas including the extent of any wild rice beds;
- 2) a map showing the locations of coarse woody habitat;
- 3) a map showing the locations and identities of invasive species observed during the surveys;
- 4) a map showing the substrates identified during the point-intercept survey;
- 5) a map showing the predominant substrate type and presence or absence of woody habitat;
- 6) a bathymetric map of the reservoir

NSPW anticipates that field work will be completed by the end of August 2022 and the draft study report will be available by October 31, 2022.

### **3. Consultation**

The ATIS study was requested by WDNR. As a result, the Licensee consulted with WDNR as follows:

#### **3.1 Wisconsin Department of Natural Resources**

On January 13, 2022, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the ATIS plan to the WDNR for comment. The WDNR did not respond with comments. Documentation of Consultation is included in Appendix 5.

#### **3.2 National Park Service**

On January 13, 2022, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the ATIS plan to the NPS for comment. The NPS responded via letter dated February 8, 2022, included in Appendix 5, which also includes licensee's responses.

#### **3.3 Trego Lake District**

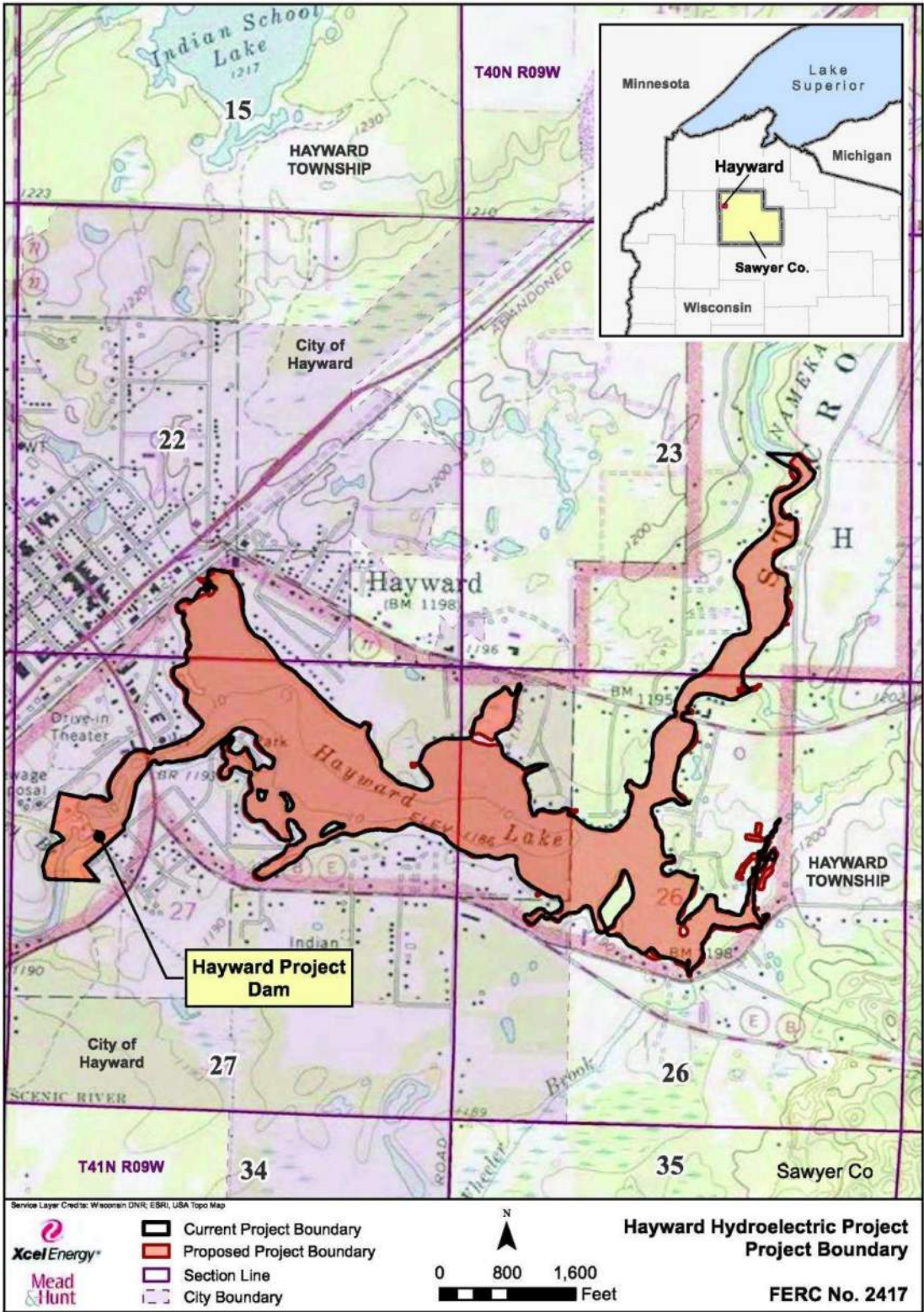
On January 13, 2022, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the ATIS plan to the Trego Lake District (TLD) for comment. The TLD did not provide comments. Documentation of Consultation is included in Appendix 5.

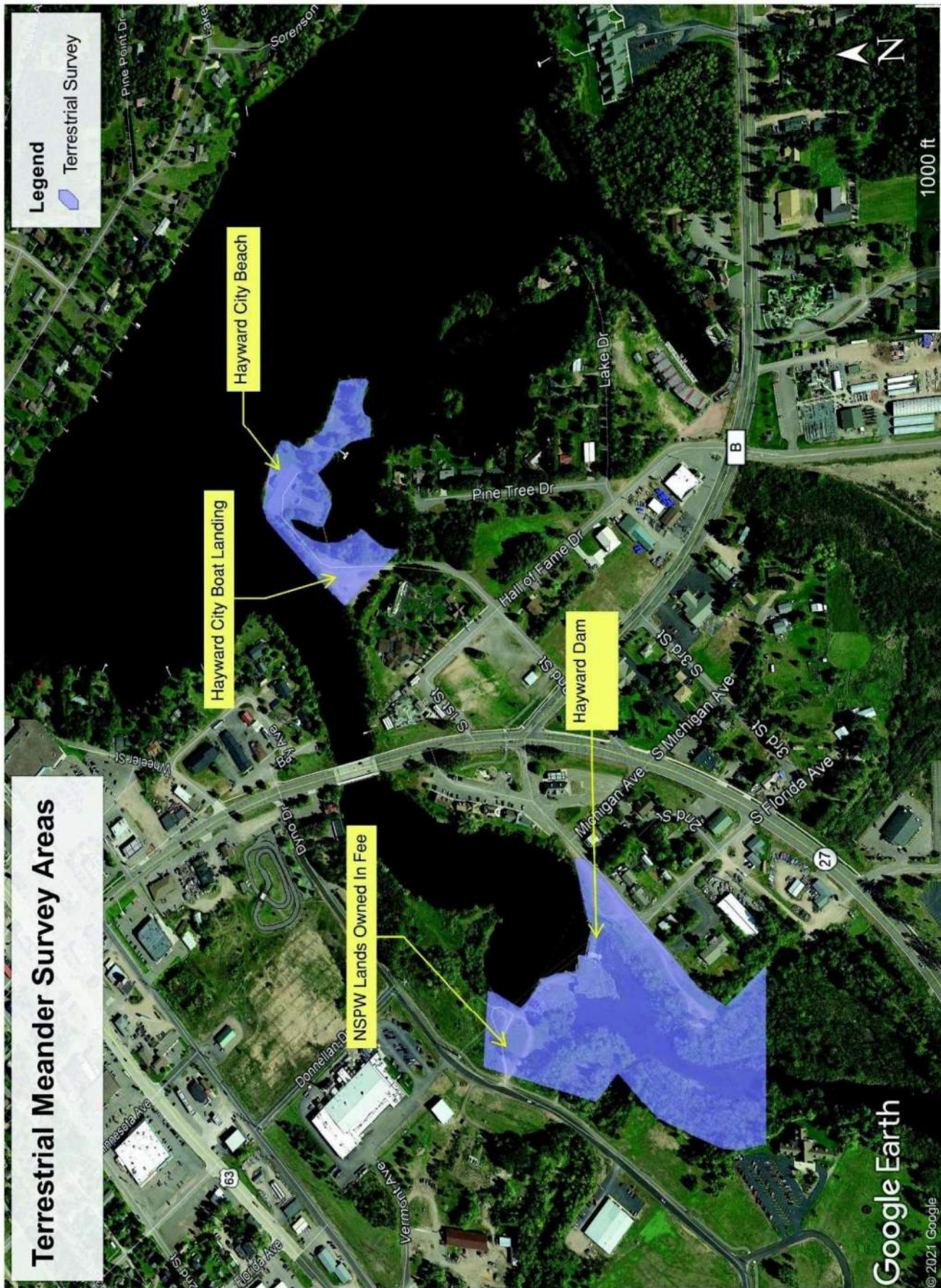
## 4. References

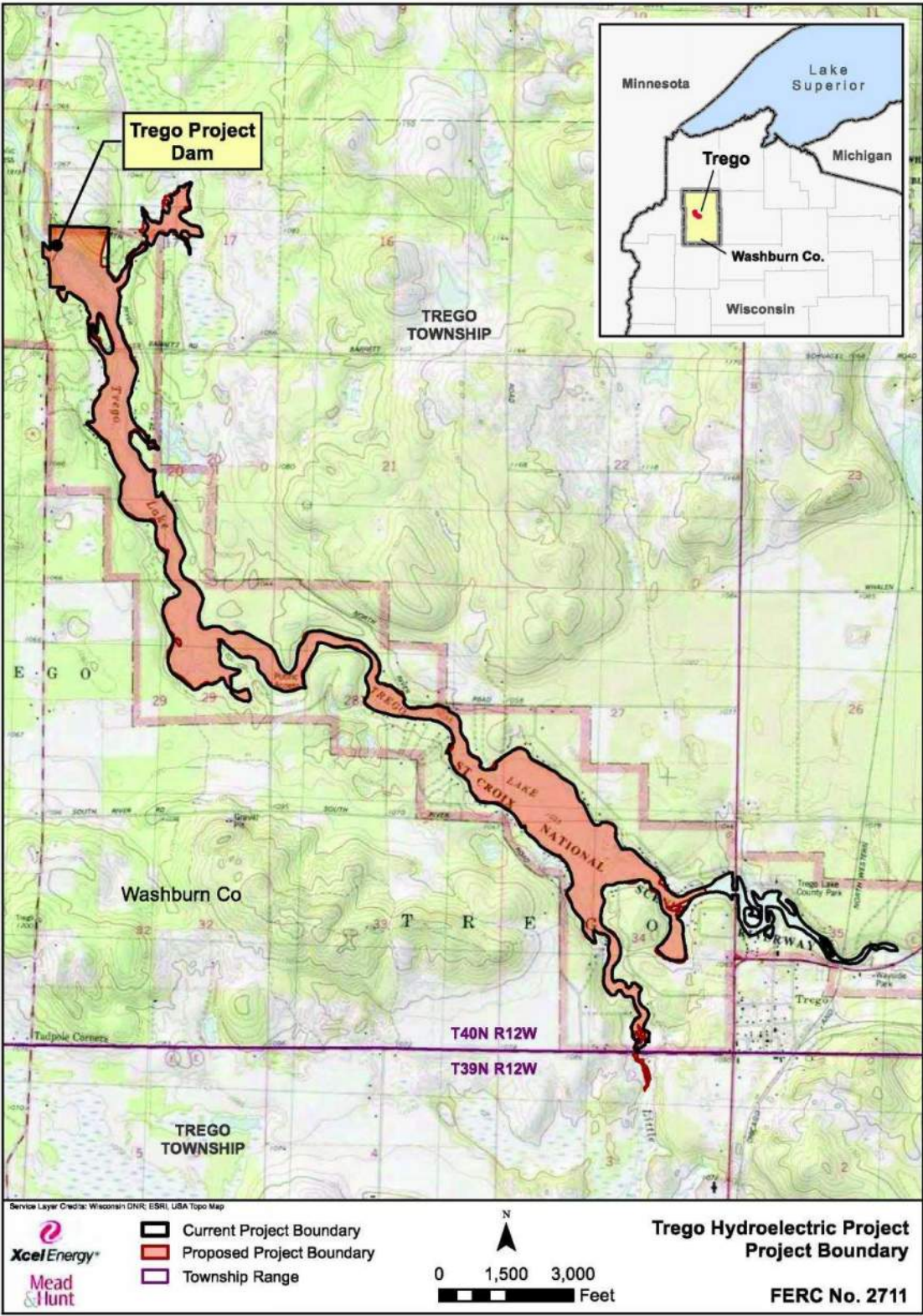
Wisconsin Department of Natural Resources Website. (2020a). Hayward Lake. Facts and Figures. <https://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2725500&page=facts>. Accessed July 27, 2020.

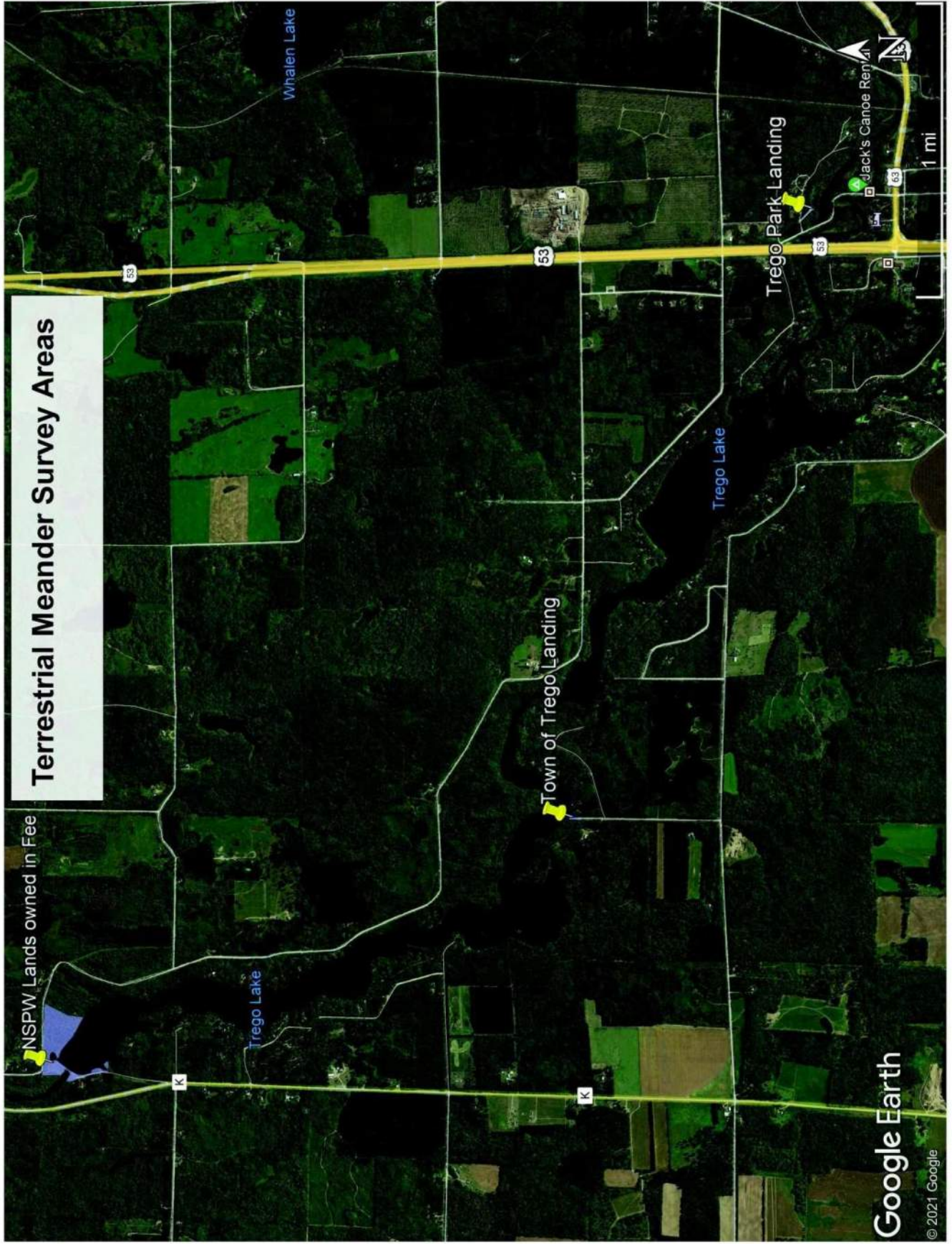
Wisconsin Department of Natural Resources Website. (2020b). Trego Lake. Facts and Figures. <https://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=2712000&page=facts>. Accessed July 27, 2020.

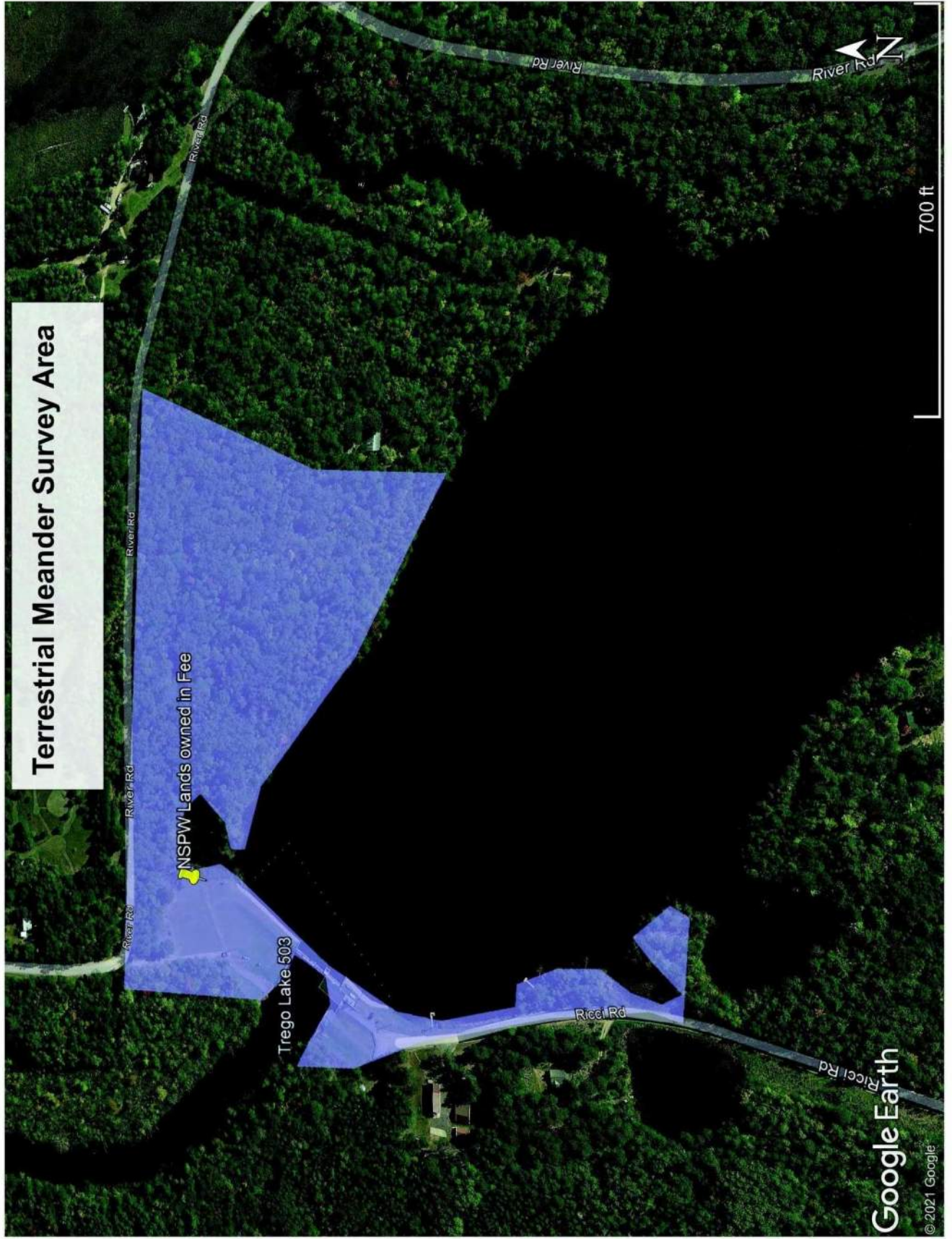
## **Appendix 1 – Invasive Species Study Area**

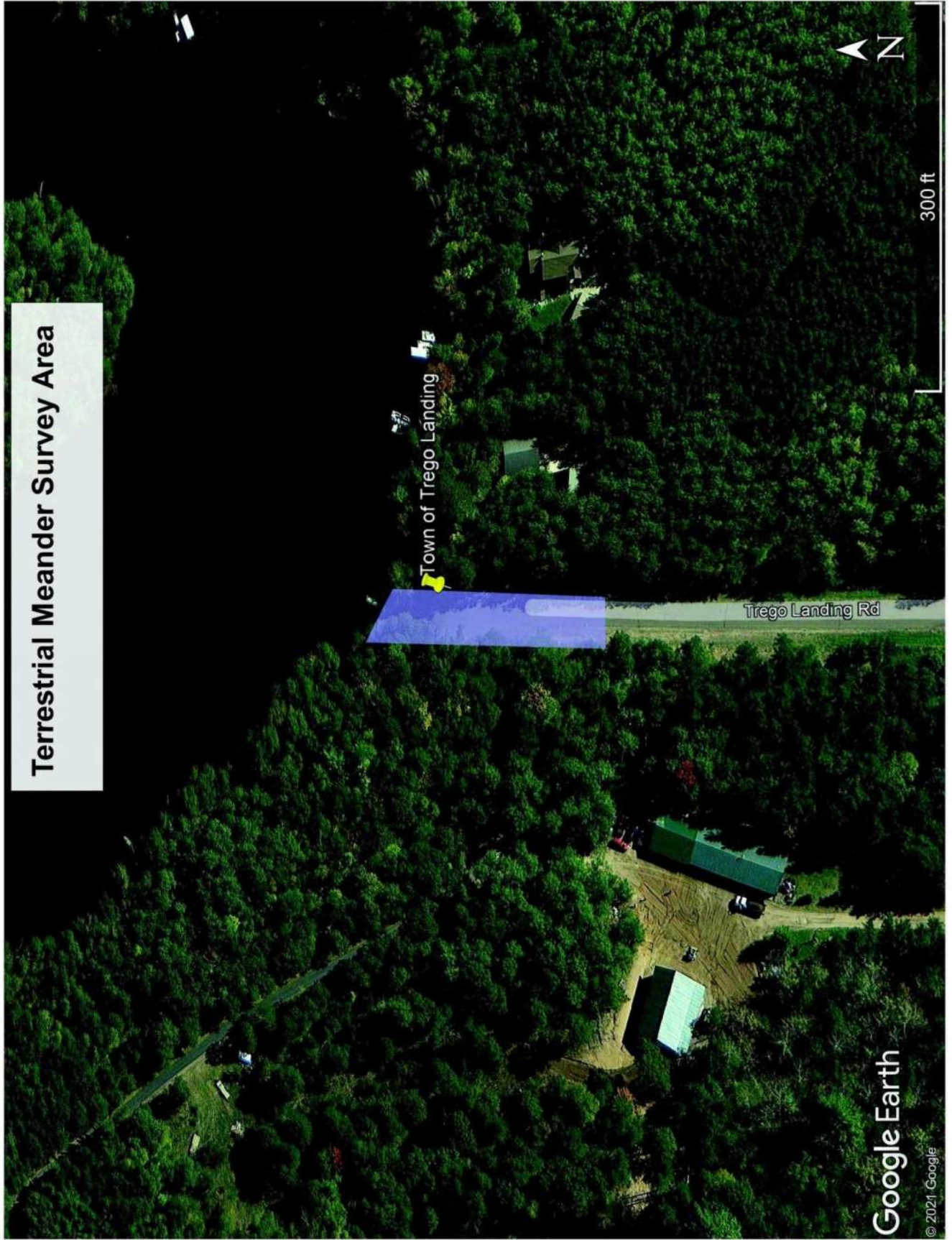


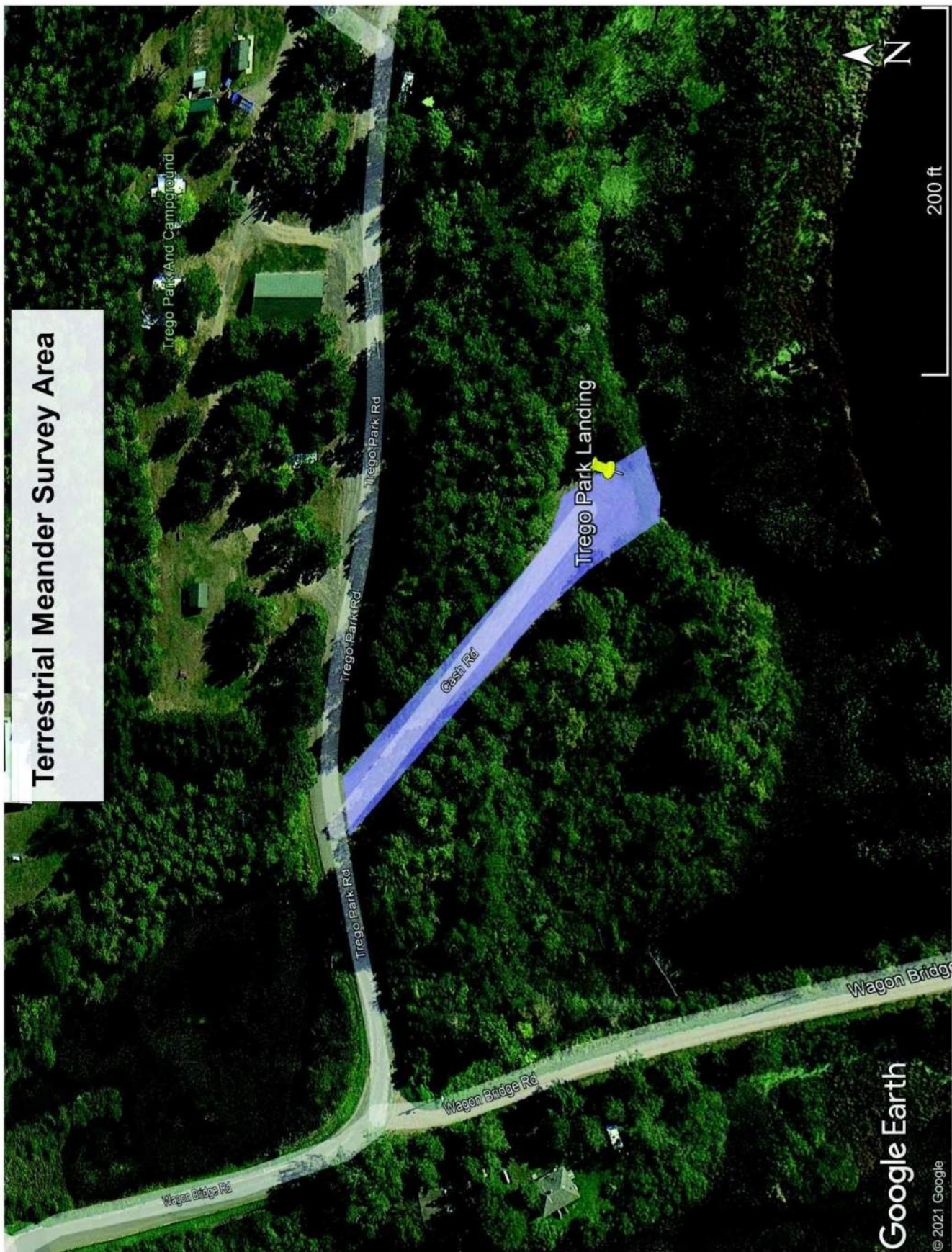








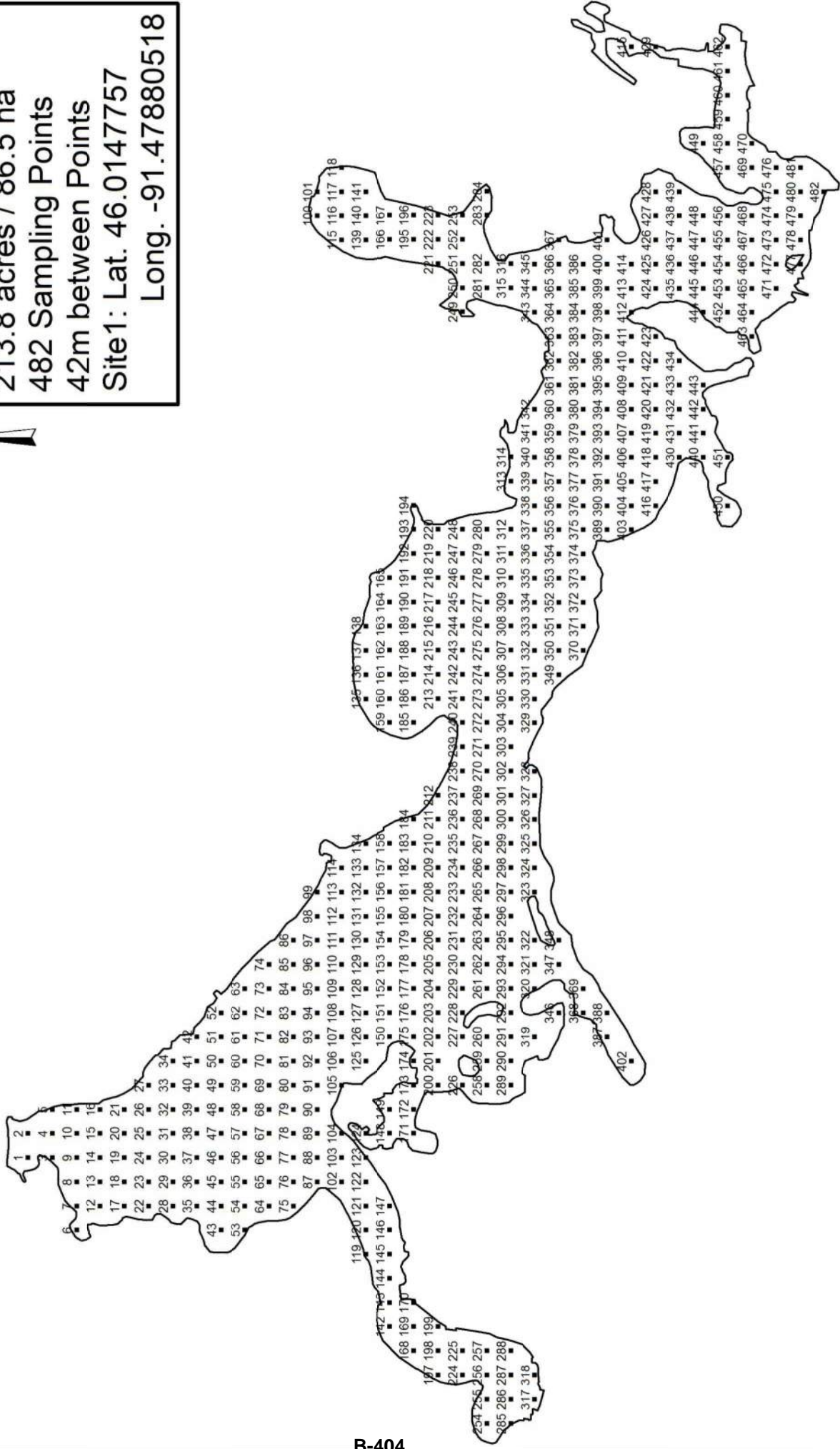




## **Appendix 2 – Point Intercept Protocol-~~See Separate~~ ~~File~~**



Hayward Lake  
Sawyer County  
WBIC 2725500  
T41N R09W S27  
213.8 acres / 86.5 ha  
482 Sampling Points  
42m between Points  
Site1: Lat. 46.0147757  
Long. -91.47880518



0 0.375 0.75 1.5  
Kilometers

Created: 2013

Trego Lake  
Washburn County  
WBIC 2712000  
T40N R12W S17  
421.7 acres / 170.7 ha  
493 Sampling Points  
59m between Points  
Site1: Lat. 45.89891301  
Long. -91.83580193

Please Note: The WDNR declined to provide a point-intercept grid upstream of the STH 53 Bridge. As a result, the consultant completing the study shall develop and provide their own point-intercept grid for the area of the current project boundary upstream of the STH 53 Bridge.



0 0.4 0.8 1.6  
Kilometers

B-405

Created: 2011

# Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis, and Applications



**Jennifer Hauxwell, Susan Knight, Kelly Wagner, Alison Mikulyuk,  
Michelle Nault, Meghan Porzky and Shaunna Chase**

**March 2010**

**Document citation:**

Hauxwell, J., S. Knight, K. Wagner, A. Mikulyuk, M. Nault, M. Porzky and S. Chase. 2010. Recommended baseline monitoring of aquatic plants in Wisconsin: sampling design, field and laboratory procedures, data entry and analysis, and applications. Wisconsin Department of Natural Resources Bureau of Science Services, PUB-SS-1068 2010. Madison, Wisconsin, USA.



Photo credits (all photos used with permission):

J. Hauxwell, Wisconsin Department of Natural Resources

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**Recommended Baseline Monitoring of Aquatic Plants in Wisconsin:  
Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis,  
and Applications**

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## **EXECUTIVE SUMMARY**

We outline a baseline monitoring protocol designed to quantitatively assess the distribution and abundance of aquatic plants in lake ecosystems. This protocol employs a point-intercept sampling design, with sites located on a geo-referenced sampling grid placed over the entire lake. At each site, the aquatic plant community is surveyed from a boat with a rake sampler to characterize species presence and rake fullness. In addition, a qualitative survey is recommended to map obvious species and augment the species list generated through quantitative sampling. Application of this methodology allows: 1) assessment of the frequencies of occurrence of different plant species, as well as estimates of species richness, abundance, and maximum depth of plant colonization; and 2) comparisons of aquatic plant variables over time and among lakes. This document contains complete instructions for conducting a baseline aquatic plant survey, including details on obtaining an electronic file of site coordinates, uploading site coordinates into a Global Positioning System (GPS) receiver, conducting field work, entering data, working with data summaries, processing voucher specimens, and provides example applications of the collected data. Final products from each baseline survey will include: 1) raw data from the quantitative survey which provides individual site-by-site species distribution and rake fullness data, 2) summary statistics useful in characterizing and comparing populations, 3) additional species observations from the general qualitative survey, and 4) voucher specimens cataloguing species presence. All electronic data should be sent for long-term record-keeping to the WDNR ([DNRBaselineAquaticPlants@wisconsin.gov](mailto:DNRBaselineAquaticPlants@wisconsin.gov)).

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## INTRODUCTION

In lake ecosystems, the aquatic plant community serves as critical habitat and nursery for fish and other animals, a source of oxygen for all organisms, a refuge for prey as well as a foraging area for predators, a buffer against erosion and sediment resuspension from both waves and shoreline inputs, and can significantly contribute to overall lake primary productivity. Over the past several decades, losses of or changes in assemblages of native submersed aquatic vegetation has been a reoccurring phenomenon due to a relatively limited number of factors. Repeatedly, changes in landscapes and atmospheric conditions as a result of human activities have increasingly affected the ecology of adjacent aquatic systems, including aquatic plant communities. In addition, in-lake aquatic plant management activities have increased due to the increasing spread of invasive exotic plants<sup>1</sup>.

The Wisconsin Department of Natural Resources (WDNR) is charged with protecting and enhancing the state's natural resources, including lake ecosystems. Given the many ecosystem services associated with aquatic plant communities as well as the recent threats to native species, it has become increasingly important to develop monitoring techniques to support science-based decision-making for effectively managing lake ecosystems. In this document, we present a quantitative, replicable monitoring protocol. Standardized, quantitative and replicable data are an essential part of strategic lake management for three reasons. First, good data allows us to better understand each individual lake; we can use survey data to produce detailed lake maps that show the locations of native, rare, or exotic plant species. Data can then be used as a baseline against which any changes in a lake associated with water clarity, exotic species introduction, water level, or lake management activity can be compared. Second, good data helps direct management by taking the conflict and guesswork out of planning. Aquatic plant management requires weighing a number of potential management options, some of which can be very costly or extensive. Baseline data allows lake groups to identify the most appropriate management options and design the best possible management plan. Additionally, by conducting quantitative comparisons between the aquatic plant communities before and after management actions, lake groups and managers may evaluate whether or not management goals were achieved. Third, by compiling and comparing survey information on lakes statewide, we are able to identify regional trends and refine our understanding of aquatic plant populations on a broader scale in both space and time.

## SURVEY OBJECTIVE

In this document, we outline a baseline monitoring protocol designed to assess aquatic plant communities on a whole-lake scale. We recommend a formal quantitative survey conducted at pre-determined sampling locations distributed evenly throughout the lake, accompanied by a general qualitative survey to map obvious species and augment the species list generated through the quantitative survey. Our primary goals in adopting this methodology are to:

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<sup>1</sup> Knight, S., and J. Hauxwell. 2009. Distribution and abundance of aquatic plants- human impacts. *In*: G. Likens (editor-in-chief), *Encyclopedia of Inland Waters*. Elsevier, Oxford, United Kingdom.

1) Collect quantitative data describing the frequencies of occurrence of different plant species, as well as estimates of species richness, abundance, and maximum depth of plant colonization for use in developing various management plans; and

2) Use the data to statistically compare aquatic plant variables over time and among lakes.

*The importance of a statewide standardized protocol is that observed differences in a lake's plant community can be attributed to actual changes in the community over time, without the confounding variation that results from different field workers employing different sampling techniques.*

The quantitative survey employs a point-intercept sampling design, adapted from terrestrial methods, with sites located on a geo-referenced sampling grid placed over the entire lake. At each site, the aquatic plant community is surveyed from a boat with a rake sampler to characterize species presence and rake fullness ratings. Although the presence/absence data cannot be used to estimate biomass or percent cover, it is less sensitive to interannual or seasonal variations in plant abundance<sup>2</sup>. The method is also relatively rapid and cost-effective and can be used on the large scale to collect baseline data and statistically compare communities over time<sup>2,3</sup>. In summary, it has the following attributes for estimation of aquatic plant distribution and abundance:

- Systematic, quantitative, and replicable
- Appropriate for lakes that vary in depth, size, region, shoreline complexity, and vegetation distribution
- Evenly spaced distribution of sites results in a good coverage of the entire lake, precluding the random exclusion of niche habitats
- Procedural simplicity
- Inexpensive implementation
- Results are easily analyzed with scientifically rigorous statistical methods
- Spatial data preserved and can be mapped for both the managers' use and for clearly communicating distributional data with the public

These guidelines are intended to work on most lakes. However, modifications may be required if a lake is uniquely shaped so that a uniform distribution of points isn't representative (long, skinny lake shape), or if obtaining rake samples is difficult due to substrate (rocky/cobble bottom).

*Please note that these are "baseline" recommendations.* Additional monitoring activities may be warranted if the goal is to assess a specific management activity. For example, to gauge the ability of chemical spot-treatments to control relatively small stands of an exotic species in a

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<sup>2</sup> Madsen, J.D. 1999. Point intercept and line intercept methods for aquatic plant management. Aquatic plant control technical note MI-02. Army Engineer Waterways Experiment Station, Vicksburg, MS.

<sup>3</sup> Dodd-Williams, L., G.O. Dick, R.M. Smart and C.S. Owens. 2008. Point Intercept and Surface Observation GPS (SOG): A Comparison of Survey Methods – Lake Gaston, NC/VA. ERDC/TN APCRP-EA-19. Vicksburg, MS: U.S. Army Engineer Research and Development Center

relatively large lake, we recommend additional mapping of the beds following the pre- and post-treatment protocol available in Appendix D of the Aquatic Plant Management guide<sup>4</sup>.

*Unlike the procedures used by the Citizen-Based Lake Monitoring Network, this protocol is not designed for most volunteers.* The protocol requires at least one of the field workers be an experienced plant taxonomist and able to identify most plant species in the field. Less experienced volunteers may be able to help with data recording and navigation, but without the help of a professional aquatic ecologist, volunteers may not be able to conduct an entire plant survey without a significant degree of training or study.

## SURVEY OVERVIEW

### Sampling Sites

This method employs a point-intercept design in which a grid of sampling sites is distributed evenly over the entire lake surface (Figure 1). Lake organizations or individuals can request an electronic file of survey sites by contacting the WDNR Lake Coordinator from their region (see Appendix 1) with the lake name and county, as well as the town, range and section (TRS) or water body identification code (WBIC). Please make requests well in advance of planned field work to allow WDNR staff sufficient time for map creation (recommend at least 1 month). WDNR staff will determine the number of sites and grid resolution based on the estimated size of the littoral zone (the area in which plants grow) and shape of the lake. Grids will be scaled to produce a greater number of sites on lakes that are larger and have more complex shorelines. Lakes with a narrow littoral zone may be assigned a comparatively high number of sampling sites to achieve sufficient survey coverage. Once created, the sampling map (Figure 1) and an associated GPS text file containing the latitude and longitude information associated with each sample site will be provided electronically by the WDNR.

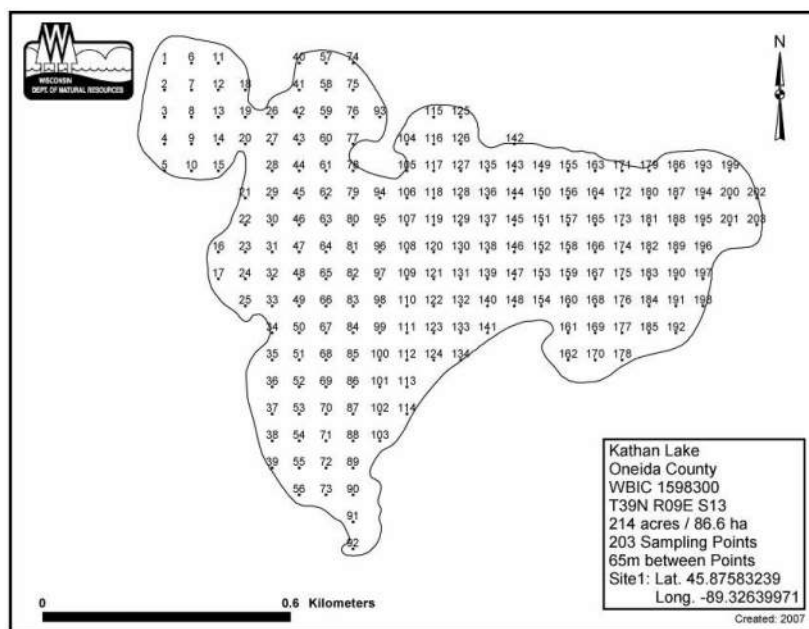


Figure 1: The point-intercept grid for Kathan Lake, Oneida County, WI, with 203 sampling sites.

### Timing of Sampling

Surveys should be conducted between early July and mid August. Although certain plant community parameters (such as rake fullness and biomass) can change over the course of the

<sup>4</sup> Aquatic Plant Treatment Evaluation. <http://www.uwsp.edu/cnr/uwexlakes/ecology/APM/Appendix-D.pdf>

growing season, presence/absence data is less sensitive to seasonal variation<sup>2</sup>; presence can often be detected throughout the season. For many species, including Eurasian water milfoil (EWM), plant biomass and density may increase as the season progresses, whereas some species like curly-leaf pondweed (CLP), senesce much earlier in the sampling season. Rake fullness data for these species must be interpreted carefully with the sampling date in mind. If early-senescent species such as CLP are targets of management actions, please contact the WDNR Lake Coordinator in your region to coordinate the best possible sampling time.

### Time Spent Sampling

Depending on the size of the lake, a survey may be completed in a few hours, or it may take several days. Ideally, a crew spends one-half to three minutes per sample site; however, this may vary depending on the following factors:

- Distance between sample sites
- Weather (i.e. wind, rain, etc.)
- Rake fullness
- Ease of navigation
- Experience; less experienced field workers may take longer to identify unfamiliar plants. However, most field workers have found that the time spent per site drops dramatically with experience. Others have reported their speed increasing greatly with a few hours of training.



## PREPARING FOR FIELD WORK

### Field Gear

Necessary equipment:

- Appropriate watercraft and all equipment required by state law
- Double-sided sampling rake attached to a 15-ft (4.6m) pole
- Weighted sampling rake attached to a 40-ft (12m) rope
- Handheld GPS receiver with WDNR sample sites loaded
- Print-out of lake map with WDNR sample sites
- Print-out of WDNR field datasheets on waterproof paper
- Pencils
- Sealable storage bags for voucher specimens
- Waterproof voucher sample labels
- Cooler(s) with ice for storing voucher specimens
- Depth finder

Helpful, but not required:

- Trolling motor for reaching shallow sites
- Bathymetric map
- Plant ID references or guides to aid in plant identification
- Hand lens to aid in plant identification
- Digital camera for plant specimens or field pictures
- Underwater video camera for viewing the maximum depth of plant colonization

### Loading Sample Site Locations onto the GPS Receiver

Detailed instructions on loading sample site locations onto the GPS receiver depend greatly on the type of GPS receiver as well as the software used to translate site location from the text file to “waypoints” in the receiver. The WDNR commonly utilizes Garmin 76 model GPS receivers and the WDNR Garmin GPS Standalone Tool software. The WDNR Standalone Tool is only available to WDNR employees, and only works with Garmin GPS receivers. The Minnesota Garmin GPS Tool and appropriate guidance documents are available to the public and can be found online at the Minnesota DNR internet site<sup>5</sup>. The two programs are similar; their chief difference is that the Minnesota tool requires the GPS text file to be comma-delimited instead of tab-delimited. Procedures for other GPS models with a Wide Area Augmentation System (WAAS-capability) may be used; please refer to the manufacturer’s instructions for details on uploading site locations.

Please note that storage capability varies by GPS model. Some GPS receivers are unable to store the large numbers of data sites required in some surveys. In the event that the number of sampling sites exceeds your receiver's storage capacity, the text file containing the survey site information can be split into smaller text files. You will then be able to upload successive files of sites as needed or work from multiple receivers in the field.

*The instructions below describe how WDNR employees can use the WDNR Garmin Standalone Tool software to load sample site locations, or “waypoints,” onto a Garmin 76 model GPS receiver.*

To upload waypoints from a GPS text file to the GPS receiver, you will need:

- **PC/laptop with WDNR Garmin GPS Tool.** Your IT administrator can help you obtain and install the software.
- **GPS text file (.txt extension).** A tab-delimited text file containing the sample sites and their geographical information.
- **A Garmin 76 model GPS receiver with external data port.**



<sup>5</sup> Available online at: <http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html> (accessed September, 2009)

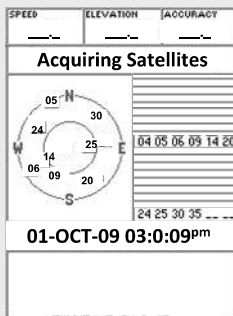


- **PC interface cable (with USB or 9-pin serial connector).** Can be purchased online at <http://www.garmin.com>

### Step 1: Set GPS to the “Simulating GPS” Mode

Operating the receiver in “Simulating GPS” mode prevents the GPS receiver from trying to acquire a satellite signal indoors.

1. Press and hold the red [ON/OFF] button for two seconds to turn the GPS receiver on.
2. Press [PAGE] to navigate through the welcome screens until the “Acquiring Satellites” page is visible.



3. Press the [MENU] button, select “Start Simulator”, and press [ENTER]; the screen heading should now read “Simulating GPS.”

### Step 2: Set Serial Data Format (this setting will **not** have to be re-set upon each use)

Set the serial data format on the Garmin 76 receiver to GARMIN prior to transferring data. Failure to set the serial data format to GARMIN will cause a communication error.

1. Press the [MENU] button twice to reach the main menu, use the rocker key to select “Setup”, and then press [ENTER].
2. Use the rocker key to scroll left or right until the “Interface” tab is highlighted. Use the rocker key to scroll down to highlight the drop-down box and press [ENTER].
3. A menu will appear; select “GARMIN” and press [ENTER]. Press [QUIT] twice to exit the menu.

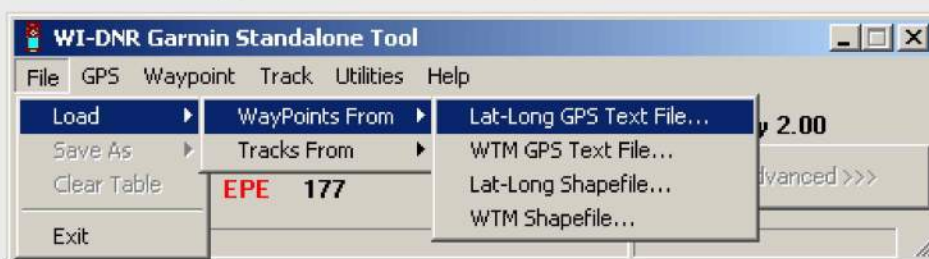
### Step 3: Plug in the PC Interface Cable

1. The GPS receiver should be on and in simulation mode.

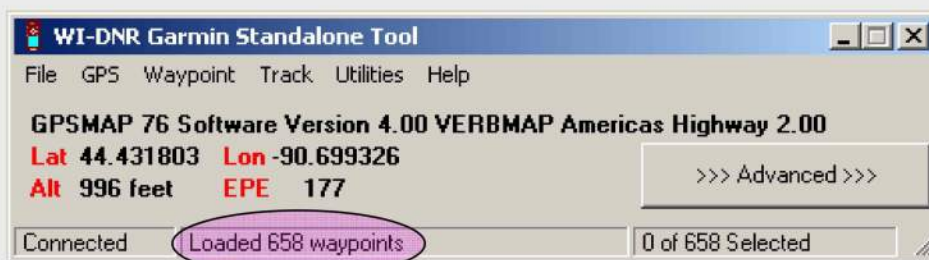
2. Plug the 9-pin serial connector cable into COM port #1 on your PC. If port #1 is in use, plug into the next available port and note the port number. The newest version of the WDNR Garmin GPS Tool (ver. 8.2.8) supports USB connectivity as an alternate to COM port connection.
3. Plug the round end of the PC interface cable into the external data/auxiliary power port under the rubber panel on the back of the GPS receiver.

**Step 4:** Load the GPS text file into the WDNR Garmin Standalone Tool

1. Open the WDNR Garmin GPS Tool file on your computer. Select:  
File > Load > Waypoints From > Lat-Long GPS Text File.



2. Navigate to and select the appropriate GPS text file and select OK. The waypoints will be visible in the Tool's status bar.

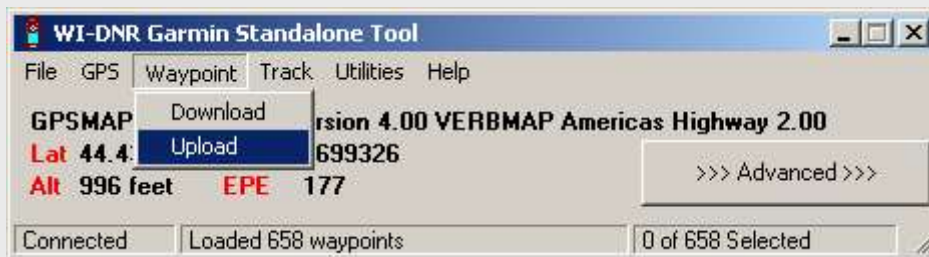


3. If necessary, you can view and edit waypoints by clicking the [Advanced] button on the WDNR Garmin GPS Tool.
4. Troubleshooting COM-enabled setups
  - a. Check that the correct COM port is selected in the WDNR Garmin GPS tool.
    - i. GPS > Assign Port > select correct port #
  - b. Check that the baud rate matches that of the GPS receiver.
    - i. GPS > Assign Port > Baud Rate > 9600
    - ii. A Garmin 76 receiver will transfer at 9600 bits per second

- c. Check that the serial data format is set to “GARMIN” (see Step 2).
- d. If your problem persists, please consult your GPS unit’s user’s manual.

**Step 5:** Upload Waypoint Data from the WDNR Garmin GPS Tool to the GPS receiver

1. In the menu bar, select: Waypoint > Upload



2. A pop-up window will indicate the completion of a successful upload. Click OK.



3. Check that the uploaded waypoints are visible on the GPS receiver: press [MENU] twice to get to the main menu, select “Points”, press [ENTER], select “Waypoints”, and press [ENTER].
4. Troubleshooting
  - a. Storage capability varies by GPS model. In the event that the number of sampling sites exceeds your receiver's storage capacity, the text file containing the survey site information can be split into smaller text files. You will then be able to upload successive files as needed or work from multiple receivers in the field.
  - b. For more help, please refer to the appropriate online documentation or user’s manuals.

## Printing Datasheets

The form used for recording data can be found on the tab labeled “FIELD SHEET” in the Aquatic Plant Survey Data Workbook, downloadable from the University of Wisconsin Extension website (<http://www.uwsp.edu/cnr/uwexlakes/ecology/APM/Appendix-C.xls>). Print the field sheet (waterproof paper recommended), using the “Print Area > Set Print Area” function under the “File” menu to set the appropriate number of rows to print. Under Header (View > Header and Footer > Custom Header) record lake name, Waterbody Identification Code (WBIC), county and survey date.

1	Observer 1: name and hours:						Observer 2: name and hours:						Observer 3: name and hours:						Total hours worked:									
2	Site #	Depth (ft)	Dominant sediment type (M, S, R)	Rake pole (P) or rake rope (R)?	Total Rake Fullness	EWM 12.3	CLP 12.3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
3	1																											
4	2																											
5	3																											
6	4																											
7	5																											
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30	28																											

Constructing the Rake Samplers

The rake samplers are each constructed of two rake heads welded together, bar-to-bar, to form a double-sided rake head. The rake head is 13.8 inches (35 centimeters) long, with approximately 14 tines on each side. For use in shallow waters, mount a double-sided rake head to a pole that has the capability to extend to 15 feet (4.6 meters). For use in deeper waters, attach a second double-sided rake head to a rope; this rake head should also be weighted (Figure 2).



	<p><b>Pole Sampler</b></p> <p>To make the pole samplers shown in the photographs, we removed the handles from 2 standard bow rakes (available at most hardware stores), and welded the rake heads together bar-to-bar. We mounted the rake head to an 8-foot (telescoping to 15.5 feet) pool skimmer handle purchased from a supply store (left, \$50). For an even sturdier sampler we purchased an aluminum Co-Handle from Duraframe Dipnet and designed a rake pole which attaches and detaches into 3 sections (right, \$200). For depth recording, mark the rake handle in one-foot increments. Electrical tape marked with permanent marker, then covered with a length of clear packing tape works well and holds up over time.</p>
	<p><b>Rope Sampler</b></p> <p>A similar rake head should be constructed and attached to a 40-foot-long rope or anchor line. In order to ensure a quick vertical descent to the lake bottom, attach a light weight (~5 lb) to the rake head, away from the tines. The rope sampler pictured here has a short piece of steel tubing welded to the rake head to serve as a handle through which 45 feet of rope is attached.</p>

Figure 2: Examples of sampling rakes used during surveys.

## COLLECTING AND RECORDING FIELD DATA

### Using the Rake Samplers

Collect one rake sample per sample site.

In water shallower than 15 feet deep, use the pole sampler. At each sample site, lower the rake straight through the water column to rest lightly on the bottom, twist the rake around twice, and then pull the rake straight out of the water.

In water deeper than 15 feet, drop the rope sampler straight into the water alongside the boat, drag the rake along the sediment surface for approximately one foot (0.3 m), and then pull the rake to the surface.

A large tray or bin may be used to aid in processing the entire sample.

### Navigating to Sites

#### *Accuracy*

The location reported by the GPS receiver has an element of error that varies under different conditions. The total error from the GPS and your navigational error *combined* should not exceed half of the sampling resolution. Therefore, when sampling with a Garmin 76 receiver, navigate at no greater than an 80-foot zoom level and aim to completely cover the sampling site with the arrow. At 80-foot zoom, the locator arrow shown on the screen represents approximately 25 feet in length. In order to sample with acceptable accuracy, the arrow must completely cover the sample site on screen. At coarser zoom levels, because the size of the arrow remains constant, the boat may be more distant from the site even though the arrow completely covers the site. You can use a lower zoom level (120-feet is appropriate) in order to travel from site to site, but as you approach the target site, you must confirm your location at using at least the 80-ft zoom resolution to ensure you are sampling with acceptable accuracy.

#### *Determining Maximum Depth of Plant Colonization*

When sampling, you will have to determine the maximum depth at which the plants are rooted. The maximum depth of colonization (MDC) can vary greatly among lakes, from just a few feet to as deep as the physiological requirements of a species will allow. When sampling a line of sites heading from shore out to deep water, take samples until plants are no longer found on the



rake. Continue sampling at least two sites deeper to ensure you sampled well over the maximum depth of colonization. If no plants are found at these sites, simply record the depth, sampling tool used, and dominant sediment type. Leave the rake fullness and species information blank. Depending on the lake bathymetry, you may choose to continue down the same row to the other side of the lake. Use a depth finder and begin sampling again when the depth reaches that of the last (no plant) site sampled. Alternatively, if the rows are very long, you may choose to move over to the next row and sample sites back into shore, working back and forth along the shoreline and around the lake. However, if the second row is shallower than the first, be sure to start sampling sufficiently far from shore so that the depth is similar to that at which you stopped sampling in the first row. By sampling in this way, over time you will begin to hone in on the maximum depth of plant colonization.



After working several rows crossing the edge of the littoral zone, estimate the maximum depth of colonization (e.g. 20 feet) and only continue to sample deeper sites within 6 feet of this estimation (all sites  $\leq 26$  feet). As you complete more rows and gain confidence in your estimation, you can then begin to gradually omit sampling depths that are too deep for plants to grow. Once you have sampled the deep end of your estimated maximum depth of colonization (i.e. 26 feet) at least three times and have not found any plants, then you can discontinue sampling at anything deeper, but continue to sample any sites shallower ( $\leq 25$  feet). If you then sample a shallower depth three times (i.e. 25 feet) and find no plants at any of those sites, you may now discontinue sampling at these deeper sites and only sample sites shallower than this new sampling depth ( $\leq 24$  feet). Continue to successively eliminate shallower depths in sequence until you establish the maximum depth of colonization. To account for patchiness and other sources of variation, never narrow the sampling window to less than 1.5 feet of the estimated maximum depth of colonization. Use your best judgment when eliminating depths, and remember that plant distribution may be uneven and that different areas of a single lake may have plants growing relatively deeper or shallower. It is good practice to err on the side of oversampling.

## Recording Data

### *Completing the Field Sheet*

#### 1. General site information

Complete the top portion of the “Field Sheet” with the lake name, county, WBIC, date, names of observers, and how many hours each person worked during the survey.



2. Site number

Each site location is numbered sequentially. Each site number will have one row of data on the "Field Sheet."

3. Depth

Measure and record the depth to the nearest half-foot increment at each site sampled, regardless of whether vegetation is present. The pole mounted rake and rope sampler should be marked to measure the depth of water at a sample site. However, a variety of options exist for taking depth measurements, including sonar handheld depth finders (trigger models) and boat-mounted depth finders. If you are using a depth finder, it is useful to know that the accuracy may decrease greatly in densely vegetated areas. Depth finders sometimes report the depth to the top of the vegetation instead of to the sediment surface. In most cases, it is best to use depth markings on a pole-mounted rake for shallow sites.

4. Dominant sediment type

At each sample site, record the dominant sediment type based on how the rake feels when in contact with the sediment surface as: mucky (M), sandy (S), or rocky (R).

5. Pole vs. Rope

Record whether the pole (P) mounted rake or the rake-on-a-rope (R) was used to take the sample.

6. Rake fullness

At each site, after pulling the rake from the water record the overall rake fullness rating that best estimates the total coverage of plants on the rake (1 - few, 2 - moderate, 3 - abundant; see Figure 3). Also identify the different species present on the rake and record a separate rake fullness rating for each. Account for plant parts that dangle or trail from the rake tines as if they were fully wrapped around the rake head. The rake may dislodge plants that will float to the surface, especially short rosette species not easily caught in the tines. Include the rake fullness rating for plants dislodged and floating but not collected on the rake. Record rake fullness ratings for filamentous algae, aquatic moss, freshwater sponges, and liverworts, but do not include these ratings when determining the overall rake fullness rating. While at a site, perform a brief visual scan. If you observe any species within 6 feet (2m) of the sample site, but not collected with the rake, record these species as observed visually ("V") on the field sheet. These species will be included in total number of species observed.




Fullness Rating	Coverage	Description
1		Only few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.
2		There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover the tines.
3		The rake is completely covered and tines are not visible.

Figure 3: Illustration of rake fullness ratings used during the survey.

#### 7. Species names

Note that the field datasheet does not include any species names, except for EWM (Eurasian water milfoil) and CLP (Curly-leaf pondweed). The sampling crew must write the species name in subsequent columns the first time that species is encountered. Names must be re-written on successive field sheets as they are encountered. You may use common or Latin names, but be sure there is no ambiguity in the name that will present problems during data entry. The use of standard abbreviations can greatly shorten this process. It is generally safe to shorten the names to include the first three letters of the genus name followed by the first three letters of the species name (i.e. *Ceratophyllum demersum* = CerDem).

#### 8. Inaccessible sites

It may be impossible or unsafe to reach some sample sites. Where the water is very shallow, rocks are present, or dense plant growth prevents navigation, field workers should attempt to access the site as long as doing so is safe and relatively practical. It is often possible to reach difficult sites by using oars or poling; however, keep safety in mind and practice good judgment. Do not get out and drag the boat through mucky sediment to reach a site. If the sampling site is shallow but the substrate is firm, you may be able to walk to the site from shore or from the boat. If you cannot access a site, leave the depth blank and record the appropriate comment on the field datasheet from the list below. Remember to also transfer these to the “Comments” column of the ENTRY sheet (see data entry section):

**a. NONNAVIGABLE (PLANTS)**

1. Sample site cannot be accessed due to thick plant growth.
2. Aquatic plants that are visible within 6 feet of a non-navigable sample site (e.g. water lilies, cattails, bulrushes, etc.) should be recorded as visuals (V) on the datasheet.

**b. TERRESTRIAL**

1. Sample site occurs on land (including islands).
2. Aquatic plants visible within 6 feet of a terrestrial sample site (e.g. water lilies, cattails, bulrushes, etc.) may be included in the general boat survey list, but should not be marked as visuals (V) on the datasheet.
3. Only species rooted in water should be recorded as present or as part of the boat survey.

**c. SHALLOW**

1. Sample site is in water that is too shallow to allow access.
2. Aquatic plants that are visible within 6 feet of a shallow sample site should be recorded as visuals (V) on the datasheet.

**d. ROCKS**

1. Sample site is inaccessible due to the presence of rocks.

**e. DOCK**

1. Sample site is inaccessible due to the presence of a dock or pier.

**f. SWIM AREA**

1. Sample site is inaccessible due to the presence of a designated swimming area.

**g. TEMPORARY OBSTACLE**

1. Sample site is inaccessible due to the presence of a temporary obstacle such as a boater, swimmer, raft, loon, etc.
2. If possible, try to revisit this site later on during the survey once the temporary obstacle has moved.

**h. NO INFORMATION**

1. No information is available about the sample site because it was not traveled to (inaccessible channel, accidentally omitted during survey, skipped due to time constraints, etc.).

**i. OTHER**

1. Site was not sampled for another reason; please provide a brief description.

**9. Filling Out the Boat Survey Datasheet**

Often there will be localized occurrences of certain species (e.g., floating-leaf or emergent species) that are missed by the point-intercept grid. For areas that are outside the grid or in between sampling sites, record the name of the plant and the closest site to the plant. This information will be entered into the "BOAT SURVEY" section of the data entry file. Emergent near-shore vegetation should only be recorded if it's rooted in water.

### *Collecting and Identifying Voucher Samples*

Voucher each plant species for verification and identification. You can often use plants collected on the rake as vouchers. However, if the sample is of poor quality or lacks reproductive structures, attempt to collect a better specimen. If a better specimen is unavailable, voucher and press what you are able to collect. Remember that the more material collected, the easier identification will be. Whenever possible, collect at least two specimens, and include reproductive material such as seeds, flowers, fruit, roots, etc. Place the voucher plant into a re-sealable plastic bag with a waterproof voucher label. The voucher label should include the species name, or in the case of unknown species, a unique identifier, the lake name, county, sample site, sediment type, collector's name, and the date. Additional information about habitat or co-occurring species may also be included on the tag. Place all specimens in a cooler for transport to the lab. See below, "Pressing Plants" for instructions once back at the laboratory.

### *Plant Identification and Troublesome Taxa*

1. Plants should be identified to species whenever possible. Certain genera, including *Carex*, *Sparganium*, and *Sagittaria* must be flowering and/or fruiting to confirm identification and may not be identifiable to species without these parts.
2. Non-angiosperms such as *Chara* or *Nitella* are identified to genus only. Often, *Isoetes* can be identified to species by looking at spores, if present. Filamentous algae, aquatic moss, and freshwater sponge can be referred to simply as algae, moss, and sponge.
3. If a plant cannot be identified in the field, place the two voucher specimens in a re-sealable bag with a separate voucher label. Take these specimens back to the lab to verify the identity. The label should include a unique identifier, lake, county, the sample site number, and sediment type. The presence and fullness of the species should be recorded on the field datasheet under the same unique identifier name listed on the voucher label.
4. In the lab, try to identify the plant using plant identification keys and a stereo microscope. If you are still uncertain of the identity of the plant, contact a DNR biologist in your region to help with identification. Do not send specimens to an expert until you notify them of your intended shipment and they have instructed you to do so. Once the plant is identified, record this information so that the correct identification is used during data entry.



## ENTERING DATA ELECTRONICALLY

### Worksheet Descriptions and Instructions

The Aquatic Plant Survey Data Workbook

(<http://www.uwsp.edu/cnr/uwexplakes/ecology/APM/Appendix-C.xls>) contains eight worksheets:



#### 1. READ ME

Provide a brief description of the six other worksheets included in the workbook.

#### 2. FIELD SHEET

The FIELD SHEET should be printed on waterproof paper for recording the field data.

#### 3. ENTRY

- a. There are many formulas embedded in the ENTRY sheet that allow for the statistical calculations on the STATS sheet. Thus, **DO NOT add or delete columns or rows on the ENTRY or STATS sheets.**
- b. Data collected in the field is recorded on the FIELD SHEET and afterwards transferred to the electronic ENTRY sheet.
- c. Copy latitude and longitude information for the sample sites from the GPS text file and paste into the appropriate columns of the ENTRY sheet.
- d. Record the lake and county name, WBIC, survey date, and the names of the field workers.
- e. There is a column for comments on the ENTRY sheet. Please use the standardized comments discussed on page 18 of this protocol.
- f. Species' Latin names appear alphabetically in the first row of the spreadsheet. Species such as aquatic moss, freshwater sponge, filamentous algae, and liverworts are listed separately at the end of the alphabetical list.
- g. Additional species not already listed should be added in the columns at the end of the alphabetical list (sp1, sp2, etc.). Any vouchered specimens that are awaiting ID confirmation should be entered here as well. You should use the same unique voucher identifier established in the field to for ease of updating the information.

- h. We strongly recommend double-checking the electronically entered data against the original field datasheets to ensure that no errors or omissions occurred during the entry process.

#### 4. BOAT SURVEY

- a. Enter information on plants observed during the survey that were observed more than 6 feet away from a sample site.
- b. Additional comments about field conditions, known management activities, or other observations can also be recorded in this worksheet.

#### 5. STATS

The STATS worksheet automatically calculates summary statistics using the data entered into the ENTRY worksheet (see Appendix 2, Table 1). There are several summary calculations including:

##### a. Individual Species Statistics:

- i. **Frequency of occurrence within vegetated areas (%):** Number of sites at which a species was observed divided by the total number of vegetated sites. Frequency of occurrence is sensitive to the number of sample sites included. Including non-vegetated sites will lower the frequency of occurrence.
- ii. **Frequency of occurrence at sites shallower than maximum depth of plants:** Number of sites a species was observed at divided by the total number of sites shallower than maximum depth of plants.
- iii. **Relative frequency (%):** This is a proportional value that reflects the degree to which an individual species contributes to the sum total of all species observations. The sum of the relative frequencies of all species is 100%. Relative frequency is not sensitive to whether all sampled sites, including non-vegetated sites, are included. Relative frequency does not take into account aquatic moss, freshwater sponges, filamentous algae, or liverworts.
- iv. **Relative frequency (squared):** This value is only part of a calculation and is not used directly.
- v. **Number of sites where a species was found:** This is the sum of the number of sites at which a species was recorded on the rake.
- vi. **Average rake fullness:** Mean rake fullness rating, ranges from 1-3.
- vii. **Number of visual sightings:** This is the total number of times a plant was seen within 6 feet of the boat, but not collected on the rake.
- viii. **Present (visual or collected):** Automatically fills in “present” if the species was observed at a sample site.

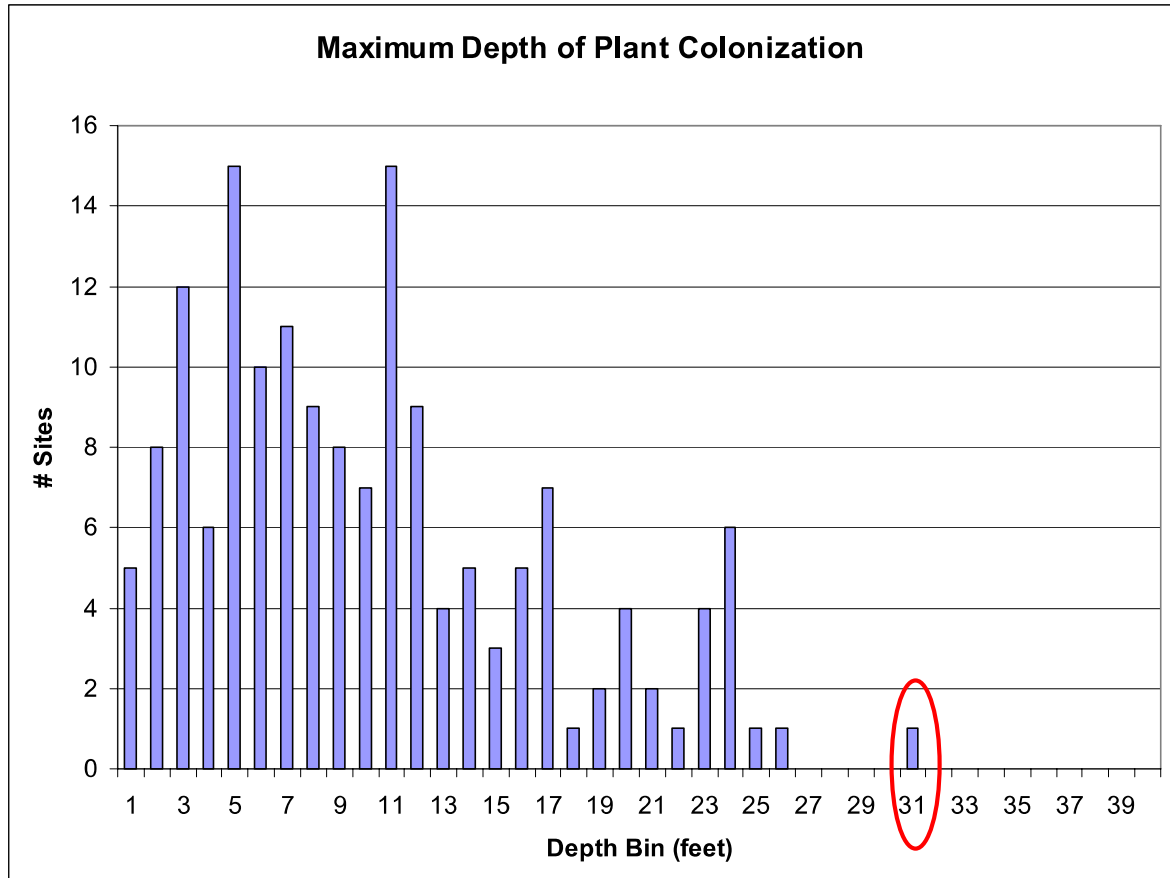
**b. Summary Statistics:**

- i. Total number of sites visited:** Total number of sites where depth was recorded, even if a rake sample was not taken.
- ii. Total number of sites with vegetation:** Total number of sites where at least one plant was found on the rake.
- iii. Total number of sites shallower than maximum depth of plants:** Total number of sites where the depth was less than or equal to the maximum depth at which plants were found. This value is used for frequency of occurrence at sites shallower than maximum depth of plants.
- iv. Frequency of occurrence at sites shallower than maximum depth of plants:** Number of times plants were recorded at a site divided by the total number of sites sampled that were shallower than the maximum depth of plants.
- v. Simpson's Diversity Index:** A nonparametric estimator of community heterogeneity. It is based on relative frequency and thus is not sensitive to whether all sampled sites (including non-vegetated sites) are included. The closer the Simpson Diversity Index is to 1, the more diverse the community.
- vi. The maximum depth of plants:** This is the depth of the deepest site sampled at which vegetation was present. Please note that this value does not take into account aquatic moss, freshwater sponges, filamentous algae, or liverworts. See "MAX DEPTH GRAPH" below for more information.
- vii. Number of sites sampled using rake on rope (R)**
- viii. Number of sites sampled using rake on pole (P)**
- ix. Average number of all species per site (shallower than max depth):** Mean number of species found at sample sites which were less than or equal to the maximum depth of plant colonization.
- x. Average number of species per site (vegetated sites only):** Mean number of species found at sample sites where vegetation was present.
- xi. Average number of native species per site (shallower than maximum depth):** This does not include Eurasian water milfoil, Curly-leaf pondweed, Purple loosestrife, Spiny naiad, or Reed canary grass.
- xii. Average number of native species per site (vegetated sites only)**
- xiii. Species richness:** Total number of species observed not including visual sightings. Please note that this value does not include aquatic moss, freshwater sponges, filamentous algae, or liverworts.
- xiv. Species richness (including visuals):** Total number of species observed including visual sightings recorded within 6 feet of the sample site (but does not include additional species found during the boat survey).

**6. MAX DEPTH GRAPH**

The maximum depth of colonization is an important metric to characterize accurately, as it can indicate changes in water clarity and water quality over time. This worksheet automatically displays a histogram of plant occurrences by water depth. Occasionally, unrooted plants floating in the water column are snagged by the rake, which can sometimes result in an inaccurate estimation of the maximum depth of colonization. It is

important to examine the reported maximum depth of plant colonization in order to detect potential outliers. As a general rule, a single plant occurrence reported at a site which is 2 or more feet deeper than the next shallowest site with plants is considered an outlier, and should be excluded when determining the maximum depth of plant colonization (see Figure 4).



**Figure 4: Distribution of plant occurrences versus water column depth. The value circled in red is more than 2 feet deeper than all other plants found during the survey, and is considered an outlier. Outliers should be omitted when determining the maximum depth of plant colonization.**

It is necessary to delete the occurrence of this outlier from the ENTRY spreadsheet so that the automatically-calculated statistics will reflect the revised maximum depth of colonization. To do this, locate the sampling point number on the ENTRY worksheet where the outlier was found. Scroll across the row until you find the outlier to omit. Once you've located the cell with the outlier, press delete to clear the cell. Right click on the cell and select "Insert Comment". Briefly describe the occurrence of the outlier and the reason for omitting it. Follow the same steps with the overall rake fullness column, deleting out the contents of the cell and including a brief comment. Please also include information regarding any omissions of outliers and revised MDC directly on the STATS spreadsheet, typing all comments in the space below "See Max Depth Graph Worksheet to Confirm".

[illegible]

**Figure 5: *Top* - Ceratophyllum demersum outlier at 31 feet (sampling point #118). *Bottom* - C. demersum outlier at 31 feet deleted from both C. demersum and total rake fullness columns. Brief descriptive comments should be inserted in cells where outliers have been deleted.**

## 7. CALCULATE FQI

This worksheet automatically calculates the Floristic Quality Index (FQI) based upon the data entered into the ENTRY worksheet. The FQI metric is designed to evaluate the closeness of the flora in an area to that of undisturbed conditions<sup>6</sup>. The species list considered in this calculation is that which Nichols<sup>6</sup> originally considered, and the “C values” used in this spreadsheet reflect those currently accepted by the Wisconsin State Herbarium<sup>7</sup>. Species are counted as being present only if they are collected on the rake at some point during the baseline survey.

## 8. ARCGIS TEMPLATE

This worksheet of truncated species names is used when creating plant distribution maps using ArcGIS 9.3. See Appendix 3 for more information.

<sup>6</sup> Nichols, S.A. 1999. Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications. *Journal of Lake and Reservoir Management*, 15(2):133-141.

University of Wisconsin-Madison, 2001. Wisconsin Floristic Quality Assessment (WFQA). Retrieved October 27, 2009 from: <http://www.botany.wisc.edu/WFOA.asp>

## **Saving the File**

Once the data is electronically entered into the Aquatic Plant Survey Data Workbook (<http://www.uwsp.edu/cnr/uwexplakes/ecology/APM/Appendix-C.xls>), please save the file with a name indicating the lake, county, WBIC, and year sampled. The format we recommend is: Lake\_County\_WBIC\_(year).xls. For example, Lake Mendota sampled in 2009 would be named: Mendota\_Dane\_805400\_(2009).xls

## **Double-Checking the Data**

We strongly recommend double-checking the electronic data against the field sheet to catch any errors made during the entry process.

## **Sending the Data**

Send the final electronic file to the WDNR via email ([DNRBaselineAquaticPlants@wisconsin.gov](mailto:DNRBaselineAquaticPlants@wisconsin.gov)). There should be one file for each completed lake survey.

## **Creation of Plant Distribution Maps**

Aquatic plant distribution maps can be easily created using the point-intercept data collected during the survey. Instructions on how to create these maps can be found in Appendix 3 and 4.

## **Statistical Analysis of Data**

Statistical comparisons of datasets can easily be analyzed between pre- and post-management activities or between two survey years by using a simple chi-square analysis. The chi-square analysis is commonly used to examine whether or not there was a statistically significant change in the occurrence of a plant species between the survey years or after management activities have occurred. The “Compute Pre-Post Data” worksheet (available at: <http://www.uwsp.edu/cnr/uwexplakes/ecology/APM/Appendix-D1.xls>), allows users to enter in the number of sites at which a species was recorded during each survey, and provides an output indicating whether or not differences reflect a statistically significant change in the plant community.

## **PRESSING PLANTS – PREPARATION OF VOUCHER SPECIMENS**

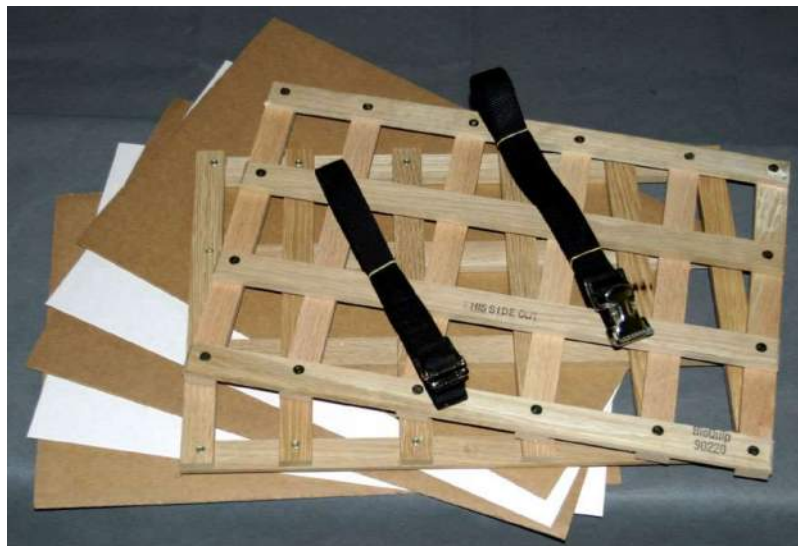
### **“Floating” Specimens**

Because most aquatic plants, especially finely dissected specimens, tend to stick to paper as they dry, it is usually better to “float” the plant directly onto herbarium paper. However, if the plant is large and robust, or not entirely aquatic (such as bulrushes, emergent sedges or pickerelweed) you can press the plant in newsprint.

1. Use a pencil to label the mounting paper with the plant name, geographic location, date collected, and serial code (a unique identifier in a series that identifies all specimens you have pressed; we use the initials of the presser followed by the year and a sequential number; i.e. AM2009-01). Mount only one species per sheet, and do not cut herbarium sheets in half.
2. Carefully rinse the plant so it is free of epiphyton, silt, and other debris.
3. Fill a sink or tray with about one inch of water. Slip the labeled mounting paper into the water.
4. Float the plant in the water and arrange it onto the sheet.
5. If the plant has fine leaflets, such as water milfoil or bladderwort, cut off one leaf and display it floated out onto the paper so that leaflet characteristics can be readily observed.
6. The plant may be bent into a “V” or “W” or curled shape to fit on the sheet.
7. Slowly lift the paper out of the water by one end. Keeping the plant in place, let the water slowly drain off.
8. Use a toothpick or probe to spread out plant parts for better display, making sure to expose identifiable characteristics such as stipules, sheaths or seeds.

### Pressing Specimens

- Cover the plant with a sheet of waxed paper or plastic wrap if it is especially delicate (we recommend this technique especially for bladderworts and other fine, delicate species).
- Place the specimen sheet inside folds of newspaper.
- Place the newspaper between two sheets of blotting paper, and the blotting paper between two sheets of corrugated cardboard.
- Place multiple specimens in a plant press. Use rope or straps to compress plants to keep specimens flat as they dry.
- Place the press somewhere warm and dry. Placing the press on its long edge on top of a ventilated aluminum or aluminum-lined box containing incandescent light bulbs allows for quick drying. Remove plants after several days when they are thoroughly dry.



## Suggested Herbarium Materials

Herbarium and science supply businesses such as the Herbarium Supply Company ([www.herbariumsupply.com](http://www.herbariumsupply.com); 800-348-2338) sell many herbarium products including mounting paper, plant presses, blotting paper, and cardboard spacers. When ordering herbarium mounting paper, look for acid-free, non-glossy, 100% rag, and heavy or standard weights.

## Preparing Dried Specimens for Shipment to an Herbarium

1. **Package specimens.** Place each dried specimen with unique identifier clearly marked on the newsprint or mounting paper in the fold of a single sheet of newspaper and place all of the newspaper/specimens between two pieces of cardboard. Tie or rubber band the cardboard bundle together, and put it into a padded envelope or a box. As long as the package is going to or from an educational institution, a special 4<sup>th</sup> class mailing rate called “Library Rate” can be used.
2. **Label information.** Both of the herbaria utilized by the WDNR label the dried plant specimens themselves. Prepare an electronic spreadsheet with the relevant information for each specimen. Send the file to Mark Wetter ([mawetter@wisc.edu](mailto:mawetter@wisc.edu)) for the Madison herbarium or to Robert Freckmann ([rfreckma@uwsp.edu](mailto:rfreckma@uwsp.edu)) for the Stevens Point herbarium. Each row (i.e. each specimen) in the file will need a unique identifier such as the collector’s initials followed by a specimen number. Use the same identifier on the specimen so the herbaria can match the label to the specimen. Each row of the spreadsheet should include columns for the following (column heading in **bold**, example in plain text):
  - a. **Specimen Identifier** CD2009-01
  - b. **Collector Name** Isabel Velez
  - c. **Preparer's Name** (If different from collector) Chad Douwe
  - d. **Lake Name** Little John Jr.
  - e. **County** Vilas
  - f. **Date collected** 7 July 2009
  - g. **Specimen ID** *Potamogeton spirillus*, Spiral-fruited pondweed
  - h. **Habitat** muck over sand
  - i. **Associated species (if known)** *Najas gracillima*, *Potamogeton friesii*
  - j. **TRS** T41N R07E S29
  - k. **WBIC** 1861700
  - l. **More detailed location** (if known) SW edge of lake, 1 m depth
  - m. **GPS lat/long coordinates** (if known) N 46°15.037' W090°01.804'
  - n. **Herbarium of deposition** UWSP
3. **Send pressed plants** to Mark Wetter or Ted Cochrane (UW- Madison), or to Dr. Robert Freckmann (UW-Stevens Point). **Please notify the herbarium of your intention and wait for confirmation before sending plants:**

Mark Wetter or Ted Cochrane  
University of Wisconsin-Madison Herbarium  
Department of Botany, Birge Hall  
430 Lincoln Drive  
Madison, WI 53706-1381  
tel.: (608) 262-2792  
FAX: (608) 262-7509  
[www.botany.wisc.edu/herbarium/](http://www.botany.wisc.edu/herbarium/)

Dr. Robert Freckmann  
Robert Freckmann Herbarium  
0310 CNR Addition  
1900 Franklin Street  
Stevens Point, WI 54481  
[rfreckma@uwsp.edu](mailto:rfreckma@uwsp.edu)

4. **Send electronic record to the WDNR.** Please send a copy of the electronic herbarium file along with the plant data to [DNRBaselineAquaticPlants@wisconsin.gov](mailto:DNRBaselineAquaticPlants@wisconsin.gov).

## CONCLUSIONS

There will be four products from each plant survey. First, there will be the raw data from the quantitative survey which provides a lakewide plant species list and distribution and rake fullness data for each species observed. Second, there will be summary statistics useful in characterizing and comparing populations. Third, there will be observations from the general boat survey. Fourth, voucher specimens will provide a catalog of plant species present in the lake and will bolster the state collections. All electronic data should be sent by email to the WDNR ([DNRBaselineAquaticPlants@wisconsin.gov](mailto:DNRBaselineAquaticPlants@wisconsin.gov)).

## ACKNOWLEDGEMENTS

We would like to extend our sincere thanks to the WDNR Lake Coordinators and Aquatic Plant Management staff for recommendations and comments in the design, implementation, and applications of the data and the survey methodology. The many hours the field staff put into testing this methodology was integral to its successful development, and we are very grateful for all of their hard work.

**Appendix 1**

Current (02/2010) contact information for regional WDNR aquatic plant management (APM) and lake coordinators

**Northern Region (NOR)**

(Ashland, Barron, Bayfield, Burnett, Douglas, Florence, Forest, Iron, Langlade, Lincoln, Oneida, Polk, Price, Rusk, Sawyer, Taylor, Vilas, & Washburn Co.)

**Frank Koshere**

APM Coordinator  
715-392-0807  
frank.koshere@wisconsin.gov

**Kevin Gauthier, Sr.**

Florence, Forest, Langlade, Lincoln, Oneida, & Vilas Co.  
715-365-8937  
kevin.gauthiersr@wisconsin.gov

**Pamela Toshner**

Barron, Bayfield, Burnett, Douglas, Polk, & Washburn Co.  
715-635-4073  
pamela.toshner@wisconsin.gov

**Jim Kreitlow**

Ashland, Iron, Price, Rusk, Sawyer, & Taylor Co.  
715-365-8947  
james.kreitlow@wisconsin.gov

**Southeast Region (SER)**

(Kenosha, Milwaukee, Ozaukee, Racine, Sheboygan, Walworth, Washington, & Waukesha Co.)

**Heidi Bunk**

: Ozaukee, Sheboygan, Walworth, Washington, & Waukesha Co.  
262-574-2130  
heidi.bunk@wisconsin.gov

**Craig Helker**

Kenosha, Milwaukee, & Racine Co.  
262-884-2357  
craig.helker@wisconsin.gov

**South Central Region (SCR)**

(Columbia, Dane, Dodge, Green, Grant, Iowa, Jefferson, Lafayette, Richland, Rock, & Sauk Co.)

**Susan Graham**

Lake & APM Coordinator  
608-275-3329  
susan.graham@wisconsin.gov

**Northeast Region (NER)**

(Brown, Calumet, Door, Fond du Lac, Green Lake, Kewaunee, Manitowoc, Marinette, Marquette, Menominee, Oconto, Outagamie, Shawano, Waupaca, Waushara, & Winnebago Co.)

**Mary Gansberg**

Kewaunee, Door, Manitowoc, & Menominee Co.  
920-662-5489  
mary.gansberg@wisconsin.gov

**Ted Johnson**

Green Lake, Marquette, Waupaca, & Waushara  
920-787-4686 ext. 3017  
tedm.johnson@wisconsin.gov

**Mark Sesing**

Fond du Lac, Outagamie, & Winnebago Co.  
920-485-3023  
mark.sesing@wisconsin.gov

**Jim Reyburn**

Brown, Oconto, & Shawano Co.  
920-662-5465  
james.reyburn@wisconsin.gov

**Greg Sevener**

Marinette Co.  
715-582-5013  
gregory.sevener@wisconsin.gov

**West Central Region (WCR)**

(Adams, Buffalo, Chippewa, Clark, Crawford, Dunn, Eau Claire, Jackson, Juneau, La Crosse, Marathon, Monroe, Pepin, Pierce, Polk, Portage, St. Croix, Trempealeau, Vernon, & Wood Co.)

**Scott Provost**

APM Coordinator  
715-421-7881 ext. 3017  
scott.provost@wisconsin.gov

**Buzz Sorge**

Lake Coordinator  
715-839-3794  
patrick.sorge@wisconsin.gov

## Appendix 2

This appendix contains examples of statistical outputs created through the point-intercept sampling method for Kathlan Lake, Oneida County. The data was collected during a survey conducted August 21-22, 2007.

**Table 1. Summary Statistics**

<b>Total number of sites set-up</b>	<b>203</b>
<b>Total number of sites visited</b>	<b>171</b>
<b>Total number of sites with vegetation</b>	<b>149</b>
<b>Total number of sites shallower than maximum depth of plants</b>	<b>165</b>
<b>Frequency of occurrence at sites shallower than maximum depth of plants</b>	<b>90.30</b>
<b>Simpson Diversity Index</b>	<b>0.94</b>
<b>Maximum depth of plants (ft)</b>	<b>9.50</b>
<b>Number of sites sampled using rake on Rope (R)</b>	<b>0</b>
<b>Number of sites sampled using rake on Pole (P)</b>	<b>171</b>
<b>Average number of all species per site (shallower than max depth)</b>	<b>3.96</b>
<b>Average number of all species per site (veg. sites only)</b>	<b>4.39</b>
<b>Average number of native species per site (shallower than max depth)</b>	<b>3.56</b>
<b>Average number of native species per site (veg. sites only)</b>	<b>3.95</b>
<b>Species Richness</b>	<b>37</b>
<b>Species Richness (including visuals)</b>	<b>38</b>
<b>Species Richness (including visuals &amp; boat survey)</b>	<b>40</b>

Table 2. Individual species frequency of occurrences

Common Name	Scientific Name	% Frequency (Littoral)	% Frequency (Whole lake)	% Frequency (in vegetated areas)	Relative Frequency (%)
Bushy pondweed	<i>Najas flexilis</i>	41.2	39.8	45.6	10.4
Common waterweed	<i>Elodea canadensis</i>	40.6	39.2	45.0	10.2
Eurasian water milfoil*	<i>Myriophyllum spicatum</i> *	40.0	38.6	44.3	10.1
Filamentous algae	<i>Algae</i> spp.	26.1	25.1	28.9	6.6
Coontail	<i>Ceratophyllum demersum</i>	23.0	22.2	25.5	5.8
Stoneworts	<i>Nitella</i> spp.	21.8	21.1	24.2	5.5
Watershield	<i>Brasenia schreberi</i>	20.6	19.9	22.8	5.2
Small bladderwort	<i>Utricularia minor</i>	17.6	17.0	19.5	4.4
Small pondweed	<i>Potamogeton pusillus</i>	17.0	16.4	18.8	4.3
Common bladderwort	<i>Utricularia vulgaris</i>	16.4	15.8	18.1	4.1
Wild celery	<i>Vallisneria spiralis</i>	15.2	14.6	16.8	3.8
Flat stem pondweed	<i>Potamogeton zosterifolius</i>	13.9	13.5	15.4	3.5
Stiff pondweed	<i>Potamogeton strictifolius</i>	11.5	11.1	12.8	2.9
Ribbon leaf pondweed	<i>Potamogeton epihydrus</i>	9.1	8.8	10.1	2.3
White water lily	<i>Nymphaea odorata</i>	7.9	7.6	8.7	2.0
Muskgrasses	<i>Chara</i> spp.	7.3	7.0	8.1	1.8
Freshwater sponge	Sponge spp.	6.1	5.8	6.7	1.5
Moss	Moss spp.	6.1	5.8	6.7	1.5
Large-leaf pondweed	<i>Potamogeton amplifolius</i>	5.5	5.3	6.0	1.4
Spiny-spored quillwort	<i>Isoetes echinospora</i>	4.9	4.7	5.4	1.2
Waterwort	<i>Elatine minima</i>	4.2	4.1	4.7	1.1
Creeping spikerush	<i>Eleocharis palustris</i>	4.2	4.1	4.7	1.1
Water horsetail	<i>Equisetum fluviatile</i>	4.2	4.1	4.7	1.1
Northern water milfoil	<i>Myriophyllum sibiricum</i>	4.2	4.1	4.7	1.1
Thin floating-leaf bur-reed	<i>Sparganium</i> sp.	4.2	4.1	4.7	1.1
Spatterdock	<i>Najas flexilis</i>	3.6	3.5	4.0	0.9
Spiral-fruited pondweed	<i>Potamogeton spirillus</i>	3.6	3.5	4.0	0.9
American bur-reed	<i>Sparganium americanum</i>	3.6	3.5	4.0	0.9
Shoreweed	<i>Littorella uniflora</i>	3.0	2.9	3.4	0.8
Brown-fruited rush	<i>Juncus pelocarpus</i> f. <i>submersus</i>	2.4	2.3	2.7	0.6
Variable pondweed	<i>Potamogeton gramineus</i>	2.4	2.3	2.7	0.6
Twin-stemmed bladderwort	<i>Utricularia geminiscapa</i>	1.8	1.8	2.0	0.5
Pipewort	<i>Eriocaulon aquaticum</i>	0.6	0.6	0.7	0.2
Clasping leaf pondweed	<i>Potamogeton richardsonii</i>	0.6	0.6	0.7	0.2
Broad-leaved arrowhead	<i>Sagittaria latifolia</i>	0.6	0.6	0.7	0.2
Thin-leaved pondweed	<i>Potamogeton</i> sp.	0.6	0.6	0.7	0.2
Flat-leaved bladderwort	<i>Utricularia intermedia</i>	0.6	0.6	0.7	0.2
Cattail	<i>Typha</i> sp.	Visual	Visual	Visual	Visual
Needle spikerush	<i>Eleocharis acicularis</i>	Boat Survey	Boat Survey	Boat Survey	Boat Survey
Three-way sedge	<i>Dulichium arundinaceum</i>	Boat Survey	Boat Survey	Boat Survey	Boat Survey

Table 3. Number of sites where species was found and average rake fullness rating

Common Name	Scientific Name	# sites where species was found	# sites where species was found (including visuals)	Average rake fullness rating
Bushy pondweed	<i>Najas flexilis</i>	68	68	1.28
Common waterweed	<i>Elodea canadensis</i>	67	67	1.28
Eurasian water milfoil*	<i>Myriophyllum spicatum</i> *	66	71	1.47
Filamentous algae	<i>Algae</i> spp.	43	43	1.00
Coontail	<i>Ceratophyllum demersum</i>	38	38	1.37
Stoneworts	<i>Nitella</i> spp.	36	36	1.00
Watershield	<i>Brasenia schreberi</i>	34	58	1.68
Small bladderwort	<i>Utricularia minor</i>	29	29	1.10
Small pondweed	<i>Potamogeton pusillus</i>	28	28	1.14
Common bladderwort	<i>Utricularia vulgaris</i>	27	27	1.30
Wild celery	<i>Vallisneria spiralis</i>	25	26	1.36
Flat stem pondweed	<i>Potamogeton zosterifolius</i>	23	25	1.22
Stiff pondweed	<i>Potamogeton strictifolius</i>	19	19	1.16
Ribbon leaf pondweed	<i>Potamogeton ephedrus</i>	15	18	1.27
White water lily	<i>Nymphaea odorata</i>	13	42	1.69
Muskgrasses	<i>Chara</i> spp.	12	12	1.25
Freshwater sponge	Sponge spp.	10	11	1.00
Moss	Moss spp.	10	10	1.20
Large-leaf pondweed	<i>Potamogeton amplifolius</i>	9	10	1.33
Spiny-spored quillwort	<i>Isoetes echinospora</i>	8	11	1.00
Waterwort	<i>Elatine minima</i>	7	8	1.00
Creeping spikerush	<i>Eleocharis palustris</i>	7	9	1.14
Water horsetail	<i>Equisetum fluviatile</i>	7	15	1.43
Northern water milfoil	<i>Myriophyllum sibiricum</i>	7	7	1.00
Thin floating-leaf bur-reed	<i>Sparganium</i> sp.	7	7	1.00
Spatterdock	<i>Nuphar variegata</i>	6	22	1.17
Spiral-fruited pondweed	<i>Potamogeton spirillus</i>	6	6	1.00
American bur-reed	<i>Sparganium americanum</i>	6	11	1.50
Shoreweed	<i>Littorella uniflora</i>	5	5	1.00
Brown-fruited rush	<i>Juncus pelocarpus</i> f. <i>submersus</i>	4	5	1.25
Variable pondweed	<i>Potamogeton gramineus</i>	4	5	1.00
Twin-stemmed bladderwort	<i>Utricularia geminiscapa</i>	3	3	1.00
Pipewort	<i>Eriocaulon aquaticum</i>	1	2	1.00
Clasping leaf pondweed	<i>Potamogeton richardsonii</i>	1	1	2.00
Broad-leaved arrowhead	<i>Sagittaria latifolia</i>	1	1	1.00
Thin-leaved pondweed	<i>Potamogeton</i> sp.	1	1	1.00
Flat-leaved bladderwort	<i>Utricularia intermedia</i>	1	1	1.00
Cattail	<i>Typha</i> sp.	Visual	3	n/a
Needle spikerush	<i>Eleocharis acicularis</i>	Boat Survey	Boat Survey	n/a
Three-way sedge	<i>Dulichium arundinaceum</i>	Boat Survey	Boat Survey	n/a

### Appendix 3

#### Creating a Plant Distribution Map Using Point Intercept Data in ArcGIS 9.3

This is a protocol for making a plant distribution map using ArcGIS 9.3 and the Excel (2003 version) file of data from the point intercept (PI) survey. This protocol can be changed in a number of different ways and still produce a similar product. The best way to make PI-based maps depends on the particular dataset; however, this procedure works well in most cases. Similar images may be created in PowerPoint or in photo editing software if the dataset is not large or complex.

1. After entering the PI survey data into the Aquatic Plant Survey Data Workbook (Appendix-C.xls), save the file using a unique name. We recommend the convention: Lake\_County\_WBIC\_(YYYY).xls
2. Prepare <Lake\_County\_WBIC\_(YYYY).xls> For Join
  - a. Open file in Excel
  - b. **File → Save As → Lake\_County\_WBIC\_(YYYY)\_JOIN.xls (DO NOT MODIFY ORIGINAL FILE)**
  - c. Delete all worksheets except for ENTRY and ARCGIS TEMPLATE (make sure to scroll left and delete the README sheet)
    - i. Click on worksheet tab; Edit → Delete Sheet → Delete
  - d. Delete the following columns
    - i. Entry columns (A & I) and calculated columns (B-H)
      1. Columns B-H are normally hidden. To “unhide” them, cursor over the column heading (A) at the top of the sheet and click/drag to highlight it and the adjacent column (I). Right click the highlighted region, then select unhide. Columns B-H are colored blue. Now delete all columns A-I.
    - ii. Latitude, Longitude columns (possibly hidden, located between sampling point and depth columns)
    - iii. Replace first row of ENTRY with ARCGIS TEMPLATE
      1. Copy the entire first row of truncated species names from the ARCGIS TEMPLATE worksheet
      2. Highlight the first row on the ENTRY worksheet and replace with the template (Edit → Paste)
    - iv. Species columns with no data
      1. Add a count row to identify empty columns to delete
        - a. Select all cells and remove any validation
          - i. Select All (Ctrl-A)
          - ii. Data → Validation → OK → Allow Any Value → OK
        - b. In the row below the last sampled point, and in the first column under a plant species, enter the formula =counta(
        - c. Then highlight the column up to the first sampling point. The beginning of this procedure is depicted below.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	sample_pt	depth_ft	sediment	rake_tool	comments	furbess	EVM	CLP	Acornus_americanus	Alisma_trifoliate	Elodea_nuttallii	Bob_gibbifolia	Brasenia_schreberiana	Caula_pos
1														
402	401	4 M	P			1								
403	402	4 M	P			1								
404	403	3 M	P											
405	404				TERRESTRIAL									
406	405				TERRESTRIAL									
407	406	1 M	P											
408	407	2.5 M	P			1								
409	408	2.5 M	P											
410	409						=counta(G2:G409)							
411	410						COUNTA(value1, [value2], ...)							
412	411													


- d. Finally, add a closing ) and hit enter. The final formula will be similar to this: =counta(G2:G500)
- e. Point the cursor over the bottom right corner of the cell until cursor turns into a "+". Click/Drag this formula all the way across to the end of the species list.
- f. Delete any columns where the sum row is equal to 0
- g. Then delete the sum row
- e. Delete any rows after the last applicable sample point
  - i. The "sample\_pt" column is usually populated up to 4000 points; delete any rows where the sampling point column is numbered, but these sample points are greater than the number of points set-up in the lakewide grid, and therefore the row doesn't contain any information.
- f. Add a "dummy" row so all data imports into ArcGIS as "text"
  - i. Add a row directly above the first sampled point
  - ii. In this newly created row, under the Sampling Point column, enter the number equal to the total number of sample points plus 1 (i.e. total sampling points in example image is 187. The number 188 would be entered into the "dummy" row under the sampling point)
- g. Enter "Z" in all other cells in all columns that contain any information

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	sample_pt	depth_ft	sediment	rake_tool	comments	furbess	EVM	CLP	Acornus_americanus	Alisma_trifoliate	Elodea_nuttallii	Bob_gibbifolia	Brasenia_schreberiana	Caula_pos
1														
2	188	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
3	1	0.25 M	P											
4	2				SHALLOW									

- h. Save the file and close Excel
3. Save the lake specific polygon and point shapefiles to a folder on a local drive
  - a. We'll refer to this folder as "MapFolder"
4. Open ArcMap
  - a. Select to Start using ArcMap with "a new empty map" and click "OK"

## 5. Add Data (either method “a” or “b”)

### a. Using Add Data Button

- i. Select the “Add Data” button; or File → Add Data 
- ii. Navigate to MapFolder
- iii. Highlight both the lake polygon (lake\_county\_WBIC\_poly.shp) and point (lake\_county\_WBIC\_XXmpts.shp) shapefiles
- iv. Click on ‘Add’

### b. Directly from ArcCatalog

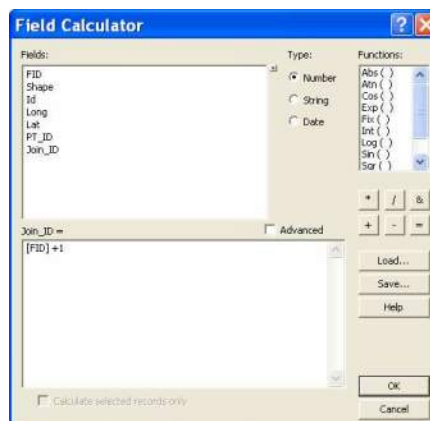
- i. Situate ArcMap and ArcCatalog windows so that you can see both
- ii. Navigate to MapFolder in ArcCatalog
- iii. Highlight both the lake polygon (lake\_county\_WBIC\_poly) and point (lake\_county\_WBIC\_XXmpts) shapefiles
- iv. Drag and drop these shapefiles into ArcMap
- v. Note: Shapefiles should only be saved, deleted, moved, etc. in ArcCatalog. Using Windows Explorer with shapefiles can result in accidental deletion of individual shapefile files (i.e. \*.shp, \*.dbf, \*.sbn, \*.shx, \*.sbx, and \*.sbn files must all be stored together. ArcCatalog packages these files together so nothing gets lost)

## 6. Defining Shapefile Projections

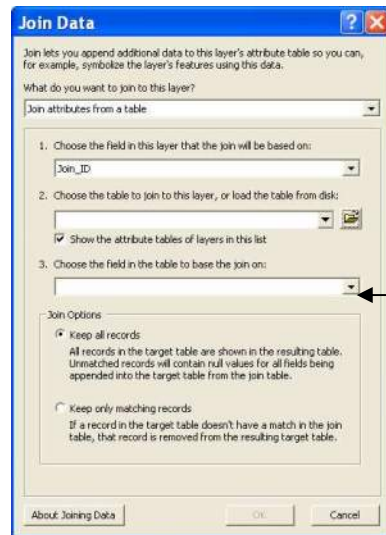
### a. If after adding in your shapefiles a warning message regarding “Unknown Spatial Reference” appears, the shapefiles coordinate system is not defined

- i. To define and verify projection, please contact [DNRBaselineAquaticPlants@wisconsin.gov](mailto:DNRBaselineAquaticPlants@wisconsin.gov)
- ii. Alternatively, the shapefile projection can be defined manually by using the Define Projection Tool located in ArcToolbox
  1. ArcToolbox → Data Management Tools → Projections and Transformations → Define Projection
  2. Input Dataset or Feature Class
    - a. Select the shapefile that needs a defined projection
  3. Click on the browse button (right side of dialog box)
  4. In the Spatial Reference Properties dialog box, click on the “Select” button
  5. Browse for the correct coordinate system
    - a. Projected Coordinate System → State Systems → NAD 1983 HARN Wisconsin TM.prj; Click Add.
      - i. Do not use the US Feet system
      - ii. The coordinate system name may also be displayed as NAD 1983 HARN Transverse Mercator
    - iii. Coordinate system parameters:
      1. Projection → Transverse Mercator
      - False Easting → 520000.00000000
      - False Northing → -4480000.000000
      - Central Meridian → -90.00000000
      - Linear Unit → Meter

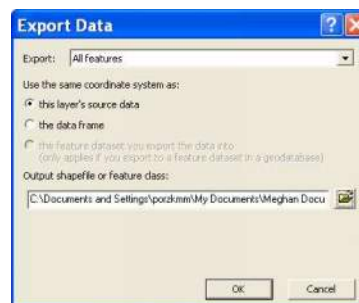
6. Select “OK” on Spatial Reference Properties dialog box, and “OK” on define projection tool
7. Edit Attribute Table for point shapefile
  - a. Open Attribute Table
    - i. Right click on point shapefile in ArcMap table of contents
    - ii. Select “Open Attribute Table”
  - b. Add a Field
    - i. Select the “Options” button → “Add Field”
    - ii. Name: Join\_ID
    - iii. Type: Double
    - iv. Precision: 10
    - v. Scale: 3
  - c. Populate Join\_ID Column
    - i. Right click on “Join\_ID” column heading
    - ii. Select “Field Calculator”
    - iii. If Field Calculator warning message pops up, click “Yes”
    - iv. Set expression by double-clicking FID in the “Fields:” box and typing +1. The white box under “Join\_ID =” should now read **[FID] +1**
    - v. Click “OK”
    - vi. Your Join\_ID column should now be populated in sequential order, starting with point #1 at the top
    - vii. Close the attribute table
    - viii. Note: This expression is assuming that each unique ID was based off of the calculation [FID] +1 when creating the initial point file. If the unique ID’s were not created in sequential order based on the FID field, then calculate Join\_ID field accordingly (example: Truncate a unique ID such as ‘Como001’ so that it just reads ‘001’ in the Join\_ID field.)
8. Join shapefile to <Lake\_County\_WBIC\_(YYYY)\_JOIN.xls>
  - a. Right click on point shapefile in ArcMap table of contents
  - b. Select Joins and Relates → Join...
  - c. Set the following options:
    - i. Join Attributes from a table
    - ii. Join will be based on “Join\_ID”
    - iii. Choose the table to join to this layer
      1. Click on Window Folder (See arrow)



2. Navigate to and double-click on the Excel file saved in step 2
3. Double-click on the 'ENTRY \$' sheet
4. Click "Add"
- iv. Base the join on "sample\_pt"
- v. Join Options: Keep All Records (If using ArcGIS 9.2, these options can be viewed by clicking the "Advanced" button)
- vi. Click "OK"
- vii. If prompted to create index, select "Yes"



9. Export joined shapefile to make it permanent
  - a. Right click on joined point shapefile in ArcMap table of contents
  - b. Select Data → Export Data
  - c. Set the following options:
    - i. Export: All Features
    - ii. Use the same coordinate system as: this layer's source data
    - iii. Output shapefile or feature class: Save in MapFolder as **Lake\_County\_WBIC\_XXpts\_YEAR\_JOIN.shp**
  - d. Click "OK"
  - e. When asked if you want to add the exported data to the map as a layer, select "Yes"
    - i. This final joined shapefile will now be referred to as "Joined Point Shapefile"
  - f. Remove the Join from the original point shapefile
    - i. Right click on point shapefile in ArcMap table of contents
    - ii. Select Joins and Relates → Remove Join(s) → Remove All Joins
  - g. In the table of contents, uncheck or remove the original point shapefile that was used to create the Joined Point Shapefile.

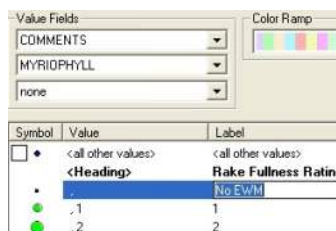


## 10. Check Join Results

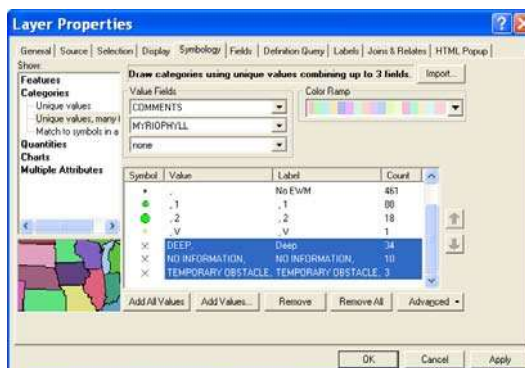
- a. Right click on the Joined Point Shapefile in the table of contents
- b. Select "Open Attribute Table"
- c. Verify that Join was successful
  - i. All data present in Excel file should now be located in the Joined Point Shapefile attribute table, and the Join\_ID and Sample\_Pt columns will be identical

## 11. Display Plant Distribution Data

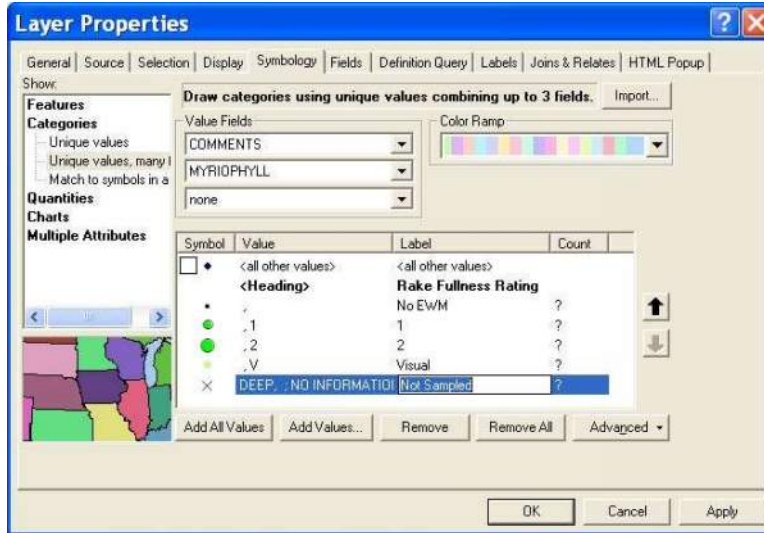
- a. Right click on the Joined Point Shapefile in the table of contents
- b. Select “Properties”
- c. Select “Symbology” tab
- d. On left side of dialog box under “Show:”, select “Categories – Unique Values, Many Fields”
- e. Value Fields should be “Comments”. Be sure to select the appropriate Comments field, as there may be two that appear similar.
- f. You will then choose additional Value Fields to display species information (i.e. If you want to display both EWM and CLP species information, then both EWM and CLP need to be chosen as Value Fields)
- g. Select “Add All Values”
  - i. All possible values are now displayed, separated by a comma. Each position indicates the unique values for each Value Field you designated in steps e & f, in the order entered. That is, if you selected ‘comments’, ‘EWM’, and ‘CLP’ as your value fields, the first value might read: ‘ , , ‘ indicating points that were sampled, but had neither a comment, EWM, nor CLP present. The next value might read ‘ , ,1’, which includes points with no comments, no EWM, and fullness rating of 1 for CLP.
  - ii. Points with information for the ‘comments’ value field were likely not sampled; the comment listed should clarify how to work with these points.
- h. Un-check <all other values> box
- i. Double-click on symbol next to each value to set symbology
  - i. You must now choose appropriate symbols and colors for the different variables being expressed.
  - ii. Typically we use increasing sizes of a green circle for EWM density ratings (values: 1, 2, 3), a small light green circle for visuals (V), a small black dot for sites sampled that had no relevant plant data, and a small “x” symbol for all sites not sampled
- j. You can change the label name of the symbol being represented by clicking on the respective space under “Label”. (e.g. change “ , , ” to “No EWM”; “ , ,1” to “1”; “ , V” to “Visual”; “Deep, ” to “Not Sampled”)



- k. You can also group values together (e.g. No Information, Deep, Shallow, etc)
  - i. Hold down the Shift key and highlight all rows that should be grouped



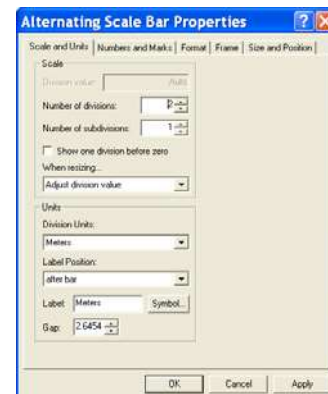
- ii. Right click on highlighted rows and select “Group Values”
- iii. The final Layer Properties dialog box should look similar to this: Note: If you want to change the order that these will appear in the legend, highlight a row and use the arrows on the right side to move.
- iv. Click “Apply” then “OK” to update symbols on map



- v. The polygon shapefile fill color and outline may also be modified similarly under the “Symbology” tab

## 12. Map Page Layout

- a. Verify that the coordinate system is defined correctly for the Data Frame
  - i. Select View → Data Frame Properties → Coordinate System Tab
  - ii. If the coordinate system is incorrectly defined, browse for the correct coordinate system
    1. Predefined → Projected Coordinate System → State Systems → NAD 1983 HARN Wisconsin TM.prj
- b. View → Layout View
- c. File → Page and Print Setup → Select Landscape or Portrait
- d. Modify size/shape of data frame to fit on entire page and serve as map border
  - i. Right click data frame, select Properties, under the ‘Frame’ tab, change border to a thickness of 2 and select OK.
- e. Insert → North Arrow
- f. Insert → Scale Bar
  - i. Select “Alternating Scale Bar 1” and click “OK”
  - ii. Double-click on Scale Bar in Layout view to edit properties
  - iii. Set the following properties:
    1. Number of divisions: 2
    2. Number of subdivisions: 1
    3. Set units to kilometers



4. Click “OK”

g. Insert → Text

i. Double-click on Text Box to edit information

1. Create text box with the following information:
  - a. Lake Name, County, Date Sampled, etc.
2. Format text as appropriate using “Change Symbol...” button



h. Insert → Picture → Navigate to WDNR Logo (Black & White)

i. Size and position appropriately

i. Legend

i. In the table of contents, modify the displayed name of your shapefile as you would like it to appear in your legend by single clicking on the text

ii. Insert → Legend

iii. Choose which layers you want to include in your legend

1. Include the layer that has the plant distribution symbology information

2. You may have to remove the polygon layer by highlighting it under “Legend Items” and clicking the single left angle bracket (<), then select “Next”

iv. Remove the word “Legend” from the Legend Title and select “Next”

v. Continue selecting “Next” and then “Finish”

vi. Format legend text

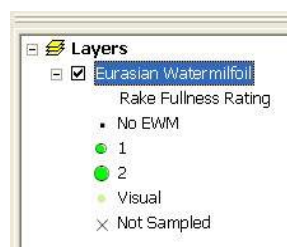
1. Right click on Legend and select “Properties”

vii. Size and position legend as appropriate

j. If you’re going to be switching between maps quickly to look at comparisons between years or species, we suggest making and refining the layout first, then saving it as an ArcMap Template so you can use the same one each time

i. File → Save As → Save As Type: ArcMap Template

k. Check printed map for color accuracy before you export (Step 13). Sometimes the colors may look different on screen, but may print with the same hue and value, making interpretation impossible. You can set a custom color if necessary.



### 13. Saving Map as JPEG

a. File → Export Map

i. Save as type: JPEG

ii. Set Resolution: 300 dpi

iii. Navigate to appropriate folder and Save

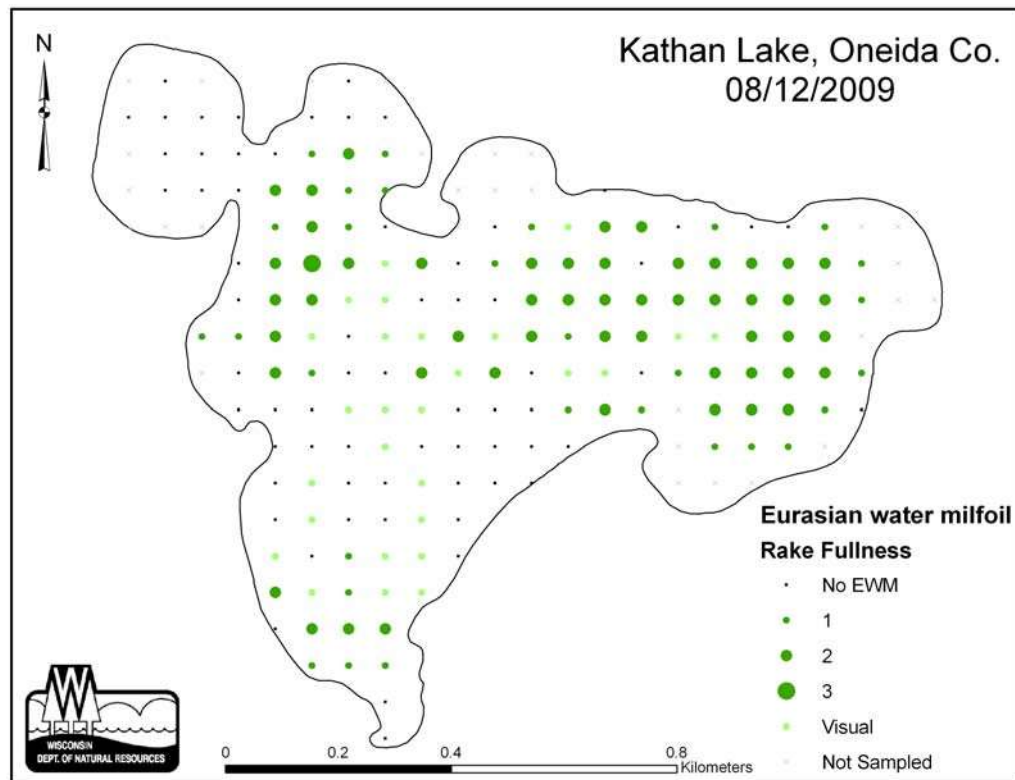


Figure 6: Example plant distribution map created using point-intercept data and ArcGIS 9.3 software for Kathan Lake, Oneida County.

## Appendix 4

### Creating a Plant Distribution Map Using Point Intercept Data in ArcGIS 3.3

This is a protocol for making plant maps using ArcView GIS 3.3 and the Aquatic Plant Survey Data Workbook Excel file <Appendix-C.xls>. This protocol can be changed in a number of different ways and still produce a similar product. The best way to make PI-based maps depends on the particular dataset; however, this procedure works well in most cases. Similar images may be created in PowerPoint or in photo editing software if the dataset is not large or complex.

1. Save the ArcView shapefiles (\*.shp, \*.dbf, \*.sbn, \*.shx, \*.sbx, \*.sbn) to a folder on a local drive.
  - a. We'll refer to this folder as "MapFolder"
2. Open ArcView and create a new project with a new view.
  - a. Click "yes" to add data
3. Add shapefiles from MapFolder
  - a. You can add multiple files at once by holding down "shift" while you click the individual files
4. View window: select the point file
  - a. Make sure both themes have the box checked in order to view them
  - b. Click once on the point layer to activate that theme (raised box around that item)
  - c. If necessary, drag the activated point layer above the polygon layer in order to see the sample points
5. Open theme table
  - a. Theme > Table or
  - b. The open theme table shortcut button
6. Start editing, add variable column
  - a. Table > Start Editing
  - b. Edit > Add Field
    - i. Enter the name of the field (e.g. EWM\_2009)
    - ii. Specifications 'type', 'width', and 'decimal places' do not need to be changed
    - iii. Click "OK"
7. Stop editing, save edits
  - a. Table > Stop Editing, 'Yes' to save edits
8. Export point file

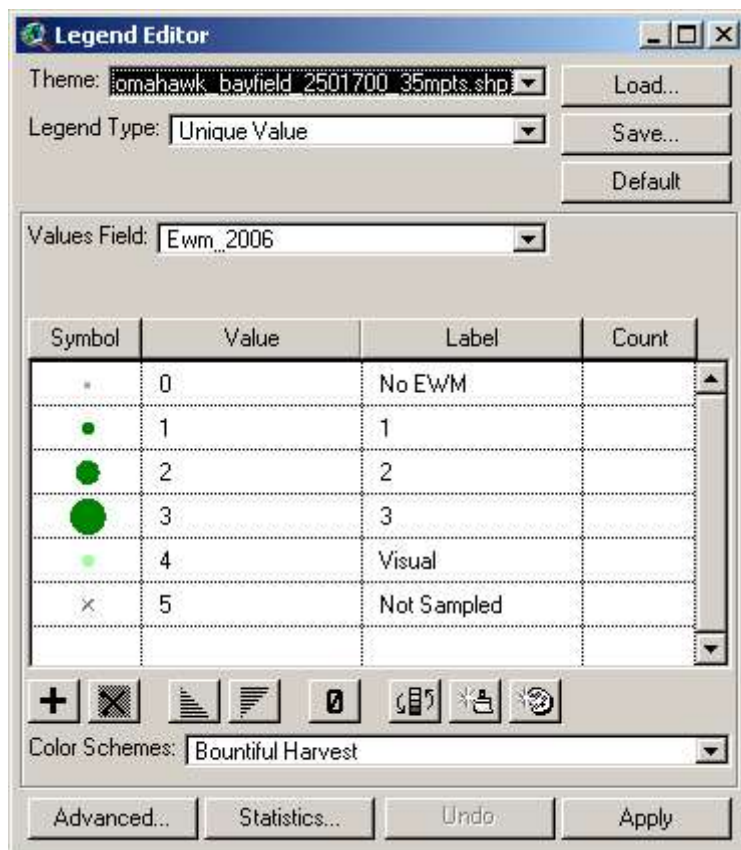


- a. File > Export
  - b. Select 'dBASE'
  - c. Select MapFolder to save file
  - d. Default will be named <table1.dbf>
  - e. Close table
9. Set-working directory
  - i. File > Set Working Directory
  - ii. Change working directory to MapFolder
10. Save project, exit ArcView
  - a. File > Save Project As > save in MapFolder (for ease of reference, lets call the file EWM\_Map.apr)
  - b. Exit ArcView
11. Open file saved in step 8 with Excel
  - a. Open excel; Open a file, when prompted to find the file, navigate to MapFolder
  - b. In "Files of type" option bar select "All files"
  - c. Open <table1.dbf>
12. List information under data field created (EWM\_2009)
  - a. Open PI data entry excel file (WiAPMS.xls)
  - b. Copy columns "Sample point, Depth, Comments, & EWM"
  - c. Paste special "values" into new excel workbook
    - i. Edit > Paste Special > Values
  - d. Highlight all data, sort by comments
    - i. Data > Sort > Comments
  - e. Enter the number 5 into EWM column for all unsampled sites (deep, terrestrial, non-navigable, etc) (this is so the legend can code these sites)
  - f. Highlight EWM data column and replace all blanks with 0 (zero), and V (visuals) with 4
    - i. Edit > Replace, replace all
  - g. Highlight all data, re-sort by sampling site
    - i. Data > Sort > Sampling Point
  - h. Copy EWM column, excluding header, paste into the .dbf file (already open, originally created in step 8)
  - i. "Save as" this file as the **original dbf** file's name (the copy you placed in MapFolder, not the original file, obviously)
    - i. i.e. overwrite the ISS original (e.g. Kathan\_Oneida\_1598300\_65mpts.dbf) with the new file you just modified in excel. The name must be EXACTLY the same!!
    - ii. Close excel
13. Reopen project in ArcView
  - a. Open existing project

- b. Open MapFolder and click on EWM\_Map.apr (or whatever you chose to name it in step 9)

#### 14. Create legend

- a. Double-click point symbol in the View frame to open the legend window
- b. In “Legend Type” option bar, choose “Unique Value”
- c. In “Values Field” option bar select “EWM\_2009” column (or whatever column you want this map to show)
- d. Apply
- e. You must now choose appropriate symbols and colors for the different variables being expressed by the legend. You can change the symbol by double clicking on it
- f. Typically we use increasing sizes of a green circle for EWM density ratings (values: 1, 2 , 3), a small light green circle for visuals (value: 4), a small black dot for sites sampled, but without EWM, (value: 0), and a small “x” symbol for sites not sampled (value: 5).
- g. You can change the label name of the symbol being represented by clicking on the respective cell under “Label”. (e.g. change “5” to “Not Sampled”, change “4” to Visual)
- h. The color or shading of the polygon can also be changed by double clicking on the theme



#### 15. Set units

- a. View > Properties
- b. Change map units to “meters” and distance units to “kilometers”

#### 16. Layout

- a. View > Layout
- b. Select Landscape or Portrait
- c. Double-click ‘View1’ to change map title
- d. Double-click scale bar to adjust range or units
- e. If you’re going to be switching between maps quickly to look at comparisons between years or species, we suggest making and refining the layout first, then saving it as a Template (Layout > Store as Template) so you can use the same one each time.

- f. Check printed map for color accuracy before you export (step 17). Sometimes the colors may look different on screen, but may print with the same hue and value, making interpretation impossible. You can set a custom color if necessary.

17. Save as JPEG

- a. Have the final layout window active
- b. Select File > Export
- c. In “List Files of Type” option bar, select JPEG
- d. Click ‘Options’ button
  - i. Set resolution to highest number
  - ii. Likely 144 DPI and Quality = 100
- e. Type file name, choose location in which to save the JPEG
- f. Click OK

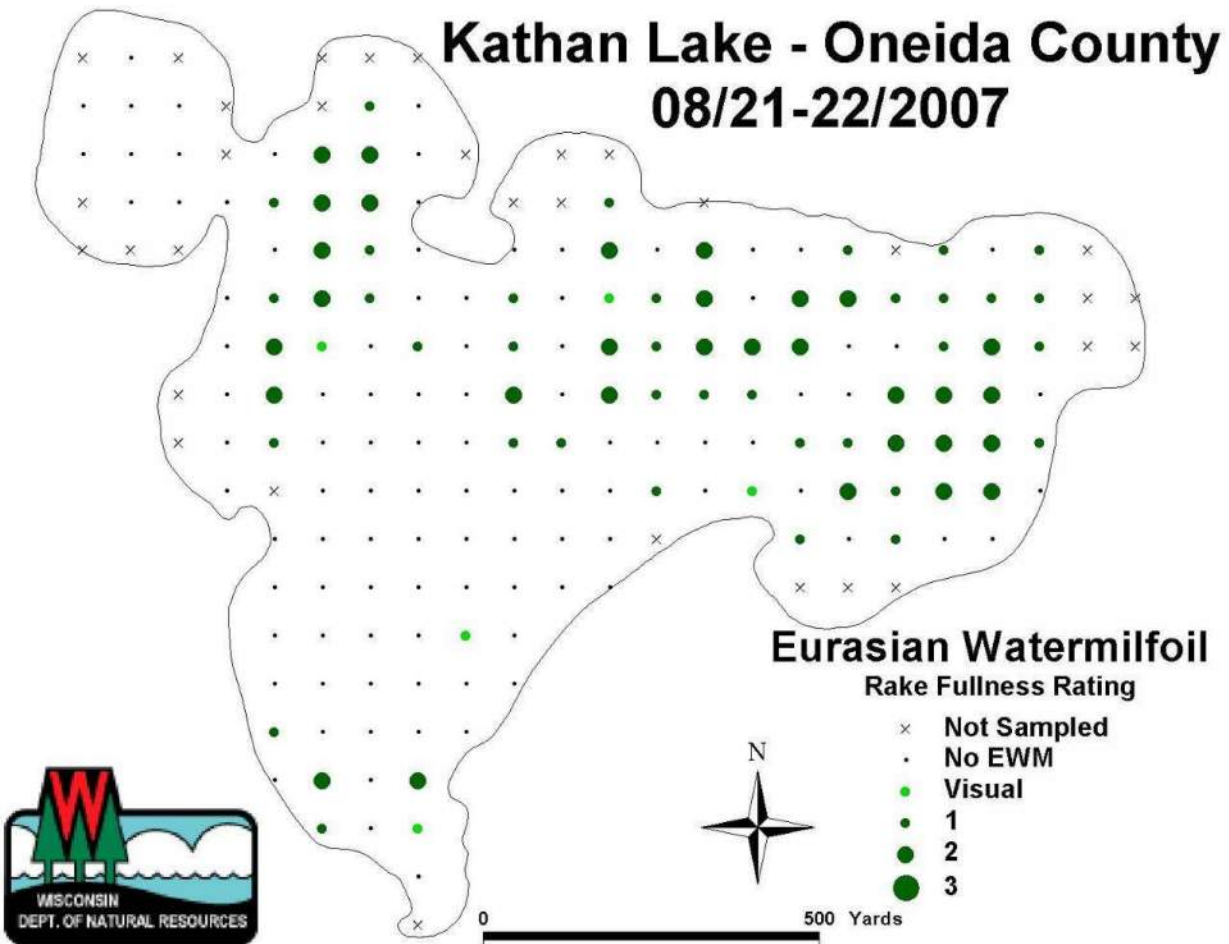


Figure 7: Example plant distribution map created using point-intercept data and ArcGIS 3.3 software for Kathan Lake, Oneida County.

**Document citation:**

Hauxwell, J., S. Knight, K. Wagner, A. Mikulyuk, M. Nault, M. Porzky and S. Chase.  
2010. Recommended baseline monitoring of aquatic plants in Wisconsin: sampling design, field and laboratory procedures, data entry and analysis, and applications. Wisconsin Department of Natural Resources Bureau of Science Services, PUB-SS-1068 2010. Madison, Wisconsin, USA.



## Science Services

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  - analyzing new information and emerging technologies.
  - synthesizing information for policy and management decisions.
  - applying the scientific method to the solution of environmental and natural resources problems.
  - providing science-based support services for department initiatives.
  - collaborating with local, state, regional, and federal agencies and academic institutions in Wisconsin and around the world.
- 



## **Appendix 3 – Aquatic Invasive Species Early Detector Handbook**

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# WISCONSIN AQUATIC INVASIVE SPECIES EARLY DETECTOR HANDBOOK



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## NOTES

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### EARLY DETECTOR BASICS

- 4 How to prepare
- 5 Example map
- 6 Assembling a monitoring kit
- 8 How to sample AIS from shore
- 10 How to sample AIS from a boat
- 12 Photographing Aquatic Invasive Species

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- 16 Brittle naiad
- 17 Carolina fanwort
- 18 Curly-leaf pondweed
- 19 Eurasian watermilfoil
- 21 European frog bit
- 22 Flowering rush
- 23 Narrow-leaf cattail / hybrid cattail
- 24 Parrot feather
- 25 Phragmites
- 26 Purple loosestrife
- 27 Starry stonewort
- 28 Water chestnut
- 29 Water hyacinth
- 30 Water lettuce
- 31 Yellow floating heart
- 32 Yellow Iris

### ANIMAL ID

- 34 Asian clam (*Corbicula*)
- 35 Banded & Chinese mystery snails
- 36 Faucet snail
- 37 New Zealand mudsnail
- 38 Round goby
- 39 Rusty crayfish
- 40 Spiny waterflea
- 41 Zebra & quagga mussels

## AIS EARLY DETECTORS

Early detection of aquatic invasive species (AIS) can be the difference between long-term management and potential eradication--the difference between \$\$\$ and \$. Once they become well-established, invasive species can be very difficult to control, and may be impossible to eradicate. Early detection and rapid response to new AIS populations in Wisconsin has resulted in some populations being eradicated from entire lakes, including notable invaders like Eurasian watermilfoil, flowering rush, and yellow floating heart (cover photo). The best possible option for a lake is to have trained eyes on the water often, so that a suspicious plant or animal can be detected early and quickly responded to.

Your Citizen Lake Monitoring Network staff and local Aquatic Invasive Species Coordinators are ready to help you! They can provide hands-on training workshops, assist with identification, suggest the best locations to monitor on your lake, and more. This is a team effort to stop invasive species from spreading to our favorite fishing spots, our cherished swimming holes, and the peaceful places where we love to observe native plants and animals. We can all do our part. Thank you for being a partner to protect the amazing lakes of Wisconsin.

This booklet is adapted from *Aquatic Invasive Species Early Detectors: A How-to Guide*, produced by the Minnehaha Creek Watershed District, Minnetonka, Minnesota, used with permission.

Produced by the Wisconsin Citizen Lake Monitoring Network, UW-Extension Lakes Program.

**Photos by Paul Skawinski** except the following:

**Jeff Gunderson**, Minnesota Sea Grant (top photo, p. 38);

**Jeffrey Thompson**, Minnesota Public Radio; (page 3)

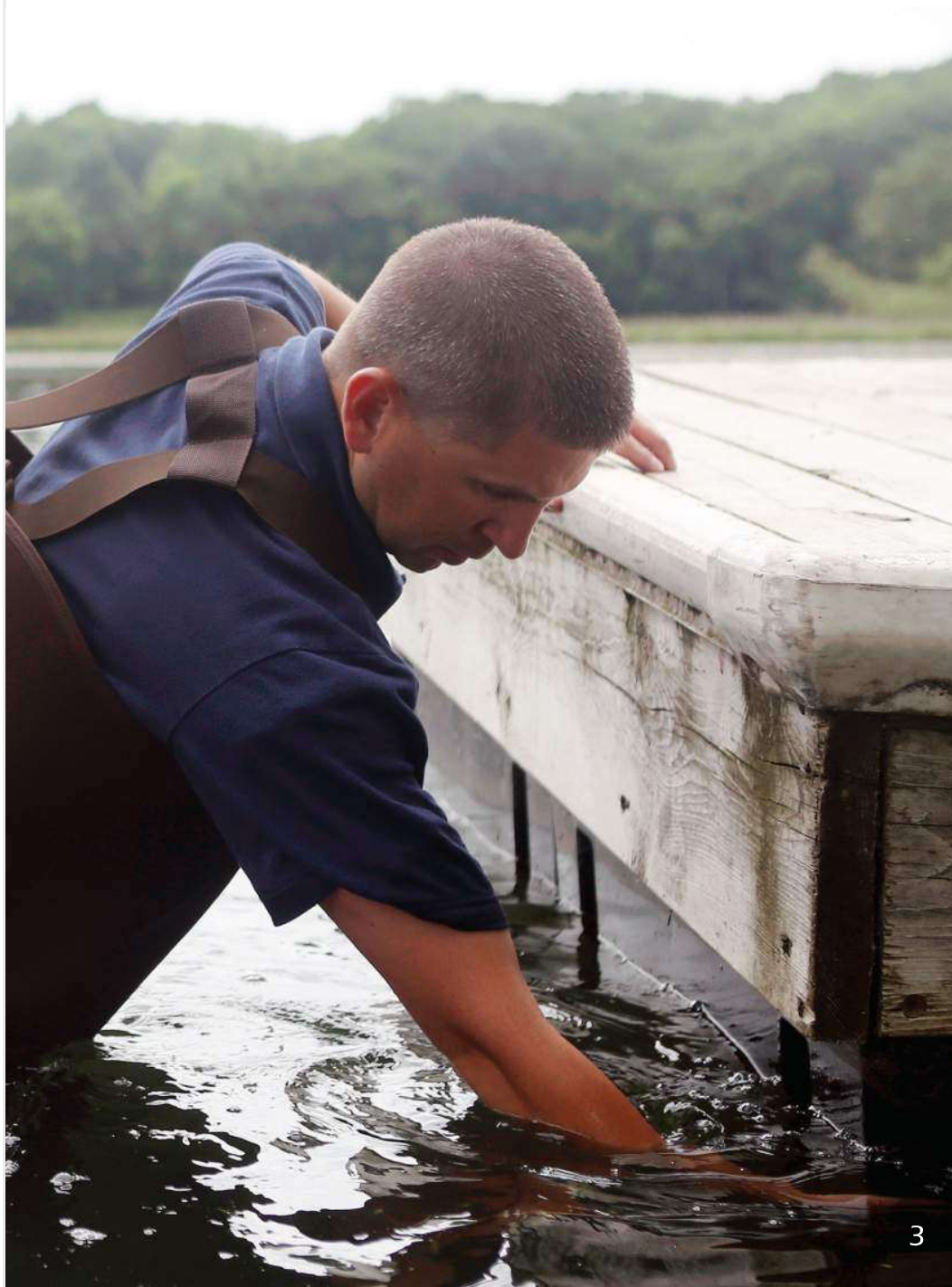
**Minnehaha Creek Watershed District**; (pages 6, 10)

**Tina Wolbers**, Minnesota Department of Natural Resources (top photo, page 32)



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## HOW TO PREPARE

1

Know which invasive species are already present in the lake or stream you are monitoring. Lists of invasive species in each water body can be found on the Wisconsin Department of Natural Resources website: [dnr.wi.gov/lakes/invasives/AISbywaterbody.aspx](http://dnr.wi.gov/lakes/invasives/AISbywaterbody.aspx)

2

Determine several locations to sample. Be sure to target boat landings, inlets/outlets, public parks, developed shorelines, and a variety of sediment types (mucky, sandy, etc.). Your own shoreline is also a great place to keep an eye on. Mark these sampling locations on a map so that you can show others where you sampled or found a suspicious species.

3

Refer to the *Assembling a Monitoring Kit* section on page 6 to prepare for monitoring. If any of your gear has been used in another waterbody, be sure that it doesn't contain any plants, animals, or debris that could be holding invasive species.



### Inspect

your equipment for any attached plants, animals, or mud



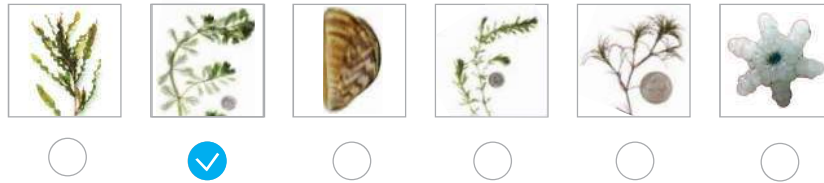
### Remove

all attached debris



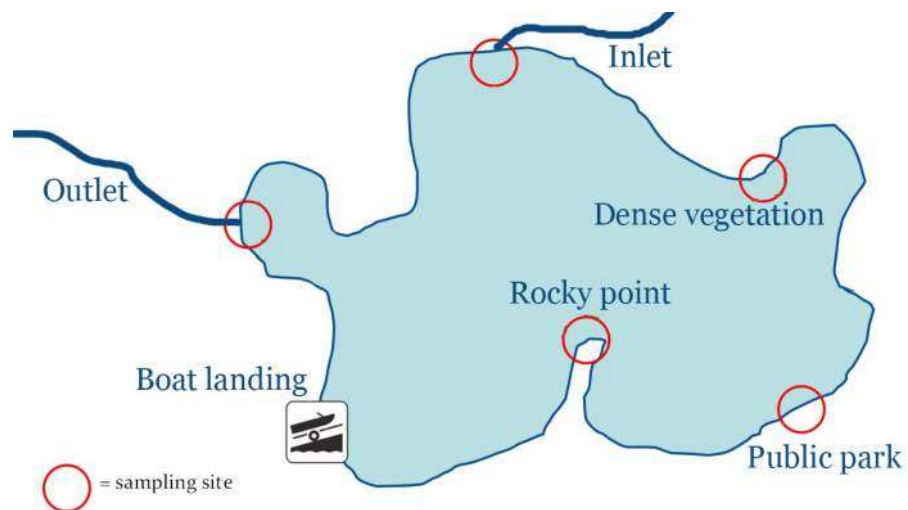
### Drain

water from your boat, motor, live wells, bait buckets, and any other location that holds water



### EXAMPLE MAP

Great maps can be found for public lakes across the state by searching [dnr.wi.gov](http://dnr.wi.gov) for “lake maps”.



## ASSEMBLING A MONITORING KIT

Use the checklist below to assemble an AIS monitoring kit. Items marked with an asterisk (\*) can be provided by your Regional Citizen Lake Monitoring Network Coordinator or local Aquatic Invasive Species Coordinator.

- 1) Aquatic plant sampling rake\*
- 2) Waterproof labels\*
- 3) Ziploc bags\*
- 4) Hand lens\*
- 5) Pencil\*
- 6) AIS monitoring forms\*
- 7) Polarized sunglasses
- 8) Towel to dry your hands and equipment
- 9) Underwater viewing scope (optional)

Waders (10) and snorkeling gear (11) can also be very useful tools for AIS monitoring, but are not required. Volunteers wishing to do a very thorough check of an area may choose to use these items.



A steel rake head (usually with at least 30 feet of rope attached to it) is a very effective aquatic plant sampling tool. You can buy a rake head by itself, or simply cut the handle off of a rake and tie the rope to the head. If desired, a double-sided rake can be made by attaching two rake heads together with cable ties or welding.



1

Polarized sunglasses reduce glare and allow a person to see much more clearly into the water.



7



8

A towel is useful to wipe your hands and your gear!

## HOW TO SURVEY FOR AQUATIC INVASIVE SPECIES FROM SHORE

Identify the public boundaries of the site. Beginning at one of the boundaries, conduct the sampling steps outlined below, and repeat these steps at five points spaced about equally between the site boundaries.



**1. Scan** the area for at least 30 seconds, examining plants in the water and any plant fragments/shells that are washed up on shore.



**2. Toss** your sampling rake from shore into the water, aiming for concentrations of plants or anything suspicious that you noticed during your scan. Be sure to hang on to the end of your rope!



**3. Retrieve** the rake and examine the attached vegetation and animals. Snails, mussels, and other creatures will often be attached to the vegetation or stuck on the rake itself. Continue tossing the rake until you feel that you have adequately sampled this location (usually 2-3 rake tosses). Use this handbook to help you identify suspicious plants and animals.

If there is a dock or pier, use it as one of your sampling locations. You can sample off of any side of the dock. If you are able to see or touch the legs of the dock, this is a good way to look for zebra mussels.

Place a sample of any suspected invasive species in a plastic bag with a waterproof label. Bags, labels, and pencils are included in your monitoring kit. Seal the bag tightly and place it somewhere secure until you can get it into a refrigerator or deliver it to an expert.



**4. Report** what you found. If you did not find any suspected invasive species, that's great! We want to know the good news! Please enter this information into the Surface Water Integrated Monitoring System (SWIMS) database, or email the *Aquatic Invasives Surveillance Monitoring* form to your local Aquatic Invasive Species Coordinator. This form can be used to record results from one day or from an entire season of monitoring, whichever is most convenient for you. Please enter or mail your results by November 1st so we can compile information from across the state.

If you found a suspected invasive species, please record that on the form. Then take digital photographs of the invasive species (please include the waterproof label in the photos) and email the photos to your local AIS Coordinator (DNR or county). Please save all suspicious plants and animals in the refrigerator or in a cooler until you hear back. Your AIS Coordinator may ask to see the actual specimen to confirm its identification.

**Who** is my local AIS Coordinator? Visit the Wisconsin DNR website at [dnr.wi.gov](http://dnr.wi.gov) and type "AIS Coordinator" into the search box. Then click on your county to find contact information for AIS staff that cover your area.

If you need help finding this information, please contact:

Paul Skawinski  
Statewide Citizen Lake Monitoring Network Coordinator  
[Pskawins@uwsp.edu](mailto:Pskawins@uwsp.edu) or 715-346-4853

## HOW TO SURVEY FOR AQUATIC INVASIVE SPECIES FROM A BOAT

Identify sites with a high risk of invasive species introductions, such as boat landings, public parks, bridges, and inlets. Conduct the sampling steps outlined below at each site you have identified around the lake. While motoring/paddling between sites, stay shallow enough that you can see aquatic plants, and watch for AIS as you go.

**1. Scan** the area for suspicious plants and animals, both in the water and along the shoreline. Scan for at least 30 seconds at each site.

**2. Toss** your sampling rake into the water, once from each side of the boat. Aim for concentrations of plants or anything suspicious that you noticed during your scan. Be sure to hang on to the end of the rope!

**3. Retrieve** the rake and examine the attached vegetation and animals. Snails, mussels, and other creatures will often be attached to the vegetation or stuck on the rake itself. Continue tossing the rake until you feel that you have adequately sampled this location (usually 2-3 rake tosses). Use the identification resources provided to help you identify suspicious plants and animals.

Place a sample of any suspected invasive species in a plastic bag with a waterproof label. Bags, labels, and pencils are included in your monitoring kit. Seal the bag tightly and place it somewhere secure until you can get it into a refrigerator or deliver it to an expert.



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[Pskawins@uwsp.edu](mailto:Pskawins@uwsp.edu) or 715-346-4853

## PHOTOGRAPHING AQUATIC INVASIVE SPECIES

Most aquatic invasive species can be readily identified from a good photograph. Here are some tips to make your specimen easy for your local AIS Coordinator to identify.



**Light it up!** Have the sun or other light source behind you, not behind the object. Shadows make it difficult to see colors and patterns.



**Show scale.** Some species can be differentiated based on size. Use a coin, hand, key, or the ruler at the front of this handbook to demonstrate size.



**Have a contrasting background.** Small features of plants and animals are tough to see against backgrounds that are busy or contain similar colors/textures.

Wisconsin Citizen Lake Monitoring Network  
Use these labels when submitting a sample of an aquatic plant or animal for identification

Which species do you think it is?  
*Asian clam*

Lake & county where it was collected:  
*Lulu Lake, Walworth Co.*

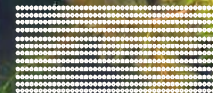
Date:  
*8/10/16*

Your name and contact information:  
*Paul Skawinski*  
*715-346-4853 Pskawins@uwsp.edu*





# PLANT ID



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## BRAZILIAN WATERWEED AND HYDRILLA

Plant type: Submergent  
Status: Prohibited  
Native look-alike:  
Common waterweed

## INVASIVE

Brazilian waterweed  
(*Egeria densa*)

- Rings (whorls) of 4-8 leaves around the stem
- Fine teeth on leaf edges. This usually requires a hand lens to see
- No teeth underneath the leaves



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NATIVE	INVASIVE
<p>Common waterweed (<i>Elodea canadensis</i>)</p> <ul style="list-style-type: none"><li>• Rings (whorls) of 3 leaves around the stem</li><li>• Smooth leaf edges</li><li>• No teeth underneath the leaves</li></ul>	<p>Hydrilla (<i>Hydrilla verticillata</i>)</p> <ul style="list-style-type: none"><li>• Rings (whorls) of 4-8 leaves around the stem</li><li>• Fine teeth on leaf edges</li><li>• Teeth are also produced underneath the leaf, along the centerline</li></ul>



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### BRITTLE NAIAD

Plant type: Submergent  
Status: Prohibited  
Native look-alike: Slender naiad

#### INVASIVE

Brittle naiad  
(*Najas minor*)

- Noticeably toothed
- Readily breaks into small fragments
- Leaves curve strongly downward

#### NATIVE

Slender naiad  
(*Najas flexilis*)

- Teeth on edge of leaf require magnification to view
- Flexible
- Leaves straight or slightly curving



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## CAROLINA FANWORT

Plant type: Submergent

Status: Prohibited

Native look-alike: Water marigold

### INVASIVE

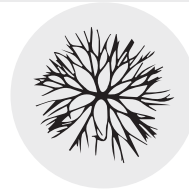
Carolina fanwort  
(*Cabomba caroliniana*)

- Leaves on short stalks, attaching on opposite sides of the stem
- Flower white with a yellow center
- May have tiny, floating leaves

### NATIVE

Water marigold  
(*Bidens beckii*)

- Ring/whorl of leaves around the stem
- Leaves do not have stalks
- Yellow, daisy-like flower



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## CURLY-LEAF PONDWEED

Plant type: Submergent  
Status: Restricted  
Native look-alike: Claspingleaf pondweed



### INVASIVE

Curly-leaf pondweed  
(*Potamogeton crispus*)

- Leaves are usually very wavy
- Finely toothed leaf edges
- Leaf tips are blunt
- Leaf base not wrapped around stem

### NATIVE

Claspingleaf pondweed  
(*Potamogeton richardsonii*)

- Leaves are gently wavy
- Leaf edges smooth, no teeth
- Leaf tips are pointed
- Leaf base wraps around stem



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## EURASIAN WATERMILFOIL

Plant type: Submergent

Status: Restricted

Native look-alikes: Other watermilfoils, common bladderwort

### INVASIVE

Eurasian watermilfoil  
(*Myriophyllum spicatum*)

- 12+ pairs of leaflets per leaf
- Stems usually weak and limp, reddish-brown to pink
- Leaves at tip of branches often red

### NATIVE

Northern watermilfoil  
(*Myriophyllum sibiricum*)

- 5-10 pairs of leaflets per leaf
- Stems tan to green, usually stiff, holding shape out of water
- Leaves at tips of branches usually green



**NATIVE**

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Whorled watermilfoil  
(*Myriophyllum verticillatum*)

- 8-17 pairs of leaflets per leaf
- Stems brown or dark green
- Rings (whorls) of leaves packed closely together on the stem

**NATIVE**

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Common bladderwort  
(*Utricularia macrorhiza*)

- Leaves contain many small sacs (bladders) that trap invertebrates
- Stems are unrooted, usually tangled on other vegetation



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## EUROPEAN FROG-BIT

Plant type: Floating  
Status: Prohibited  
Native look-alike: White water lily

### INVASIVE

European frog-bit  
(*Hydrocharis morsus-ranae*)

- Free-floating, roots hang below
- Small, heart-shaped leaves (2-3")
- Small, white flower, 3 petals

### NATIVE

White water lily  
(*Nymphaea odorata*)

- Rooted to the bottom
- Round leaves with a slit/notch
- Large leaves up to 12" diameter
- Large, white flower, many petals



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## FLOWERING RUSH

Plant type: Emergent/submergent  
Status: Restricted  
Native look-alike: Bur-reeds

### INVASIVE

Flowering rush  
(*Butomus umbellatus*)

- Cluster of pink/red flowers held above the plant
- Can be emergent or submergent
- Tall, dark green leaves are triangular in cross-section and often twisted near the top
- Produces small, onion-like growths on the roots called bulbils
- Usually 3-6 feet tall





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**NARROW-LEAF CATTAIL**

Plant type: Emergent  
Status: Restricted

INVASIVE	NATIVE
<p>Narrow-leaf cattail (<i>Typha angustifolia</i>)</p> <ul style="list-style-type: none"> <li>• Leaves 4-10mm wide</li> <li>• Male and female flowerheads separated by 1" or more</li> <li>• Pollen is shed as single grains</li> </ul>	<p>Broad-leaf cattail (<i>Typha latifolia</i>)</p> <ul style="list-style-type: none"> <li>• Leaves &gt;12mm (1/2") wide</li> <li>• Male and female flowerheads touching, or nearly touching</li> <li>• Pollen is shed in clusters of four grains</li> </ul>
<p>Note: Narrow-leaf and broad-leaf cattails can hybridize. Hybrid cattail (<i>Typha x glauca</i>) typically has a gap of 1/4" to 1" between the male and female flowerheads, sheds pollen mostly in single grains but also as clusters of two, three, and four, and grows in very dense stands.</p>	

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## PARROT FEATHER

Plant type: Emergent/submergent  
Status: Prohibited

### INVASIVE

Parrot feather  
(*Myriophyllum aquaticum*)

- 6-30 pairs of short leaflets
- Rings/whorls of 4-6 widely spaced leaves
- Can emerge up to 8" from the water



## PHRAGMITES

Plant type: Shoreline or emergent  
Status: Prohibited/restricted (split-listed)  
Native look-alike: Native Phragmites

### INVASIVE

Non-native Phragmites  
(*Phragmites australis*  
ssp. *australis*)

- Often more than 10 feet tall
- Large, feathery seedheads
- Dark green leaves
- Dull, ridged stem

### NATIVE

Native Phragmites  
(*Phragmites australis*  
ssp. *americanus*)

- Usually less than 8 feet tall
- Sparse seedheads
- Bright green leaves
- Smooth, glossy stem, often reddish



<p>Document Accession #: 20220421-5203 Filed Date: 04/22/2022</p>	
	
<p><b>PURPLE LOOSESTRIFE</b></p> <p>Plant type: Emergent/shoreline  Status: Restricted  Native look-alike: Blue vervain</p>	
<p><b>INVASIVE</b></p>	<p><b>NATIVE</b></p>
<p>Purple loosestrife  (<i>Lythrum salicaria</i>)</p> <ul style="list-style-type: none"> <li>• Flowers pink-purple, with 6 petals, blooming in a tall spike</li> <li>• Leaves have smooth edges and are opposite or in rings/whorls of 3,</li> <li>• Square or 6-sided stem</li> </ul>	<p>Blue vervain  (<i>Verbena hastata</i>)</p> <ul style="list-style-type: none"> <li>• Flowers blue, with 5 petals, blooming one ring/whorl at a time</li> <li>• Leaves opposite with toothed edges</li> <li>• Square stem</li> </ul>
	

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## STARRY STONEWORT

Plant type: Submergent  
Status: Prohibited  
Native look-alike: Native stoneworts



### INVASIVE

Starry stonewort  
(*Nitellopsis obtusa*)

- Rings/whorls of 4-6 branchlets
- Smooth stem
- Uneven forking near end of branchlets
- Produces star-shaped bulbils in sediments
- Stiff; holds shape out of water



### NATIVE

Slender stonewort  
(*Nitella flexilis*)

- Rings/whorls of 4-6 branchlets
- Smooth stem
- Symmetrical forking near end of branchlets
- Does not produce bulbils in sediments
- Delicate; collapses out of water



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## WATER CHESTNUT

Plant type: Floating  
Status: Prohibited

### INVASIVE

Water chestnut  
(*Trapa natans*)

- Triangular, toothed leaves
- Leaf bases are inflated
- Mostly free-floating
- Fruits with sharp spines formed underneath the leaves
- Entire plant may be over 1 foot in diameter



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## WATER HYACINTH

Plant type: Floating  
Status: Prohibited

### INVASIVE

Water hyacinth  
(*Eichhornia crassipes*)

- Leaves are waxy and very shiny
- Leaf base is inflated
- Lavender flower with a purple/yellow spot
- Roots hang below the plant
- Forms interconnected colonies





## INVASIVE

Water lettuce  
(*Pistia stratiotes*)

- Free-floating
- Roots hang below the plant
- Leaves are thick, ridged, fuzzy, and light green
- Forms dense, interconnected colonies
- Resembles a floating head of lettuce



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## YELLOW FLOATING HEART

Plant type: Floating  
Status: Prohibited  
Native look-alike: Bullhead pond lily

### INVASIVE

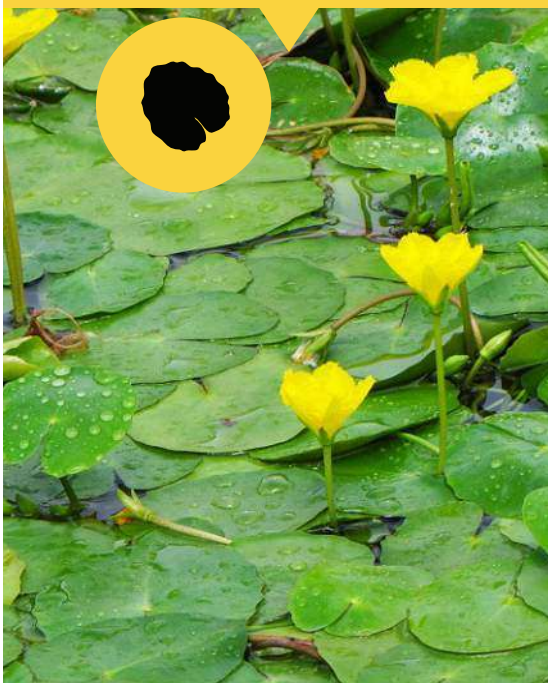
Yellow floating heart  
(*Nymphoides peltata*)

- Heart-shaped leaves up to 4 inches long
- Leaves have wavy edges
- Yellow flowers have five fringed petals
- Plant is rooted to the bottom

### NATIVE

Bullhead pond lily  
(*Nuphar variegata*)

- Heart-shaped leaves up to 15 inches long
- Leaves do not have wavy edges
- Yellow flower is cup-shaped
- Plant is rooted to the bottom





**INVASIVE**

Yellow Iris  
*(Iris pseudacorus)*

- 3-5 feet tall
- Leaves are dark green or blue-green
- Flower is yellow
- Center of leaf is sharply thickened

**NATIVE**

Blue-flag Iris  
*(Iris versicolor & Iris virginica)*

- 2-4 feet tall
- Leaves light green
- Flower is blue
- Center of leaf gradually thickened

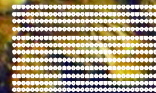




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Filed Date:

# ANIMAL ID



## ASIAN CLAM

Status: Prohibited

Native look-alike: Fingernail clams

### INVASIVE

Asian clam  
(*Corbicula fluminea*)

- Distinctly raised rings on shell
- Up to 2 inches across
- Shell yellow-brown, often blue inside, solid and opaque
- Three large hinge teeth on each shell

### NATIVE

Fingernail clams  
(many species)

- Rings of shell not distinctly raised
- Under 1 inch across
- Shell light to dark brown and white inside
- Shell translucent and fragile
- 1 or 2 teeth at the hinge



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04/21/2022

Filed Date:

### BANDED & CHINESE MYSTERY SNAILS

Status: Restricted

#### INVASIVE

Banded mystery snail  
(*Viviparus georgianus*)

- 1-1.5 inches tall
- Horizontal brown bands on shell
- Bands may be hidden by algae or sediment

#### INVASIVE

Chinese mystery snail  
(*Cipangopaludina chinensis*)

- Up to 3 inches tall
- Dark brown shell, often with short ridges near the shell opening



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05/21/2022

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## FAUCET SNAIL

Status: Prohibited

Native look-alike: Several other small snails. Consult an expert for verification.

## INVASIVE

Faucet snail  
(*Bithynia tentaculata*)

- Small, 12-15mm long (1/2 inch)
- Light brown to black
- 5-6 spirals
- Shell opening is on right side and teardrop-shaped





## INVASIVE





## INVASIVE

Round goby  
(*Neogobius melanostomus*)

- Commonly 3-6 inches long
- Round head with bulging eyes
- Pelvic fins on underside are fused into one circular fin
- Dark spot on back of dorsal fin





## INVASIVE

Rusty crayfish  
(*Orconectes rusticus*)

- Rusty brown spot on each side
- Body is mostly light brown
- Up to 5 inches long
- Claws have black and orange bands



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04/21/2022

Filed Date:

## SPINY WATER FLEA

Status: Prohibited

### INVASIVE

Spiny waterflea  
(*Bythotrephes longimanus*)

- About 1cm (3/8") in length
- Very long tail spine
- Often seen as clumps on fishing line, anchor lines, downriggers



Document Accession #: 20220421-5293  
04/21/2022

Field Date:



## ZEBRA AND QUAGGA MUSSEL

Status: Restricted (Zebra), Prohibited (Quagga)

### INVASIVE

Zebra mussel  
(*Dreissena polymorpha*)

- D-shaped shell
- Sits flat on its side
- Color varies but is usually light brown to white with brown-black stripes
- Up to 1.25" in length
- Usually attached to hard surfaces

### INVASIVE

Quagga mussel  
(*Dreissena bugensis*)

- Teardrop-shaped shell
- Does not sit flat on its side
- Color varies but is usually light brown to white with brown stripes
- Can grow up to 1.5" in length
- Usually attached to hard surfaces



Document Accession #: 20220421-5293  
04/21/2022

Filed Date:



Wisconsin's Citizen Lake Monitoring Network supports nearly a thousand volunteers like you as they monitor the health of Wisconsin's lakes. This information is used to assess the health of our lakes, develop lake management plans and invasive species management strategies, identify long-term trends, evaluate effects of land use practices, and more.

Visit our website to learn more!

[uwsp.edu/uwexplakes](http://uwsp.edu/uwexplakes)

## **Appendix 4 – Terrestrial Invasive Species Monitoring Form**

See also separate  
Excel File

Project			Latitude Coordinates		Longitude Coordinates		Terrestrial Invasive Species Monitoring Form																				
County	Date	Field Crew	Site #				Japanese honeysuckle	Mulberry rose	Common buckthorn	Glossy buckthorn	Saw-toothed buckthorn	Dakian buckthorn	Japanese buckthorn	Chinese buckthorn	Dakian buckthorn	Kudzu-vine	Exotic duan honeysuckles	Exotic olives	Salt cedars	Paleon henrick	Giant hogweed	Oriental bittersweet	Lesser celandine	Teasel	Japanese knotweed	Giant knotweed	Botanica knotweed
			1	Relative Abundance	Length of Shoreline																						
			2	Relative Abundance	Length of Shoreline																						
			3	Relative Abundance	Length of Shoreline																						
			4	Relative Abundance	Length of Shoreline																						
			5	Relative Abundance	Length of Shoreline																						
			6	Relative Abundance	Length of Shoreline																						
			7	Relative Abundance	Length of Shoreline																						
			8	Relative Abundance	Length of Shoreline																						
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			12	Relative Abundance	Length of Shoreline																						
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			27	Relative Abundance	Length of Shoreline																						
			28	Relative Abundance	Length of Shoreline																						
			29	Relative Abundance	Length of Shoreline																						
			30	Relative Abundance	Length of Shoreline																						

## **Appendix 5 – Documentation of Consultation**

**Shawn Puzen**

---

**From:** Shawn Puzen  
**Sent:** Thursday, January 13, 2022 4:52 PM  
**To:** cheryl.laatsch@wisconsin.gov; angietornes@gmail.com; susan\_rosebrough@nps.gov; Lisa\_Yager@nps.gov; jharn@nps.gov; cjpetersen@msn.com  
**Cc:** Darrin Johnson; Miller, Matthew J; Shawn Puzen; brey.j.maurer@xcelenergy.com; Crotty, Scott A  
**Subject:** Hayward and Trego Invasive Species DRAFT Monitoring Plan  
**Attachments:** Appendix 3 Reduced.pdf; Appendix 2 Invasive Study Point Intercept Protocol.pdf; Appendix 4 Wisconsin Point Intercept Worksheet with addtl substrate info.xls; 20220113 Hayward Trego Draft ATIS Study Plan.pdf

**Categories:** Filed by Newforma

Good Afternoon,

Attached is a draft Hayward and Trego Invasive Species Monitoring Plan for your review and comment. The intent is to complete this study during this field season.

By your initial comments on the relicensing of the Hayward and Trego Hydroelectric Project, you requested NSPW complete an invasive species survey.

Prior to executing the study, NSPW is requesting your comments on the enclosed draft study plan.

Please provide your comments as soon as possible, but no later than February 11, 2022.

Please feel free to contact me if you have any questions.

Thanks,

---

**SHAWN PUZEN**

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt  
Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



120 YEARS OF SHAPING THE FUTURE



## United States Department of the Interior

National Park Service  
St. Croix National Scenic Riverway  
401 N. Hamilton Street  
St. Croix Falls, Wisconsin 54024



IN REPLY REFER TO:  
1.A.1

February 8, 2022

Mr. Shawn Puzen  
Shawn.Puzen@meadhunt.com  
Mead & Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: Hayward and Trego Hydroelectric Projects Draft Aquatic and Terrestrial Invasive Species Study Plan, FERC Nos. p-2417 and p-2711, Namekagon River

Dear Mr. Puzen:

The National Park Service (NPS) appreciates the opportunity to provide comments on the *Hayward and Trego Hydroelectric Projects Draft Aquatic and Terrestrial Invasive Species Study Plan*. This study plan was prepared by Mead & Hunt for Xcel Energy for the Hayward and Trego hydroelectric projects on the Namekagon River, within the St. Croix National Scenic Riverway (Riverway) administered by the NPS. The NPS is interested in the protection of native species and limiting the spread of invasive species throughout the Riverway. The NPS requested to review this study plan in our initial comments because Xcel/NSPW is using this study to fulfill some of the information the NPS recommended for inclusion in other study plans and because of our interest in wild rice, which Xcel/NSPW also proposed to include in this study.

We received this proposed study plan by email dated January 13, 2022. We understand you intend to complete field work by the end of August 2022 and the draft study report will be available by October 31, 2022.

Please Note: The report will be provided to NSPW by October 31, 2022 not to the NPS

## 1. Introduction

We concur and are pleased that this study plan responds to the request from the Wisconsin Department of Natural Resources (WDNR), using WDNR protocols. We note that some elements of this study relate to components that NPS recommended for inclusion in other studies. We offer the following comments.

### 2.1 Study Goals and Objectives

Although the objective of the Aquatic and Terrestrial Invasives Species (ATIS) study is to provide baseline data, the NPS encourages including analysis and description of changes that have occurred under the existing license, when information is available. The NPS 08/31/2021 comment letter highlighted the need to include analysis of change from previous surveys associated with sediment deposition, aquatic plant growth, and recreation access (including flooding) as part of the ATIS and Recreation studies. This will help inform the development of protection, mitigation, and enhancement measures in the subsequent license.

An analysis of the effects of the proposed project operation will be included in the license application.

## 2.2 Background and Existing Information

The NPS requests analysis of change from annual purple loosestrife surveys conducted under the existing license.

NSPW will analyze the effect of the proposed project operations on invasive species as appropriate in the license application.

## 2.3 Nexus between Project Operations and Effects on Resources

Please describe conditions, including sediment and substrate conditions, under which invasive species become established after introduction to better understand how inundation and sedimentation capture due to the dam contribute to establishment.

## 2.4 Study Area

The NPS concurs with the proposed study area.

Based upon existing information provided by the USACE the accumulation of the reservoir is due to sedimentation upstream of the reservoir and is not due to project operations-FERC Order Modifying and Approving Drawdown Needs Analysis issued October 31, 1995 for the Trego Hydroelectric Project.

## 2.5 Methodology

### 2.5.1 Upstream and Downstream Inundated Areas

The plan notes that water depth information collected for all survey points will be used to develop a bathymetric map for each reservoir. The NPS raised concerns about this method in our comments on 08/31/2021.

The NPS continues to remain concerned about whether the new bathymetric map will be of sufficient detail to detect changes from the previous map as well as evaluate changes over time through the license period. The NPS requests that additional points be included in the survey, particularly in the area recommended for removal from the boundary at the upper end of the Trego reservoir. Please consider adding detailed information as requested in the WDNR sediment study. In addition, the NPS recommends that the study report include a description of changes that have been seen in the bathymetry and aquatic vegetation since the last map cited in the Preliminary Application Document (PAD).

The current study plan is designed to gather information on all aquatic plants encountered as part of the survey. Therefore, information on wild rice will be collected as part of the survey. Additional information has been added to the plan to allow for the mapping of any wild rice beds encountered as part of the point intercept survey.

The initial study plan summary indicated that information about aquatic vegetation, including wild rice, would be part of the ATIS study. There is no specific mention of wild rice in this study plan, however. Section 4.10.3.6 of the PAD acknowledges the relationship of Ojibwe Tribes and the wild rice beds of Northern Wisconsin. The same section acknowledges that Ojibwe Tribes retained the right to hunt, fish, and gather in ceded lands in the Treaty of 1837 and that the Hayward and Trego Projects are both located within the 1837 Ceded Territory.

In an 08/11/20 email, WDNR expressed to the Licensee that Trego Lake enjoys ASNRI Outstanding and Exceptional Status due, in part, to the presence of wild rice. In a 04/27/21 letter, our agency requested a study documenting the presence/extent/type of aquatic vegetation, including "highly valued wild rice." The NPS has responsibility to review water resources projects under Section 7 of the Wild and Scenic Rivers Act to ensure the project will not have a direct and adverse effect on the values for which the river was designated. The Hayward and Trego Projects are in segments of the Riverway that possess outstandingly remarkable cultural values based on the presence of resources related to American Indian heritage. Wild rice is a resource of particular importance, given its cultural significance to Ojibwe Tribes.

NSPW requested additional information from WDNR including detailed maps from their 1989 evaluation report for the relicensing record and the WDNR does not have any mapping information for a comparison. Therefore, no comparisons with current conditions could be completed. Lastly, existing information from the USACE indicates sedimentation is not due to the current and proposed run-of-river operation.

For these reasons, NPS suggests the special importance of wild rice be reflected in the study plan and that the presence and extent of wild rice be mapped within the Study Area.

Also of note, the scientific name for zebra mussel is misspelled in the second to last paragraph on page 3.

#### **2.5.2 Upland Shorelines Not Owned by the Licensee and 2.5.3 Upland Shorelines Owned by the Licensee and Recreation Sites**

The plan notes that observed locations of terrestrial invasive plants listed in NR40 will be recorded via Global Positioning System (GPS), with provisions for future mapping. To ensure that this information is useful for NPS management, please provide shapefiles and metadata.

Please cite the source of the protocol to be used for the meander terrestrial surveys included in section 2.5.3.

The plan does not reference a specific source of the protocol for the meander survey. The meander survey is not a timed survey, but requires the survey person to meander until they believe they have adequately covered the area subject to survey.

What source(s) will be used to identify early detection terrestrial species?

As stated in Section 2.5.5-The Wisconsin Aquatic Species Invasive Species Early Detector Handbook.

#### **2.5.4 Personnel Qualifications**

The NPS appreciates recognition of the need for obtaining all necessary local, state, and federal permits required for completing the work.

The NPS requests that Xcel (or contractors working on Xcel's behalf) apply for and receive a NPS scientific research and collecting permit to conduct the work outlined in this proposal. Please contact Caitlin Nagorka, natural resources program manager, St. Croix National Scenic Riverway at caitlin\_nagorka@nps.gov for next steps regarding this permit requirement.

The contact information has been added to the plan.

#### **2.7 Project Schedule and Deliverables**

The NPS requests that the Analysis and Discussion report include a description of how ATIS have changed over the life of the current license. Special attention should be given to the years of data collected under existing license articles for surveys of purple loosestrife and any other aquatic vegetation that has been monitored during the license. Special attention should also be given to bathymetric changes.

See responses to comments 2.2, 2.3 and 2.5.1.

The NPS requests that the following additional individual maps be developed and presented:

1. For the reasons included in our agency's comments on Section 2.5.1, a map documenting the presence and extent of wild rice should be included as a deliverable of the study.
2. A map series showing how the presence of purple loosestrife has changed over the life of the current license, given that this has been the subject of monitoring under the current Hayward license.

The plan has been amended accordingly.

See response to comment 2.2.

The NPS also requests a copy of the GIS shapefiles with Metadata for all maps.

The GIS shapefiles can be provided upon request.

**Conclusion**

Thank you for your consideration of these additional comments as you develop your final study plan. The NPS looks forward to the results of this study as well as the opportunity to continue to collaborate with you throughout the licensing process. Please include the following contacts in all future communication and distribution of study plans and reports:

- Lisa Yager, NPS, St. Croix National Scenic Riverway – [lisa\\_yager@nps.gov](mailto:lisa_yager@nps.gov)
- Jonathan Moore, NPS, St. Croix National Scenic Riverway – [jonathan\\_moore@nps.gov](mailto:jonathan_moore@nps.gov)
- Susan Rosebrough-Jones, NPS Hydropower Program – [susan\\_rosebrough@nps.gov](mailto:susan_rosebrough@nps.gov)
- Joan Harn, consultant working with NPS – [jharn.nps@gmail.com](mailto:jharn.nps@gmail.com)
- Angie Tornes, consultant working with NPS – [angietornes@gmail.com](mailto:angietornes@gmail.com)

If you have any questions about our response, please contact Lisa Yager at [lisa\\_yager@nps.gov](mailto:lisa_yager@nps.gov).

Sincerely,

**THERESA HOGAN**

Digitally signed by THERESA  
HOGAN  
Date: 2022.02.08 08:22:49 -06'00'

Theresa Hogan  
Acting Superintendent

The contacts have been added to the relicensing participant list. However, NSPW will consider Lisa Yager the main point of contact for the NPS on this project.

**The Wisconsin Department of Natural Resources and the Trego Lake District did not respond with comments.**

**Hayward and Trego  
Hydroelectric Projects  
FERC Nos. 2417 and 2711**

**Final Mussel Study Plan  
Work Scope 22 MHT**

**Prepared for**

**Northern States Power Company,  
a Wisconsin corporation**

**Prepared by**



**March 2022**

## 1. Introduction

Northern States Power Company, a Wisconsin corporation (NSPW or Licensee), currently holds licenses issued by the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the Hayward and Trego Hydroelectric Projects (Project or Projects). The Projects are owned, operated, and maintained by the Licensee. The current licenses, which designate the Projects as FERC Nos. 2417 and 2711 respectively, expire on November 30, 2025. To obtain subsequent licenses, the Licensee must submit a final license application to FERC no later than November 30, 2023. The final license application, in part, must include a review of freshwater mussel data in the vicinity of the Projects.

On March 11, 2021, the Licensee held a Joint Agency Meeting to present information about the Projects. At the meeting, and during the 60-day comment period immediately following, the Licensee received comments and study requests from several entities. Wisconsin Department of Natural Resources (WDNR) requested that mussel surveys be completed.

The WDNR recommended that the Licensee conduct a mussel study using the WDNR Guidelines for Sampling Freshwater Mussels in Wadable Streams and the WDNR Quantitative Habitat Assessment Methodology. This study plan is consistent with the WDNR request.

## 2. Study Plan Elements

### 2.1 Study Goals and Objectives

The objective of this mussel study is to provide baseline data determine freshwater mussel regarding the general density and diversity of freshwater mussels, including characterizing mussel habitat within the Project area. The study will provide a better understanding of baseline conditions for the Project area.

### 2.2 Background and Existing Information

No federally or state threatened/endangered or special concern mussel species are known to occur in the impounded sections of the reservoirs; however, listed species may occur downstream from the dams or further upstream from the impounded reaches of the reservoirs (WDNR, 2021).

### 2.3 Nexus between project operations and effects on resources

The operations of the Projects could influence the freshwater mussel populations located within the Project boundary.

### 2.4 Study Area

The mussel study will include the sampling of two riverine reaches in each Project vicinity, one upstream of the dam in a riverine area of the impoundment and one downstream of the Project powerhouse outside of the mixing zone. The study areas are depicted in Appendix 1.

## 2.5 Methodology

### 2.5.1 Mussel Survey

The 2015 Wisconsin Department of Natural Resources (WDNR) Guidelines for Sampling Freshwater Mussels in Wadable Streams (Guidelines) and other standard survey methodologies were used to develop the mussel survey parameters (Piette, 2015). The Guidelines provide information on minimum survey efforts for wadable conditions and have been modified for non-wadable conditions. The objective of this mussel study is to provide baseline data regarding mussel diversity within the vicinity of the Projects including a general characterization of mussel habitat within the Project boundary. *Aquatic Habitat Classification on the St. Croix National Scenic Riverway*, by Haibo Wan et.al., shall be referenced when assessing and characterizing mussel habitat.

Two river reaches will be surveyed at each Project. At the Hayward Project, Reach 1 will begin approximately 430 meters above the Highway 77 Bridge and extend 1,000 meters upstream. Reach 2 will begin at the canoe portage put-in and extend 1,000 meters downstream. At the Trego Project, Reach 1 will begin at the Wagon Bridge Road crossing and extend 1,000 meters downstream. Reach 2 will begin 45 meters below the Trego Dam and extend 1,000 meters downstream.

Surveys will consist of sampling transects extending bank to bank that will be spaced every 100 meters in each reach creating a series of 10 transects per reach. Transects will be numbered 1-10 from downstream to upstream, and a random number selector will be utilized to select five transects for survey in each reach.

Searches along each transect will be conducted in 10-meter-long segments and will extend 0.5 meters on each side of the transect. A rapid visual search for signs of freshwater mussels (living or shell material) will be performed within the segment. The rapid visual search entails an initial search of 0.2 minutes per square meter along each 10-meter segment to determine if mussels are present. If mussels are present within a segment, a semi-quantitative search will be triggered, and the time will be extended to 1 minute per square meter. If mussels are absent, a semi-quantitative search will not be conducted. During the semi-quantitative search, divers will visually search, probe the substrate, and turn over rocks to detect small, burrowed mussels.

General stream conditions and morphology within the study area will be recorded, including bottom substrate composition using the Wentworth Scale (% observed of silt, sand, gravel, etc.) will be recorded. The survey will be conducted only when visibility at depth is at least 20 inches.

In addition to the mussel sampling within the transects, a general description of mussel habitat within the Project boundary will be provided.

### 2.5.2 Data and Mussel Handling

Live mussels found will be kept submersed in ambient river water and kept cool and moist during processing. All live mussels will be identified to species, counted, and sexed (sexually dimorphic species only) by the team malacologist. Dead shell specimens will be scored as fresh dead (dead < 1 year; lustrous nacre), weathered dead (dead one to many years; chalky nacre, fragmented, and worn periostracum), or subfossil (dead many years to many decades; severely worn and fragmented). Detailed digital images of the study area and representative mussel species will be recorded. A station location data sheet will also be populated per the Guidelines. Data will be recorded using the forms in Appendix 2 to allow distinction between searches. Mussel taxonomy will follow the names presented by Williams et al., 2017.

If any federally or state-listed species is observed, dead or alive, the Licensee will be notified immediately. WDNR (Lisie.Kitchel@wisconsin.gov), U.S. Fish and Wildlife Service (USFWS) ([Darin\\_Simpkins@fws.gov](mailto:Darin_Simpkins@fws.gov)), and the National Park Service (Lisa\_Yager@nps.gov) will be notified per surveyor collection permit requirements. No live mussels will be harmed or taken during the study. Any federally or state-listed species that are encountered will be individually hand placed into their places of origin.

### 2.5.3 Personnel Qualifications

All surveys will be conducted by individuals with prior mussel identification training and experience with aquatic and mussel surveys.<sup>1</sup>

### 2.5.4 Survey Report

A draft report will be developed within 30 days of completion of field work for agency review and comment. A final report will be completed within two weeks of receiving agency comments. The report shall include a description of mussel survey activities and provide summary tables of all data collected, including mussel species numbers, sizes, and distribution within the study area. The report shall also describe general mussel density and diversity within the vicinity of the two Projects.

A general description of mussel habitat within the Project boundaries, including the reservoirs, bypass reaches and tailwater areas, will also be provided. GIS-based mapping will provide a visual representation of the findings. The report will include completed survey sheets.

## 2.6 Consistency with generally accepted scientific practice

The Mussel Study follows generally accepted scientific practice regarding field data collection and reporting. Similar protocols have been used in other FERC relicensing studies.

---

<sup>1</sup> Consultant(s) selected to complete the work will be responsible for obtaining any NPS or WDNR scientific collectors permits required.

## 2.7 Project Schedule and Deliverables

The study will be completed in 2022. Scientific collector's permits will be obtained, as appropriate, from the WDNR and National Park Service (NPS) prior to the field work commencing. To minimize thermal stress to the mussel specimens, field work will generally be completed between June and mid-September when water temperatures exceed 50 degrees Fahrenheit. Normal to low water conditions and good underwater visibility must be present to effectively conduct field work; therefore, project activities will be planned accordingly.

NSPW anticipates that all field work will be completed by mid-September with a draft report available by October 1, 2022.

## 3. Consultation

The mussel study was requested by WDNR. The Licensee consulted with WDNR and NPS as follows.

### 3.1 Wisconsin Department of Natural Resources

On February 2, 2022, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Mussel Study plan to the WDNR for comment. On February 16, 2022, the WDNR provided comments which were subsequently accepted and incorporated into the plan. Documentation of consultation is included in Appendix 3.

### 3.2 National Park Service

On February 2, 2022, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Mussel Study plan to the NPS for comment. The NPS provided comments via their March 4, 2022 letter, which licensee subsequently addressed as detailed in Appendix 3.

## 4. References

Piette, R.R. 2015. Guidelines for sampling freshwater mussels in wadable streams. Wisconsin Department of Natural Resources. 50 pp.

Smith, D.R. 2006. Survey design for detecting rare freshwater mussel species. *Journal of the North American Benthological Society* 25:701-711.

Williams, J.D et. al. 2017. A revised list of the freshwater mussels (Mollusca: Bivalvia Unionida) of the United States and Canada. *Freshwater Mollusk Biology and Conservation*, 20(2), 33-58.

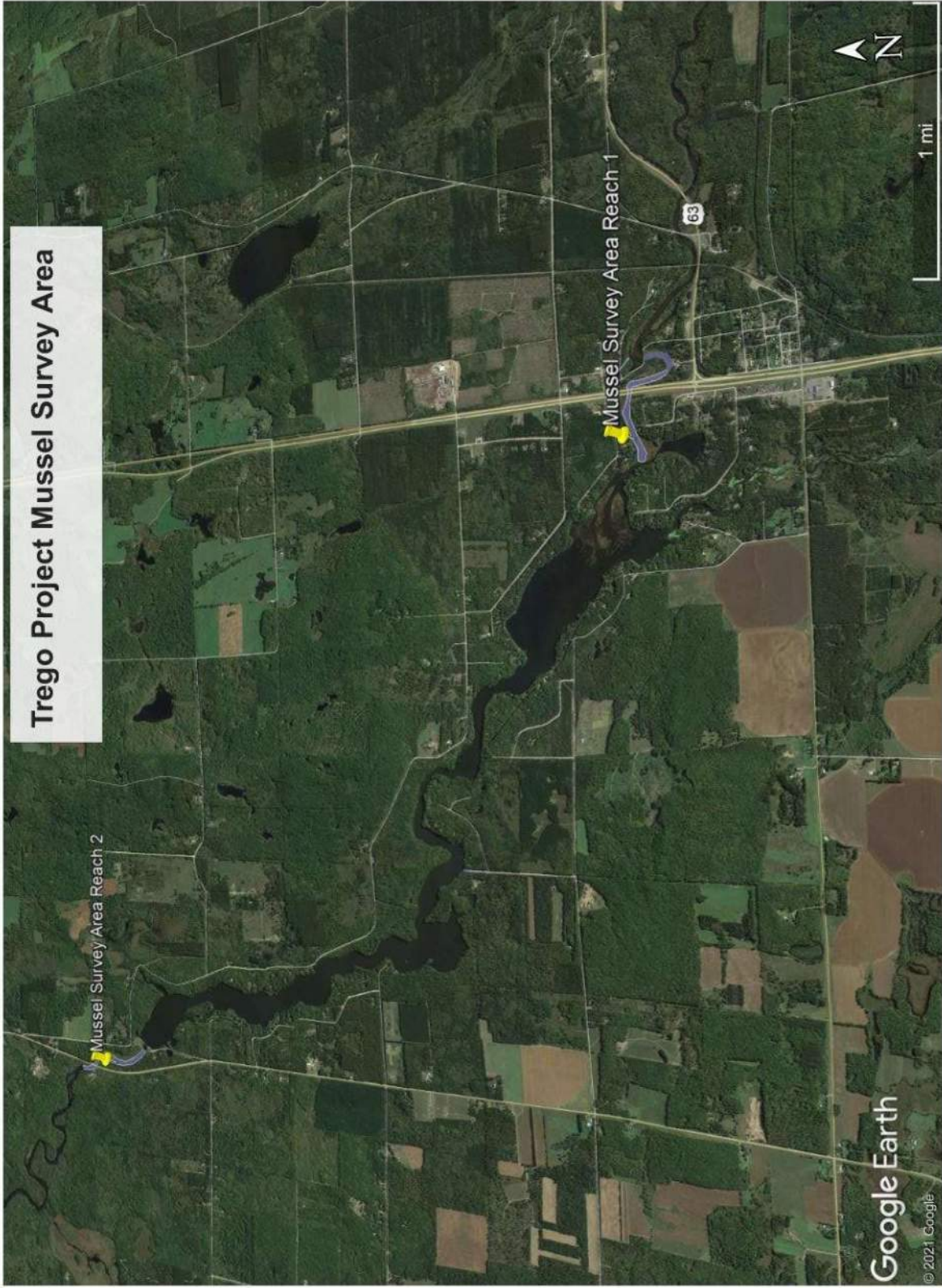
Wisconsin Department of Natural Resources. 2020. Study Requests Relicensing of Hayward (P-2417) and Trego (P-2711) Projects. May 7, 2021.

## **Appendix 1 – Mussel Survey Locations**













## **Appendix 2 – Mussel Survey Data Forms**

Substrate and Water Depth Per Segment										
Reach	Transect	Segment	Water Depth (ft)	Substrate Characteristic (%)						
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt	LWD
Reach 1	T1	10								
	T1	20								
	T1	30								
	T1	40								
	T1	50								
	T1	60								
	T1	70								
	T1	80								
	T1	90								
	T1	100								
	T1	110								
	T1	120								
	T1	130								
	T1	140								
	T1	150								
	T1	160								
	T1	170								
	T1	180								
Reach 1	T2	10								
	T2	20								
	T2	30								
	T2	40								
	T2	50								
	T2	60								
	T2	70								
	T2	80								
	T2	90								
	T2	100								
	T2	110								
	T2	120								
	T2	130								
	T2	140								
	T2	150								
	T2	160								
	T2	170								
	T2	180								
Reach 1	T3	10								
	T3	20								
	T3	30								
	T3	40								
	T3	50								
	T3	60								
	T3	70								
	T3	80								
	T3	90								
	T3	100								
	T3	110								
	T3	120								
	T3	130								

Substrate and Water Depth Per Segment										
Reach	Transect	Segment	Water Depth (ft)	Substrate Characteristic (%)						
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt	LWD
	T3	140								
	T3	150								
	T3	160								
	T3	170								
	T3	180								
Reach 1	T4	10								
	T4	20								
	T4	30								
	T4	40								
	T4	50								
	T4	60								
	T4	70								
	T4	80								
	T4	90								
	T4	100								
	T4	110								
	T4	120								
	T4	130								
	T4	140								
	T4	150								
	T4	160								
	T4	170								
	T4	180								
Reach 1	T5	10								
	T5	20								
	T5	30								
	T5	40								
	T5	50								
	T5	60								
	T5	70								
	T5	80								
	T5	90								
	T5	100								
	T5	110								
	T5	120								
	T5	130								
	T5	140								
	T5	150								
	T5	160								
	T5	170								
	T5	180								
	T1	10								
	T1	20								
	T1	30								
	T1	40								
	T1	50								
	T1	60								
	T1	70								
	T1	80								

Substrate and Water Depth Per Segment										
Reach	Transect	Segment	Water Depth (ft)	Substrate Characteristic (%)						
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt	LWD
Reach 2	T1	90								
	T1	100								
	T1	110								
	T1	120								
	T1	130								
	T1	140								
	T1	150								
	T1	160								
	T1	170								
	T1	180								
Reach 2	T2	10								
	T2	20								
	T2	30								
	T2	40								
	T2	50								
	T2	60								
	T2	70								
	T2	80								
	T2	90								
	T2	100								
	T2	110								
	T2	120								
	T2	130								
	T2	140								
	T2	150								
	T2	160								
	T2	170								
	T2	180								
Reach 2	T3	10								
	T3	20								
	T3	30								
	T3	40								
	T3	50								
	T3	60								
	T3	70								
	T3	80								
	T3	90								
	T3	100								
	T3	110								
	T3	120								
	T3	130								
	T3	140								
	T3	150								
	T3	160								
	T3	170								
	T3	180								
	T4	10								
	T4	20								
	T4	30								

Substrate and Water Depth Per Segment										
Reach	Transect	Segment	Water Depth (ft)	Substrate Characteristic (%)						
				Bedrock	Boulder	Cobble	Gravel	Sand	Silt	LWD
Reach 2	T4	40								
	T4	50								
	T4	60								
	T4	70								
	T4	80								
	T4	90								
	T4	100								
	T4	110								
	T4	120								
	T4	130								
	T4	140								
	T4	150								
	T4	160								
	T4	170								
	T4	180								
Reach 2	T5	10								
	T5	20								
	T5	30								
	T5	40								
	T5	50								
	T5	60								
	T5	70								
	T5	80								
	T5	90								
	T5	100								
	T5	110								
	T5	120								
	T5	130								
	T5	140								
	T5	150								
	T5	160								
	T5	170								
	T5	180								



## **Appendix 3 – Documentation of Consultation**

**Shawn Puzen**

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**From:** Shawn Puzen  
**Sent:** Wednesday, February 2, 2022 2:55 PM  
**To:** cheryl.laatsch@wisconsin.gov; angietornes@gmail.com; susan\_rosebrough@nps.gov; Lisa\_Yager@nps.gov; Joan Harn  
**Cc:** Darrin Johnson; Miller, Matthew J; Shawn Puzen; brey.j.maurer@xcelenergy.com; Crotty, Scott A  
**Subject:** Hayward and Trego Mussel DRAFT Monitoring Plan  
**Attachments:** 20220202 Hayward-Trego Mussel Study Plan sent to Agencies.pdf

Good Afternoon,

Attached is a draft Hayward and Trego Mussel Monitoring Plan for your review and comment. The intent is to complete this study during this field season.

By your initial comments on the relicensing of the Hayward and Trego Hydroelectric Project, you requested NSPW complete a mussel survey.

Prior to executing the study, NSPW is requesting your comments on the enclosed draft study plan.

Please provide your comments as soon as possible, but no later than March 4, 2022.

Please feel free to contact me if you have any questions.

Thanks,

---

**SHAWN PUZEN**

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt  
Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



**Shawn Puzen**

---

**From:** Laatsch, Cheryl - DNR <Cheryl.Laatsch@wisconsin.gov>  
**Sent:** Wednesday, February 16, 2022 12:16 PM  
**To:** Darrin Johnson; Shawn Puzen  
**Cc:** Miller, Matthew J  
**Subject:** FW: Hayward and Trego Mussel DRAFT Monitoring Plan  
**Categories:** Filed by Newforma

See comments below. I confirmed to Jesse that all study reports will be provided to the DNR.

**We are committed to service excellence.**

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Cheryl Laatsch  
Statewide FERC Coordinator  
Bureau of Environmental Analysis and Sustainability  
Wisconsin Dept of Natural Resources  
N7725 Hwy 28  
Horicon WI 53032  
(T) 920-387-7869 (Fax) 920-387-7888  
[Cheryl.Laatsch@wisconsin.gov](mailto:Cheryl.Laatsch@wisconsin.gov)



---

**From:** Weinzinger, Jesse J - DNR <Jesse.Weinzinger@wisconsin.gov>  
**Sent:** Wednesday, February 16, 2022 12:10 PM  
**To:** Laatsch, Cheryl - DNR <Cheryl.Laatsch@wisconsin.gov>; Kitchel, Lisie E - DNR <Lisie.Kitchel@wisconsin.gov>  
**Subject:** RE: Hayward and Trego Mussel DRAFT Monitoring Plan

Overall, I fully support the study plan and have two comments:

1. Can the author briefly describe what happens at individual 10-meter segments where no evidence of mussels occur. Are segments omitted from semi-quantitative searches?
2. We'd like to obtain a copy of the completed datasheets for use in comparing the current mussel bed to an historical dataset (Heath & Rasmussen 1990). Author mentions, *"The report, including completed survey sheets, will be summarized and appended to the DLA."* So I just want to clarify these datasheets will be available.

**We are committed to service excellence.**

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Jesse Weinzinger  
Conservation Biologist - NHC  
Wisconsin Mussel Monitoring Program  
Wisconsin Department of Natural Resources  
Phone: (608) 576-8631 **(New)**  
[Jesse.Weinzinger@Wisconsin.gov](mailto:Jesse.Weinzinger@Wisconsin.gov)

---

**From:** Laatsch, Cheryl - DNR <[Cheryl.Laatsch@wisconsin.gov](mailto:Cheryl.Laatsch@wisconsin.gov)>  
**Sent:** Wednesday, February 02, 2022 2:58 PM  
**To:** Kitchel, Lisie E - DNR <[Lisie.Kitchel@wisconsin.gov](mailto:Lisie.Kitchel@wisconsin.gov)>; Weinzinger, Jesse J - DNR <[Jesse.Weinzinger@wisconsin.gov](mailto:Jesse.Weinzinger@wisconsin.gov)>  
**Subject:** FW: Hayward and Trego Mussel DRAFT Monitoring Plan  
**Importance:** High

Please review and let me know if you have comments or we need to set up a conf call.

**We are committed to service excellence.**

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Cheryl Laatsch  
Statewide FERC Coordinator  
Bureau of Environmental Analysis and Sustainability  
Wisconsin Dept of Natural Resources  
N7725 Hwy 28  
Horicon WI 53032  
(T) 920-387-7869 (Fax) 920-387-7888  
[Cheryl.laatsch@wisconsin.gov](mailto:Cheryl.laatsch@wisconsin.gov)



---

**From:** Shawn Puzen <[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)>  
**Sent:** Wednesday, February 2, 2022 2:55 PM  
**To:** Laatsch, Cheryl - DNR <[Cheryl.Laatsch@wisconsin.gov](mailto:Cheryl.Laatsch@wisconsin.gov)>; [angietornes@gmail.com](mailto:angietornes@gmail.com); [susan\\_rosebrough@nps.gov](mailto:susan_rosebrough@nps.gov); [Lisa\\_Yager@nps.gov](mailto:Lisa_Yager@nps.gov); Joan Harn <[jharn.nps@gmail.com](mailto:jharn.nps@gmail.com)>  
**Cc:** Darrin Johnson <[Darrin.Johnson@meadhunt.com](mailto:Darrin.Johnson@meadhunt.com)>; Miller, Matthew J <[Matthew.j.miller@xcelenergy.com](mailto:Matthew.j.miller@xcelenergy.com)>; Shawn Puzen <[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)>; [brey.j.maurer@xcelenergy.com](mailto:brey.j.maurer@xcelenergy.com); Crotty, Scott A <[scott.a.crotty@xcelenergy.com](mailto:scott.a.crotty@xcelenergy.com)>  
**Subject:** Hayward and Trego Mussel DRAFT Monitoring Plan

**CAUTION: This email originated from outside the organization.  
Do not click links or open attachments unless you recognize the sender and know the content is safe.**

Good Afternoon,

Attached is a draft Hayward and Trego Mussel Monitoring Plan for your review and comment. The intent is to complete this study during this field season.

By your initial comments on the relicensing of the Hayward and Trego Hydroelectric Project, you requested NSPW complete a mussel survey.

Prior to executing the study, NSPW is requesting your comments on the enclosed draft study plan.

Please provide your comments as soon as possible, but no later than March 4, 2022.

Please feel free to contact me if you have any questions.

Thanks,

---

**SHAWN PUZEN**

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt

Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



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## United States Department of the Interior

National Park Service  
St. Croix National Scenic Riverway  
401 N. Hamilton Street  
St. Croix Falls, Wisconsin 54024



IN REPLY REFER TO:  
1.A.1

March 4, 2022

Mr. Shawn Puzen  
[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)  
Mead & Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: Hayward and Trego Hydroelectric Projects Draft Study Plans for Mussels, Water Quality, and Wood and Blanding's Turtle Nesting Habitat, FERC Nos. p-2417 and p-2711, Namekagon River

Dear Mr. Puzen:

The National Park Service (NPS) is consolidating our comments for the three aforementioned studies received by email dated February 2 and 3, 2022.

The NPS reiterates our request for information reflected in our original study requests on April 27, 2021 for shoreline surveys and hydraulics, sedimentation, and channel change, and our August 31, 2021 comments on your draft Study Summary and Responses. The study plans reviewed here have components that would contribute important information relating to our original study requests.

The NPS administers the Namekagon River as part of the National Wild and Scenic Rivers System (NWSRS) and the National Park System, as established by Congress in 1968 (Public Law 90-542). Under this law, the NPS is required by the Wild and Scenic Rivers Act to preserve the St. Croix River and its tributary, the Namekagon River, in a natural condition; to protect and enhance the exceptional natural, scenic, and cultural resources of the Riverway; and to provide high-quality recreational opportunities. River values identified in the hydropower project areas include aquatic, cultural, recreation, and scenic/aesthetic resources. The Namekagon River is managed as part of the St. Croix National Scenic Riverway and is protected under the Organic Act.

Prior to the FERC issuing a new license, the NPS will need to evaluate the proposed license under Section 7(a) of the Wild and Scenic Rivers Act and to determine whether it will have direct and adverse effects on the values for which the river was designated. If the NPS identifies direct and adverse effects, the license/project will need to be modified to ensure that park resources are protected. The NPS study requests are needed to provide information to enable timely completion of this NPS review as well as the FERC NEPA analysis. Continuing impacts on resource values must be identified so that protection and enhancement measures can be incorporated into a new license.

#### Comments on Draft Study Plans

Please contact Caitlin Nagorka, natural resources program manager, St. Croix National Scenic Riverway at [caitlin\\_nagorka@nps.gov](mailto:caitlin_nagorka@nps.gov) to obtain all required NPS scientific research and collecting permits prior to implementing the study plans.

## 1. Mussels

NSPW does not propose to change the operation of the Project from its current run-of-river operating mode and there is no need for routine or scheduled drawdowns. Any future drawdowns that "may" be needed during the subsequent license period will be required by the Commission to be completed in consultation with the resource agencies to assure any adverse impacts are avoided or mitigated at the time of the drawdown. The data being requested for a future event that "could" happen is better collected, if needed, once the scope of the proposed action is proposed and collected as needed and analyzed at that time. Therefore, the study being requested for the purpose of a potential future drawdown is not being conducted at this time as part of the relicensing process.

Mussels are a significant component of the aquatic resources Outstandingly Remarkable Value (ORV) for the Wild and Scenic River designation. It is our agency's understanding that drawdowns may be necessary during the proposed forty-year license period for maintenance and other purposes. Drawdowns have the potential to affect mussels that are present in the portion of riverbed that emerges during the drawdown. To better understand potential effects to mussels, additional reaches will need to be included within the impoundments, especially in the areas near the shoreline that would become exposed during a drawdown event. The study area as currently proposed includes only two riverine reaches at either end of the Project boundaries, which is inadequate to understand the presence, species, and density of mussels in the areas of the impoundments that would be most affected by a drawdown. Please add additional reaches within each impoundment to the study area. The NPS is available to consult further on identifying and prioritizing additional reaches for the purposes of this study.

The NPS concurs with the use of WDNR guidelines.

On page 3, include the NPS in the notification list, along with WDNR and USFWS, if any federally or state-listed species is observed, dead or alive. This will also be specified within the required NPS research and collecting permits.

The plan has been amended.

When assessing and characterizing mussel habitat, researchers should reference *Aquatic Habitat Classification on the St. Croix National Scenic Riverway* by Haibo Wan et al.

The plan has been amended

## 2. Water Quality Study

Water quality is a significant component of the aquatic resources Outstandingly Remarkable Value (ORV) for the Wild and Scenic River designation. The Wild and Scenic Rivers Act directs the NPS to protect water quality of the Namekagon (Sec. 1(b)) and work with the Environmental Protection Agency and the WDNR to eliminate or diminish water pollution of the river (Sec. 12(c)).

- The NPS concurs with the use of WDNR protocols and the rationale for not monitoring cyanobacteria.
- The NPS requests that sediment accumulation also be monitored. Results would provide useful baseline information and facilitate better understanding of sedimentation within the project boundaries.

Based upon existing information provided by the USACE, the accumulation of sediment in the upper end of the reservoir is due to sedimentation upstream and not due to operation of the Project-FERC Order Modifying and Approving Drawdown Needs Analysis issued October 31, 1995.

## 3. Wood and Blanding's Turtle Nesting Habitat Study

- This is another example, like the Aquatic and Terrestrial Invasive Plant study, where the effort that goes into the study could provide shoreline survey information outlined in the NPS study request; however, the draft plan does not provide enough detail on shoreline survey methods to determine if NPS needs would be met through this work.
- The NPS-requested shoreline study would provide current information on the status of the shoreline and identify problem areas and the need for potential management attention. It would provide a baseline for monitoring conditions and change over the life of the license. The NPS has responsibility to review shoreline alteration activities such as bank stabilization and small boat docks as water resources projects under Section 7 of the Wild and Scenic Rivers Act.
- The NPS Shoreline Survey request Method 1<sup>1</sup> recommended a longitudinal survey of the river and its banks, using georeferenced photographic equipment (video or still) and cited the High-

<sup>1</sup> NPS comments on the Pre-Application Document and Study Requests, dated 4/28/21, <https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020CF9CB-66E2-5005-8110-C31FAFC91712>

The HDSS method described by NPS was only used at the RL Harris Hydroelectric Project (FERC No. 2628), a 135 MW peaking facility, to determine the impacts of project operations (peaking) in a 44 mile stretch of the Tallapoosa River downstream of the dam. This method was not used to evaluate erosion or sedimentation within the RL Harris Project Reservoir. Erosion and sedimentation sites within the reservoir were identified by stakeholders and by examining available aerial photography and LIDAR data. Only sites identified by this analysis were then surveyed in the field during the fall/winter pool drawdown. Since the Trego Project is operated in a run-of-river mode that does not conduct seasonal drawdowns, this survey method is not possible at the Project. The Licensee has proposed to evaluate the entire shoreline, and document all erosion sites within the Project rather than just in pre-determined locations. The HDSS study is not necessary to evaluate the Namekagon River downstream of the Project since all inflow is passed downstream of the Project. Project operation does not cause flow fluctuations downstream.

**Definition Stream Survey (HDSS) method** (Trutta, 2019)<sup>2</sup> used in recent FERC hydropower licensing proceedings, which enables mapping, a visual record of stream and shoreline characteristics, and data collection from multiple sensors. For any planned boat surveys of the shoreline (e.g., turtle, cultural resources, vegetation), please reconsider adopting study Method 1 proposed in the NPS shoreline survey study request to systematically evaluate, quantify, and photograph shoreline conditions including streambank conditions, bank stabilization types and conditions, docks/piers, and public access locations.

The Section 7(a) evaluation to evaluate the effects of the proposed operation of the Project on the Wild and Scenic River. NSPW has proposed studies that provide the data that is not already available to assess the impact of the proposed operation of the Project. The question of 4(e) authority for the Project was previously addressed in the issuance of the current license by order dated June 3, 1994.

#### Outstanding Study Requests

Our agency requests that the Licensee reconsider the additional study requests outlined in our April 27, 2021 letter, including the shoreline survey and hydraulics, sedimentation, and channel change. As previously described, the proposed license will require a Section 7(a) evaluation by the NPS under the Wild and Scenic Rivers Act. These studies are necessary to the timely completion of our agency's review. They are also needed to satisfy Section 4(e) of the Federal Power Act, which directs FERC to "give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality." Equal consideration is not possible without adequate information on these important and relevant topics.

#### Conclusion

Thank you for your consideration of our agency's comments as you develop your final study plan. The NPS looks forward to the results of the three studies reviewed in this letter, as well as the opportunity to continue to collaborate with you throughout the licensing process. Please distribute future communications through Lisa Yager, chief of resource stewardship and education at the St. Croix National Scenic Riverway. Information will be distributed to the NPS team as appropriate through Lisa.

If you have any questions about our response, please contact Lisa Yager at [lisa\\_yager@nps.gov](mailto:lisa_yager@nps.gov).

Sincerely,

**CRAIG  
HANSEN**

Craig Hansen  
Superintendent

Digitally signed by  
CRAIG HANSEN  
Date: 2022.03.04  
13:13:56 -06'00'

<sup>2</sup> Trutta Environmental Solutions, *Tallapoosa River High Definition Stream Survey Final Report*, December 2019, included in Alabama Power filing, draft Erosion and Sedimentation Study Report for the R.L. Harris Project under P-2628-065, December 2020. Last accessed 3/31/2021:  
[https://elibrary.ferc.gov/eLibrary/filelist?document\\_id=14850582&accessionnumber=20200410-5091](https://elibrary.ferc.gov/eLibrary/filelist?document_id=14850582&accessionnumber=20200410-5091)

**Hayward and Trego  
Hydroelectric Projects  
FERC Project Nos. 2417 and 2711**

**Recreation Study Plan**

**Prepared for**



**Prepared by**



**December 2021**

## 1. Introduction

Northern States Power Company – Wisconsin (NSPW or Licensee), d/b/a Xcel Energy, currently holds licenses issued by the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the Hayward and Trego Hydroelectric Projects (Projects). The Projects are owned, operated, and maintained by the Licensee. The current licenses, which designate the Projects as FERC Nos. 2417 (Hayward) and 2711 (Trego), expire on November 30, 2025. To obtain subsequent licenses, the Licensee must submit final license applications to FERC no later than November 30, 2023. The final license applications, in part, must include an evaluation of the existing recreational facilities associated with each Project along with proposed recreation enhancements.

On March 11, 2021, the Licensee held a Joint Agency Meeting to present information about the Projects. At the meeting, and during the 60-day comment period immediately following, the Licensee received comments and study requests from several entities. The National Park Service (NPS) and Wisconsin Department of Natural Resources (WDNR) requested a study of recreation facilities and an investigation of recreation enhancements as part of the relicensing process.

NPS requested that the Licensee conduct an inventory of recreation opportunities and facilities including determining recreation demand using field observations, user surveys, and focus groups and estimating recreation needs based on the data gathered.

WDNR requested that the Licensee evaluate current recreational uses, including opportunities for low flow and high flow events, public access, natural scenic beauty, trails, water sports, and fishing, with consideration for the different seasonal uses.

This study plan is consistent with the NPS and WDNR requests.

## 2. Study Plan Elements

### 2.1 Study Goals and Objectives

The objective of this study is to provide a subjective assessment of existing recreation facility conditions as well as recommended enhancements. The study will also determine the capacity of existing facilities to help assess current and future user demand, produce sufficient information to evaluate such impacts, and provide the rationale for recommended recreation enhancements.

### 2.2 Background and Existing Information

Recreation in the vicinity of the Projects is dominated by activity near the Projects' facilities. The existing recreational facilities within the Projects will be evaluated for recreational use and improvements.

The last recreation studies for the Projects were completed in 2020 and filed with FERC on February 24, 2021. The Hayward report indicated that "...the Lake Hayward area offers a sufficient amount of recreational opportunities for both land and water-based activities. The recreational facilities, while limited in number, are in good condition and receive regular maintenance and upgrades when required.

The number and size/capacity of the facilities appear sufficient to accommodate the current amount of use on all but the busiest of days” (NSPW, 2021).

The Trego report indicated that “...the Trego Flowage area offers reasonable opportunities for both water and land-based recreational activities, including opportunities for overnight recreation (i.e., camping, night fishing, etc.). Although the number of recreational facilities is limited, most are in good condition and receive routine maintenance. The number and capacity of the facilities appear sufficient to accommodate current recreational use on all but the busiest days, despite the apparent observed increase in recreational activity related to COVID-19.”

In March 2019, the State of Wisconsin published its Statewide Comprehensive Outdoor Recreation Plan (SCORP) for 2019-2023. The SCORP identifies recreation needs by region rather than specific sites or Project areas.

The SCORP places an emphasis on nature-based recreational opportunities including hiking, fishing, and boating. For both Projects, the Licensee currently provides a carry-in access on the reservoir, a tailrace fishing area downstream of the powerhouse, and a canoe portage that helps fulfill recreation needs. These recreational opportunities are consistent with the SCORP.

## 2.3 Nexus between Project Operations and Effects on Resources

Hydro operations, including fluctuations in reservoir elevation, and insufficient public access can limit recreational opportunities. Adequate information is necessary to determine what impacts may be occurring from hydro operations as well as which recreational opportunities may be enhanced.

## 2.4 Study Area

Since it is believed no additional recreation sites are necessary, the inventory and recreational use study will incorporate the recreation sites listed below in Table 2.4-1.

**Table 2.4-1. Recreation Sites to be Inventoried and Surveyed for Existing Use**

Hayward Canoe Portage Take-Out and Carry-In Reservoir Access
Hayward Canoe Portage Trail and Put-In
Hayward Informal Tailwater Bank Fishing Area
Hayward City Boat Landing
Hayward City Beach & Barrier-Free Fishing Pier
Hayward Bartz’s Bay Informal Ice Fishing Access <sup>1</sup>
Town of Trego Park Boat Landing
Town of Trego Boat Landing
Trego North Tailwater Access (Canoe Portage)
Trego South Tailwater Access

<sup>1</sup> Bartz’s Bay Informal Ice Fishing Access will only be surveyed during the January and February survey periods.

## 2.5 Methodology<sup>2</sup>

### 2.5.1 Recreation Inventory

Each of the recreation sites listed in Table 2.4-1 will be inventoried during the summer using the forms attached as Appendix 1 to collect information on recreation amenities and capacity. The following types of information will be recorded:

- 1) The primary type(s) of recreation provided at the site.
- 2) Existing sanitation facilities (if any).
- 3) Type of vehicle access and parking capacity (if any).
- 4) The presence and type (if any) of barrier-free facilities.
- 5) The GPS location of the facility.
- 6) Signage.
- 7) Photographs of the recreation site, amenities, signage, and entryways to the site from the main road(s), including photographs of any adverse impacts the site may have on environmental resources including shoreline erosion.

### 2.5.2 Facility Condition Assessment

During at least one visit to each of the recreation sites listed in Table 2.4-1, the condition of each amenity or feature (including recreational wayfinding signs and interpretive signs) and its immediate vicinity will be assessed. A rating for each site will be made according to the following scale:

- 1) Missing and Needs Replacement
- 2) Not Usable and Needs Replacement
- 3) Needs Repair
- 4) Needs Maintenance or cleaning
- 5) Good Working Condition (does not need any attention)

If a rating is assigned indicating that additional attention is required, the specific item that needs additional attention will be noted on the form.

### 2.5.3 Recreation Use Survey

Recreation use surveys will be conducted during visits to each of the recreation sites listed in Table 2.4-1. The surveys will last at least one hour per site between the hours of 7:00 a.m. and 7:00 p.m. Surveying will be completed on a rotating schedule to avoid surveys from repeatedly being conducted at the same time of day and will also account for time-of-day use patterns. The recreation use survey form included in Appendix 2 will be administered to users to gather their opinion about the existing recreation facilities and opportunities. The survey will record the number of people in a party, their primary reason for visiting the site, their perception of level of

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<sup>2</sup> Please note: The methodology does not include regional demand assessment or recreation needs assessment. These analyses will be completed as part of the License Application.

use, and their opinions regarding the amount and types of recreation opportunities offered within the proposed Project vicinity. The recreation use surveys will be conducted according to the following schedule in Table 2.5.3-1

**Table 2.5.3-1. Recreation Use Survey Schedule**

<b>Survey Month</b>	<b>Recurrence Interval</b>
January	One randomly selected weekend day and one randomly selected weekday.
February	One randomly selected weekend day and one randomly selected weekday
April	One randomly selected weekend day.
May	One randomly selected weekend day. One day during Memorial Day weekend.
June	One randomly selected weekday. Two randomly selected weekend day.
July	One randomly selected weekday. Two randomly selected weekend day.
August	One randomly selected weekday. Two randomly selected weekend day.
September	One weekend day the weekend following Labor Day weekend.

#### **2.5.4 Spot Counts**

When first arriving at each recreation site where recreation use surveys will be collected, a spot count will be conducted using the recreation use spot count form enclosed in Appendix 3. This information will be statistically analyzed to develop recreational use figures for the Projects. This information will be summarized by season and activity for each type of use in the study report.

#### **2.5.5 Future and Potential Recreation**

To assess future recreation needs within the Project vicinity, the questionnaire enclosed in Appendix 4 will be sent to municipalities and other entities responsible for existing recreation within the Project vicinity. Specifically, the questionnaire will be sent to the City of Hayward, Hayward Area Chamber of Commerce, and Sawyer County for the Hayward Project and the Town of Trego, Trego Lake District, and Washburn County for the Trego Project. It will also be sent to the NPS St. Croix National Scenic Riverway for the Hayward and Trego Projects.

Each entity will be allowed 30 days to respond to the questionnaire and their responses will be incorporated into the license application. The type of maps of the recreation sites that will be included in the questionnaires have been included in Appendix 5.

## **2.6 Consistency with Generally Accepted Scientific Practice**

The overall design of the recreational survey is similar to that commonly used in relicensing proceedings and is consistent with generally accepted methods for recreation studies.

## 2.7 Project Schedule and Deliverables

NSPW anticipates that field work will begin in January 2022 (for winter surveys) and be completed by mid-September. The study results will be incorporated into a draft report by October 31, 2022. A final report is expected to be completed by January 31, 2023.

## 3. Consultation

The Recreation study was requested by the NPS and WDNR. As a result, the Licensee consulted with the NPS and WDNR on the study plan as discussed in the following sections.

### 3.1 National Park Service

On November 5, 2021, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Recreation Study Plan to the NPS for comment. Comments were received from the NPS on December 4, 2021. NSP made the changes requested by the NPS except for the following:

- 1) NSP did not mention the fact that the Town of Trego Boat Landing is not within the proposed Project boundary because there is no discussion in the plan about the Project boundary.
- 2) NSP changed the reference in the text and form from “Facility Lacking; need to install facility or otherwise add enhancement (identify item).” to “Missing-Needs Replacement” because the inventory and condition assessment is not designed to provide input on what amenities should be added. It is intended to determine what amenities are present, the condition or if they are missing.
- 3) NSP changed the form in Appendix 2 to insert the text regarding a “40 to 50-year license.”
- 4) NSP did not include the following language in Appendix 2: “to be included in the license” because not all recommendations automatically become part of the license.
- 5) NSP added a blank line to allow the interviewee to specify the reason for “Unsatisfactory facilities or conditions of land or water” to Appendix 2.

All Documentation of Consultation is included in Appendix 6.

### 3.2 Wisconsin Department of Natural Resources

On November 5, 2021, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Recreation Study Plan to the WDNR for comment. The WDNR did not respond with comments. Documentation of Consultation is included in Appendix 6.

## 4. References

EA Engineering. 2021a. Recreation Report for the Hayward Hydroelectric Project (FERC Project No. 2417). February 2021.

EA Engineering. 2021b. Recreation Report for the Trego Hydroelectric Project (FERC Project No. 2417). February 2021.

## **Appendix 1 – Recreation Site Inventory Form**

Recreation Inventory and Condition Assessment												
Location:								Date:				
Hayward Hydroelectric Project P-2417												
Survey Person:												
GPS Location:												
Amenity Photo Numbers:												
Shoreline Photo Numbers:												
Entryway Photo Number:												
Type of Amenity:		Quantity of Amenities:		Condition of Amenity:				Notes:	Barrier Free? (Y or N)			
				-Missing-Needs Replacement (NR) -Not Usable (N) -Needs Repair (R) -Needs Maintenance (M) -Good Working Condition (G)								
Boat Launch		Lanes: 1	Launches: 1	NR	N	R	M	G				
Scenic Overlook				NR	N	R	M	G				
Tailwater Access				NR	N	R	M	G				
Restroom				NR	N	R	M	G				
Trash Receptacles				NR	N	R	M	G	NA			
Other (picnic units, informal trails, camping, etc.)				NR	N	R	M	G				
Parking		No. Spaces (each type):		Trailer:				Condition:	Notes:			
		Standard:	Barrier-Free:							Other (specify):		
								N	R	M	G	Gravel?
Signage:		Number:		Condition:				Comments: Provide Details on which signs need attention.				
FERC Project Sign				NR	N	R	M	G				
Regulations Signs				NR	N	R	M	G				
Directional				NR	N	R	M	G				
Interpretive				NR	N	R	M	G				
Additional Comments:												
Describe any signs of overuse or anything observed that is not already documented above.												

Recreation Inventory and Condition Assessment											
Location:										Date:	
Trego Hydroelectric Project P-2711											
Survey Person:											
GPS Location:											
Amenity Photo Numbers:											
Shoreline Photo Numbers:											
Entryway Photo Number:											
<b>Type of Amenity:</b>		<b>Quantity of Amenities:</b>		<b>Condition of Amenity:</b>				<b>Notes:</b>		<b>Barrier Free? (Y or N)</b>	
				-Missing-Needs Replacement (NR)							
				-Not Usable (N)							
				-Needs Repair (R)							
				-Needs Maintenance (M)							
		Lanes: 1		-Good Working Condition (G)							
Boat Launch		Launches: 1		NR N R M G							
Scenic Overlook				NR N R M G							
Tailwater Access				NR N R M G							
Restroom				NR N R M G							
Trash Receptacles				NR N R M G						NA	
Other (picnic units, informal trails, camping, etc.)				NR N R M G							
<b>Parking</b>		<b>No. Spaces (each type):</b>		<b>Condition:</b>				<b>Notes:</b>			
		Standard:		Barrier-Free:		Trailer:		Other (specify):		N R M G Gravel?	
<b>Signage:</b>		<b>Number:</b>		<b>Comments: Provide Details on which signs need attention.</b>							
FERC Project Sign		NR N R M G									
Regulations Signs		NR N R M G									
Directional		NR N R M G									
Interpretive		NR N R M G									
<b>Additional Comments:</b>											
Describe any signs of overuse or anything observed that is not already documented above.											

## **Appendix 2 – Recreation Use Survey Form**

**ON-SITE/IN-PERSON RECREATION INTERVIEW****Hayward & Trego Hydroelectric Projects (FERC Nos. 2417 and 2711)****NPS Recreation Survey Questionnaire**

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is in the process of applying for subsequent 40 to 50-year licenses from the Federal Energy Regulatory Commission (FERC) to continue to operate and maintain the existing Hayward and Trego Hydroelectric Projects (Project or Projects). The Projects are owned, operated, and maintained by NSPW. To obtain a license for the Projects, NSPW must submit a final license application to FERC no later than November 30, 2023. As part of the relicensing process, NSPW is conducting several environmental studies which will enable FERC to prepare an environmental report. The purpose of this survey is to collect information about recreational use and visitors' experiences at public recreation facilities around the Hayward and Trego Project reservoirs so that we may better assess existing and future recreational.

1. Check the box on the location where you received this survey:

Hayward Project:

- ☐ Hayward Canoe Portage Take-out and Carry-In Access
- ☐ Hayward Canoe Portage Trail and Put-in
- ☐ Informal Tailwater Bank Fishing Access
- ☐ City of Hayward Boat Landing
- ☐ City of Hayward Beach/Fishing Pier
- ☐ Bartz's Bay Informal Ice Fishing Access

Trego Project:

- ☐ Town of Trego Park Boat Landing
- ☐ Town of Trego Boat Landing
- ☐ Trego North Tailwater Access/Canoe Portage
- ☐ Trego South Tailwater Access

2. Below is a list of activities available. Please indicate:

(A) Which of these activities have you participated in **on your current visit** to the area.

(B) Which **ONE** of these activities is your **PRIMARY ACTIVITY** on this trip to the area?

ACTIVITY	(A) Participated in <u>ON THIS TRIP</u> (Check <u>all</u> that apply)	(B) PRIMARY ACTIVITY (Check <u>only one</u> )
Shoreline/tailwater fishing		
Fishing from a boat		
Motorized boating		
Non-motorized boating		
Swimming		
Picnicking		
Wildlife Viewing		
Ice Fishing		
Other (specify)		

3. (A): Were there any activities that you and your group wanted to do on this visit to (AREA) that you were not able to?

☐ YES ☐ NO

(B): If YES: What was it? \_\_\_\_\_

(C): Which of the following reasons, if any, explain why you did not engage in the activity?

- ☐ Rules or regulations did not allow for activity
- ☐ Area was temporarily closed to the public
- ☐ Not enough time
- ☐ Safety concerns
- ☐ Not enough information about the activity
- ☐ Too crowded
- ☐ Difficult road or trail access
- ☐ No road or trail access
- ☐ Unsatisfactory facilities or conditions of land or water (please specify) \_\_\_\_\_
- ☐ Resource damage due to overuse
- ☐ No facilities or services
- ☐ Bad weather
- ☐ Flooding or other natural hazard
- ☐ Other (please specify) \_\_\_\_\_

4. Does anyone in your personal group have a physical condition or personal limitation that made it difficult to access or participate in [site] activities or services?

☐ YES ☐ NO

If YES, on this visit what activities or services did the person(s) have difficulty accessing or participating in?

(Please describe): \_\_\_\_\_

5. (A) How crowded did you feel while recreating at these locations today at this recreation facility/reservoir?

[Select one number for each or indicate it was not applicable to your visit.]

LOCATION / AREA	Not at all crowded	Slightly crowded	Moderately crowded	Very crowded	Extremely crowded	Not applicable
In parking areas	1	2	3	4	5	<input type="checkbox"/>
On the trails	1	2	3	4	5	<input type="checkbox"/>
At a developed campground	1	2	3	4	5	<input type="checkbox"/>
At a boat-in campsite	1	2	3	4	5	<input type="checkbox"/>
While fishing from the shoreline	1	2	3	4	5	<input type="checkbox"/>
While boating/fishing from a boat	1	2	3	4	5	<input type="checkbox"/>

(B) If you felt crowded, did you modify your recreation plans because you felt crowded?

☐ YES ☐ NO

(C) If YES, what did you do?

- ☐ Moved to a new location
- ☐ Changed the time of day
- ☐ Changed your activity
- ☐ Chose not to recreate
- ☐ Continued with current plans
- ☐ Other: \_\_\_\_\_

## 6. During the planning process for your visit, how did the possibility of crowds affect your trip plans?

(Please select one response)

- ☐ It did not affect my plans
- ☐ I visited at a time of day I thought would be less crowded
- ☐ I visited on a day of the week I thought would be less crowded
- ☐ I avoided places here I thought would be crowded today
- ☐ Other (please specify) \_\_\_\_\_

## 7. Did the actions or behavior of any other group or individual interfere with your enjoyment on this trip?

- ☐ YES ☐ NO

If yes, what type of group or person interfered with your enjoyment on this trip?

Group/Person	Reason(s)		
	Proximity	Loudness	Other (please specify)
Motorized boaters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Non-motorized watercraft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vehicles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## 8. How satisfied were you with the following amenities at this recreation facility/reservoir today.

**Important:** Please only circle a number for the items **that you used during your current visit** to this specific recreation facility/reservoir. Also, please **check** the "Did Not Use" box, if you did not use the item or it does not exist at the specific recreation facility.

		Very Satisfied	Satisfied	Neither	Dissatisfied	Very Dissatisfied	Did Not Use	If you were dissatisfied for any reason, please explain why:
	Restroom	1	2	3	4	5	<input type="checkbox"/>	
	Picnic sites	1	2	3	4	5	<input type="checkbox"/>	
	Trash receptacles	1	2	3	4	5	<input type="checkbox"/>	
	Vehicle parking areas	1	2	3	4	5	<input type="checkbox"/>	
	Boat launch parking area	1	2	3	4	5	<input type="checkbox"/>	
	Boat launch	1	2	3	4	5	<input type="checkbox"/>	
	Boat dock	1	2	3	4	5	<input type="checkbox"/>	
	Other:	1	2	3	4	5	<input type="checkbox"/>	
	Roads to facility	1	2	3	4	5	<input type="checkbox"/>	
	Signage to the facility	1	2	3	4	5	<input type="checkbox"/>	
	Signage within the facility	1	2	3	4	5	<input type="checkbox"/>	
	Other:	1	2	3	4	5	<input type="checkbox"/>	

## 9. How did you obtain information to plan your current trip? (Please select all that apply)

- |  |   |
|--|---|
| <input type="checkbox"/> Federal or State website          | <input type="checkbox"/> Word of mouth                                |
| <input type="checkbox"/> City, local, or municipal website | <input type="checkbox"/> Social media (e.g., Facebook, Twitter, etc.) |
| <input type="checkbox"/> Xcel website                      | <input type="checkbox"/> Travel guides and tour books                 |
| <input type="checkbox"/> Other websites                    | <input type="checkbox"/> Newspaper/magazine article                   |
| <input type="checkbox"/> Maps, brochures, pamphlets        | <input type="checkbox"/> Radio/TV broadcasts                          |
| <input type="checkbox"/> Visitor bureaus/centers           | <input type="checkbox"/> Other (specify): _____                       |
| <input type="checkbox"/> Previous visits                   |   |

What is the ZIP code where you live or country if not in the United States?

ZIP code: \_\_\_\_\_ or, country (if not the United States): \_\_\_\_\_

What is your age: \_\_\_\_\_

What is your gender? ☐ Male ☐ Female ☐ Non-binary

Which of these categories best indicates your race and ethnicity? Answer only for yourself.

Please select one or more.

- |  |   |                                     |
|--|---|-------------------------------------|
| <input type="checkbox"/> American Indian/Alaskan       | <input type="checkbox"/> Asian                  | <input type="checkbox"/> White      |
| <input type="checkbox"/> Native Hawaiian/other Pacific | <input type="checkbox"/> Hispanic or Latino     | <input type="checkbox"/> Don't know |
| <input type="checkbox"/> Black/African-American        | <input type="checkbox"/> Not Hispanic or Latino |                                     |

Please let us know if you have any additional comments regarding your recreation experience during your visit:  
(contact information)

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## **Appendix 3 – Recreation Use Spot Count Form**

Recreation Observation (Spot Count) Form											
Date:		Time:									
Hayward Project P-2417											
Survey Person:		Wind Speed:		Recreation Activities				Note: Please list primary activity by placing a "P" in the box. Use and "S" for secondary activities.		Notes	
Temperature:											
		Weather:		Number of People		Shoreline Fishing		Boat Fishing		Swimming	
						Hiking/Walking/Jogging		Bicycling		Picnicking	
						Bird Watching		Wildlife Viewing		Non-Powered Boating	
						Power Boating		ATV/Snowmobile		Other (specify)	
Recreation Site											
Canoe Portage Take-Out & Carry-In Reservoir Access											
Canoe Portage Trail and Put-In											
Informal Tailwater Bank Fishing Area											
Hayward City Boat Landing											
Hayward City Beach/Barrier-Free Fishing Pier											
Bartz's Bay Informal Ice Fishing Access (Jan & Feb only)											
Additional Comments:											

Recreation Observation (Spot Count) Form															
Date:	Time:														
Trego Project P-2711															
Survey Person:															
Temperature:	Weather:		Wind Speed:		<small>Note: Please list primary activity by placing a "p" in the box. Use and "s" for secondary activities.</small>										
		Number of People	Recreation Activities							Notes					
			Shoreline Fishing	Boat Fishing	Swimming	Hiking/Walking/Logging	Bicycling	Picnicking	Bird Watching		Wildlife Viewing	Non-Powered Boating	Power Boating	ATV/Snowmobile	Other (specify)
Additional Comments:															

## **Appendix 4 – Future and Potential Recreation Questionnaire**



Hayward and Trego Hydroelectric Project s– FERC Project Nos. 2417 & 2711  
Namekagon River- Sawyer and Washburn County, Wisconsin  
Future and Potential Recreation Questionnaire

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is in the process of relicensing the Hayward and Trego Hydroelectric projects (Projects) located on the Namekagon River in Sawyer and Washburn Counties, respectively. The Projects are owned, operated, and maintained by NSPW and currently operate under licenses issued by the Federal Energy Regulatory Commission (FERC). In order to continue to operate and maintain the Projects, NSPW must apply for subsequent licenses from the FERC. A final license application must be submitted to FERC no later than November 30, 2023. As part of the relicensing process, NSPW is gathering information about potential recreation needs in the vicinity of Projects.

The Hayward Project vicinity is defined as the area within ¼ mile of the shoreline between ½ mile downstream and 2 ½ miles upstream of the Hayward Dam. The Trego Project vicinity is defined as the area within ¼ mile of the shoreline between ½ mile downstream and 5 ¾ mile upstream of the Trego Dam.

If you have any questions, please contact Matthew Miller at [matthew.j.miller@xcelenergy.com](mailto:matthew.j.miller@xcelenergy.com) or 715-737-1353.

1. Information about person completing the questionnaire:

Name & Title: \_\_\_\_\_  
Organization: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_  
Phone: \_\_\_\_\_  
Email Address: \_\_\_\_\_

2. Is your organization responsible for or interested in recreation sites, amenities, formal access sites, or planning for recreation sites within the Project vicinity as defined above?

☐ Yes *(Please proceed to 2a below)* ☐ No *(No additional information is needed and thank you for your input)*

- a. Please describe your primary function pertaining to recreation and list any recreation sites or access sites (formal or informal) in the Project vicinity you are responsible for or have interest in the space provided below: *(Additional information may be provided on the final sheet of this questionnaire.)*

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Please proceed to question 2b on the next page.



Hayward and Trego Hydroelectric Project s– FERC Project Nos. 2417 & 2711  
Namekagon River- Sawyer and Washburn County, Wisconsin  
Future and Potential Recreation Questionnaire

- b. Please list all recreation amenities available at each recreation site or access site you manage or have an interest in (e.g. docks, restrooms, parking areas, interpretive signage, picnic tables, trails, etc.) below: *(Additional information may be provided on the final sheet of this questionnaire.)*

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- c. Please provide the location of each site listed above using a the enclosed map, street address, or GPS location: *(Additional information may be provided on the final sheet of this questionnaire.)*

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- d. Have any of the sites or amenities listed in 2a and 2b exceeded capacity or not had sufficient parking? *(Additional information may be provided on the final sheet of this questionnaire.)*

☐ Yes *(Please list location, amenity and when capacity is exceeded.)* ☐ No

**Recreation Site/Amenity**

**Event(s) Exceeding Capacity**

<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>

Please proceed to question 2e on the next page.



Hayward and Trego Hydroelectric Project s– FERC Project Nos. 2417 & 2711  
Namekagon River- Sawyer and Washburn County, Wisconsin  
Future and Potential Recreation Questionnaire

- e. Do you have any planned improvements for the recreation sites listed in 2a and amenities listed in 2b or any plans for development of new recreation sites? *(Additional information may be provided on the final sheet of this questionnaire.)*

☐ Yes *(Please list location, planned improvement, and anticipated opening date below.)*

☐ No

**Planned Improvements/Locations**

**Anticipated Opening Date**


- f. Do you believe additional recreation sites/amenities are needed, or any enhancements are needed at existing recreation sites, within the Project vicinity? *(Additional information may be provided on the final sheet of this questionnaire.)*

☐ Yes *(Please list reasoning below.)*

☐ No

**Additional Recreation Sites/Amenities Reasoning**


- g. Please indicate if there is a specific representative you wish to designate as a follow-up contact to be used by Xcel Energy or their representative *(Additional information may be provided on the final sheet of this questionnaire.)*

**Representative Contact Information**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_



Hayward and Trego Hydroelectric Project s– FERC Project Nos. 2417 & 2711  
Namekagon River- Sawyer and Washburn County, Wisconsin  
Future and Potential Recreation Questionnaire

## Additional Information or Comments:

***(Please indicate applicable section)***

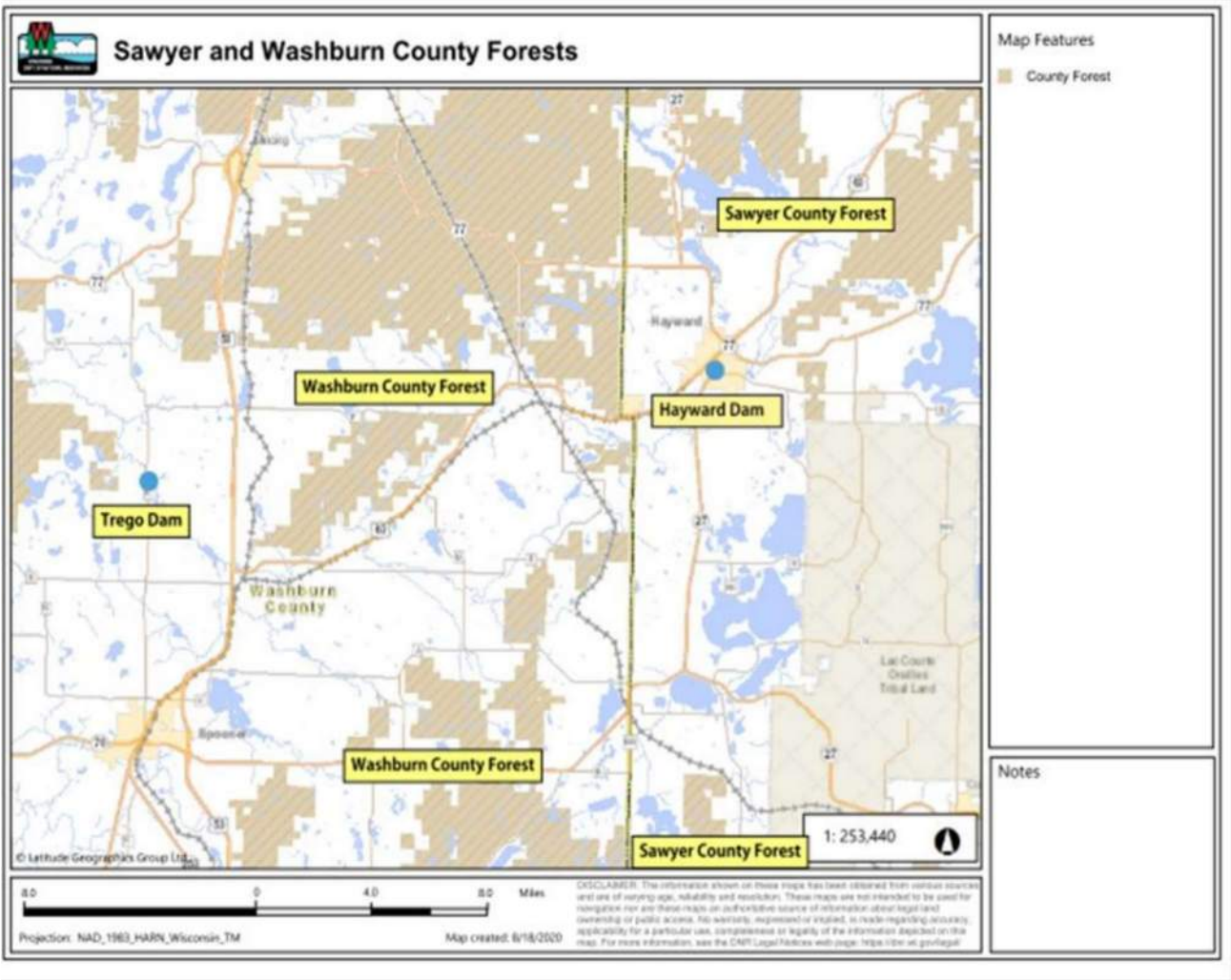
This image shows a full page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, leaving small margins at the top and bottom. There are no vertical margin lines, text, or other markings on the page.

**Please return this questionnaire to Xcel Energy in the enclosed self-addressed, stamped envelope or via email at the email address below within 30 days of receipt** to allow for follow-up contact by Xcel or Xcel's representative, if needed. *Not responding within 30 days will indicate you or your agency are not aware of any relevant information regarding potential recreation needs in the vicinity of the Hayward or Trego Hydroelectric Projects.*

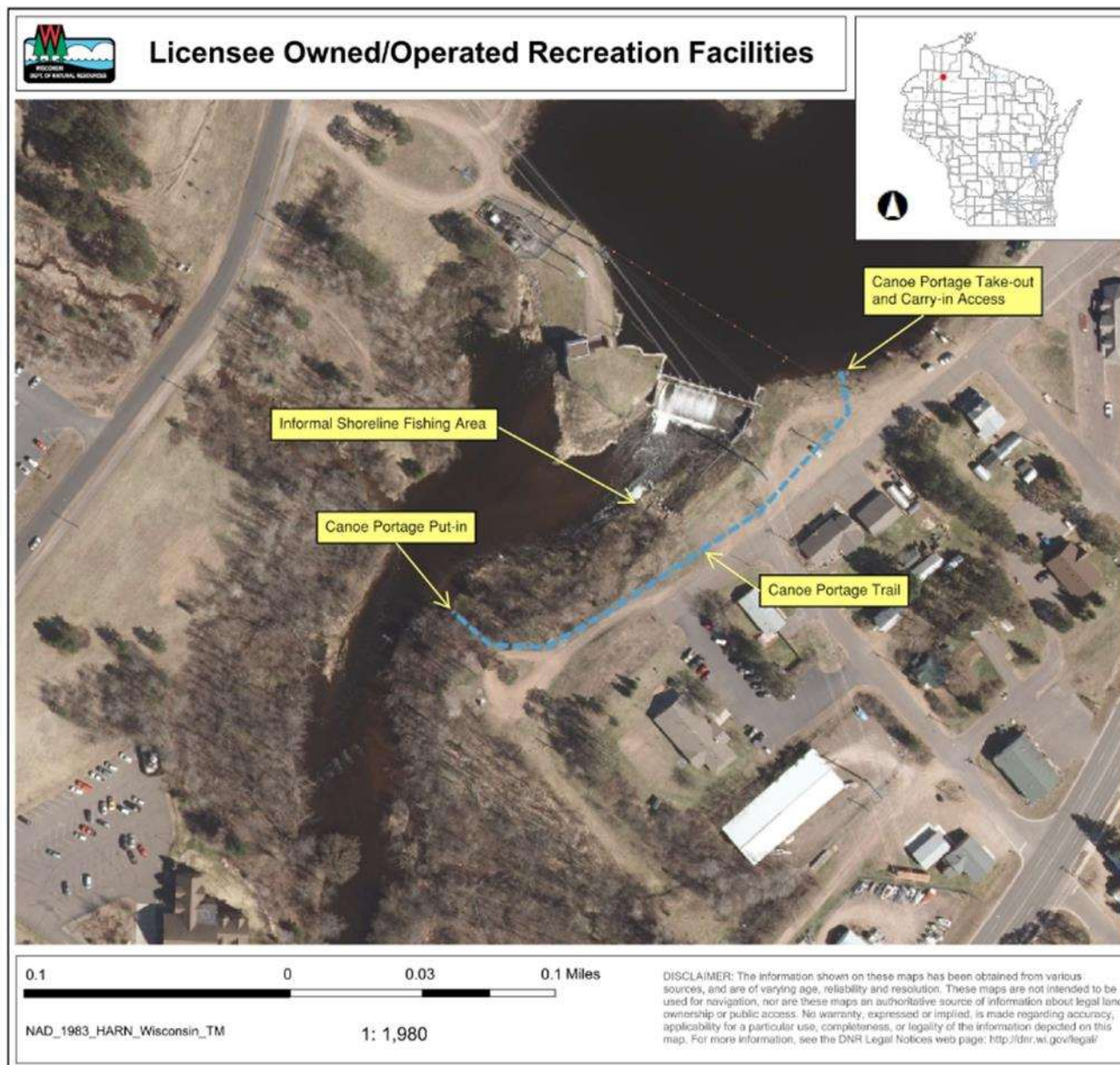
**Comments, questions, and/or this completed questionnaire may also be sent via email to:**

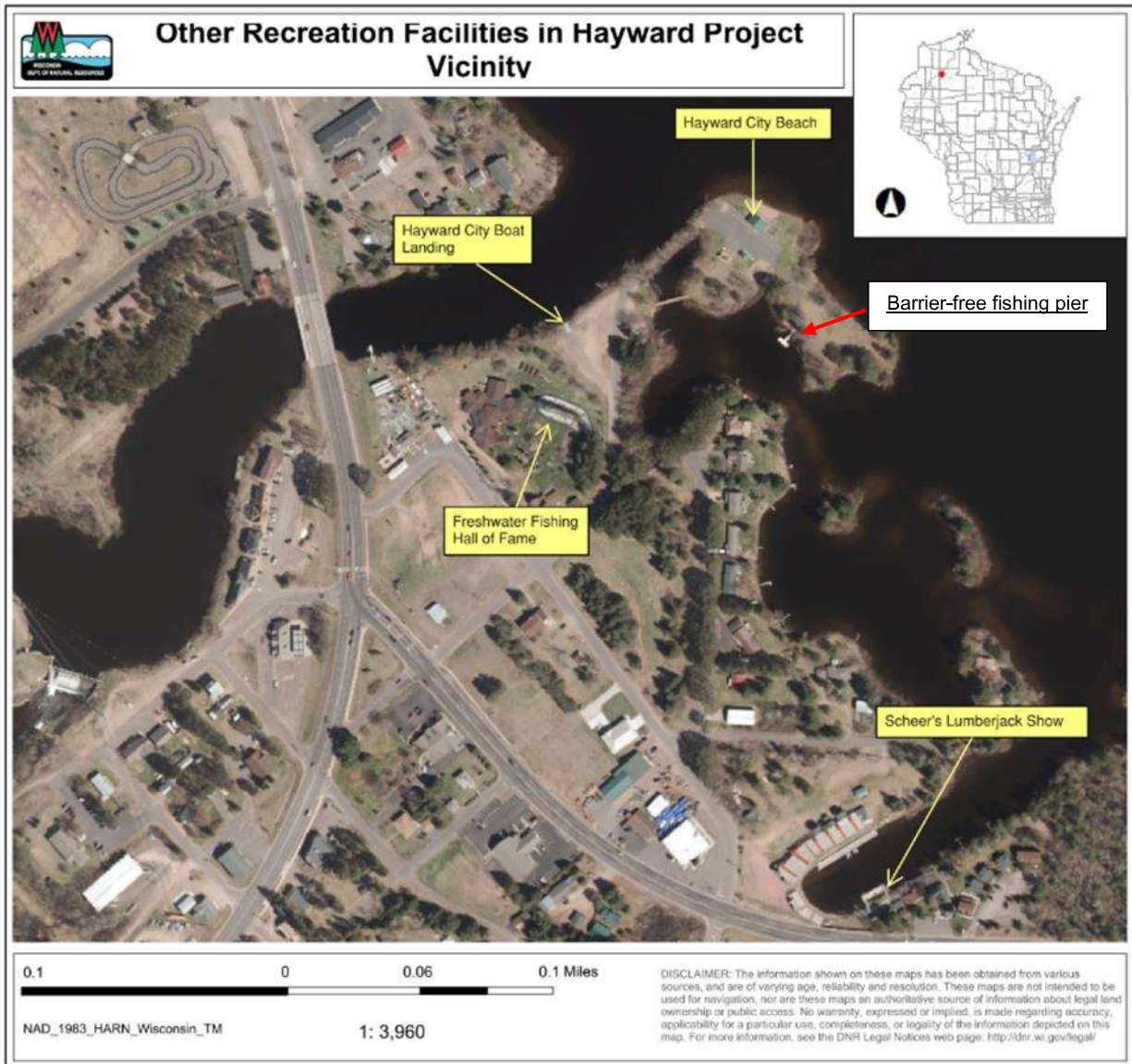
**Matthew.J.Miller@XcelEnergy.com**

## **Appendix 5 – Maps of Recreation Sites**

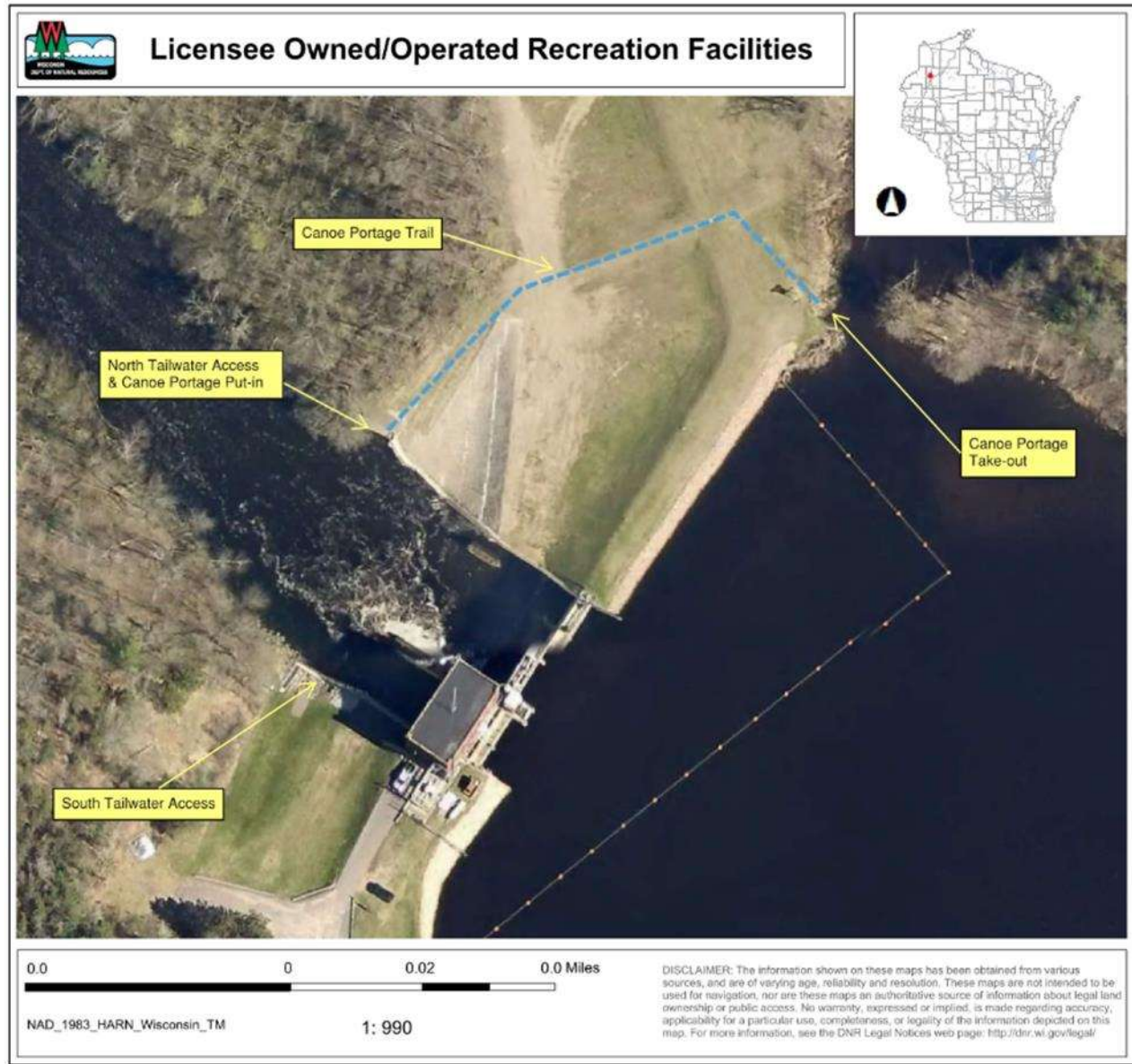


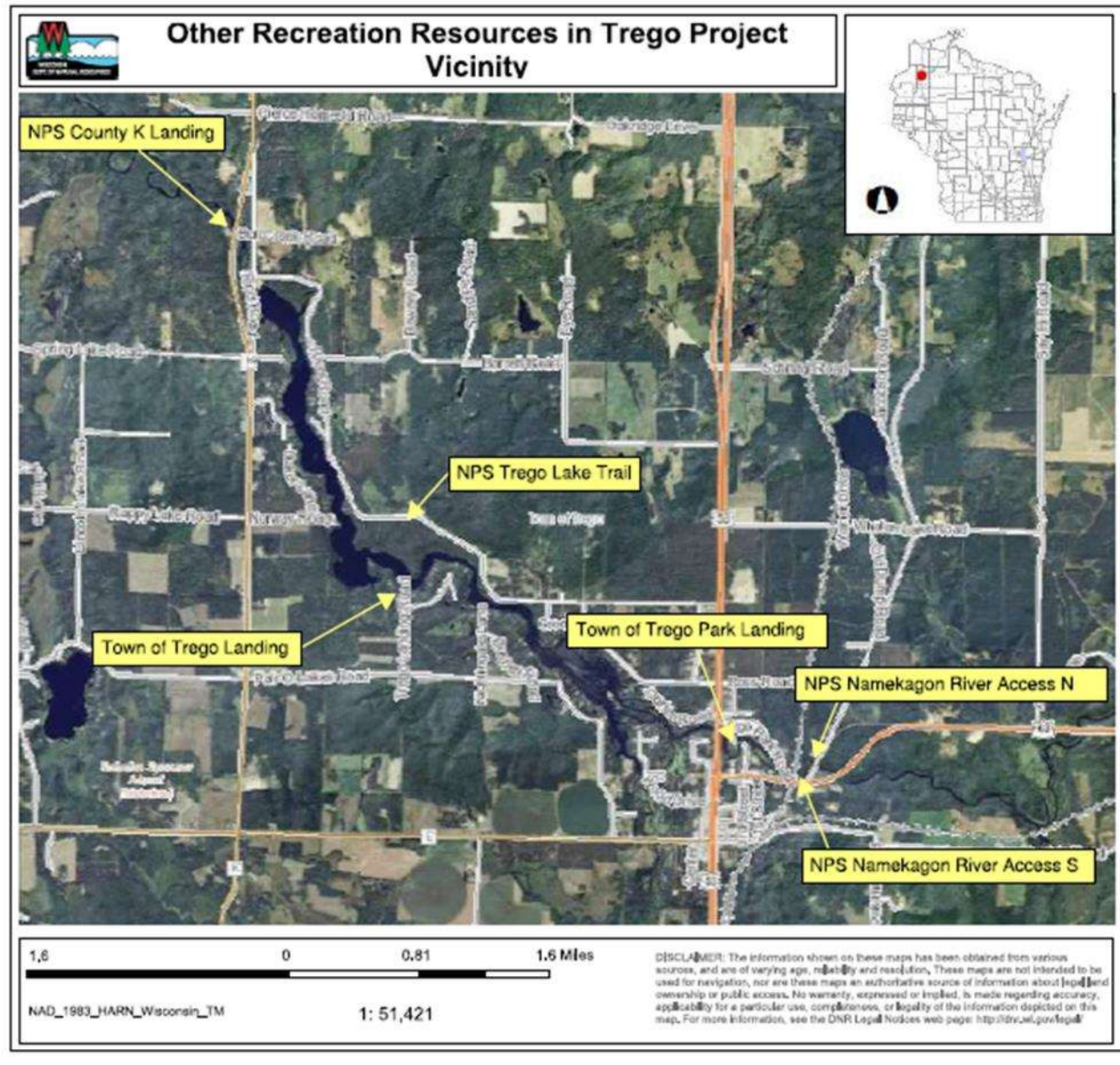
## Hayward Hydroelectric Project





# Trego Hydroelectric Project





## **Appendix 6 – Documentation of Consultation**

**The Wisconsin Department of Natural Resources did not respond with comments.**



## United States Department of the Interior

National Park Service  
St. Croix National Scenic Riverway  
401 N. Hamilton Street  
St. Croix Falls, Wisconsin 54024



IN REPLY REFER TO:  
L.A.1

December 3, 2021

Mr. Shawn Puzen  
Mead & Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: Hayward and Trego Hydroelectric Projects Draft Recreation Study Plan, FERC Nos. p-2417 and p-2711, Namekagon River

Dear Mr. Puzen:

The National Park Service (NPS) appreciates the opportunity to provide comments on the *Hayward and Trego Hydroelectric Projects Draft Recreation Study Plan* prepared by Mead & Hunt for Xcel Energy. The Recreation Study Plan is being developed for the Hayward and Trego hydroelectric projects, hereinafter (Projects), on the Namekagon River within the St. Croix National Scenic Riverway that is administered by the NPS. We received this proposed study plan by email dated November 5<sup>th</sup>, 2021. We understand that you will review and address these comments prior to study plan execution starting in January 2021.

### 1. Introduction

We concur and are pleased that this study plan is mostly consistent with the study request delineation and guidance the NPS submitted to Mead and Hunt on April 27, 2021. We offer the following comments to further enhance the study plan and survey instruments.

### 2. Study Plan Elements

#### 2.1 Study Goals and Objectives

We concur that the objectives of this study include 1) provision of a subjective assessment of existing recreation facility conditions as well as recommended enhancements; and 2) determination of the capacity of existing facilities to help assess current and future user demand, produce sufficient information to evaluate such impacts, and provide the rationale for recommended recreation enhancements.

#### 2.2 Background and Existing Information

We are pleased that the study plan allows for evaluation of the existing recreational facilities within the Projects for recreational use and improvements. These study plans address our April 27<sup>th</sup>, 2021, comment letter in which we disagreed with the findings in the Projects' recreation study reports completed in 2020 that "The number and size/capacity of the facilities appear

sufficient to accommodate the current amount of use on all but the busiest of days.” (NSPW, 2021)

We note in the draft study plan a statement that “In March 2019, the State of Wisconsin published its Statewide Comprehensive Outdoor Recreation Plan (SCORP) for 2019-2023. The SCORP did not identify any specific recreation needs in the immediate vicinity of the Projects.” The SCORPS, by definition, do not identify specific recreation needs in immediate vicinities of specific targeted areas such as these Projects. We suggest deleting this sentence or clarifying by inserting the following:

The SCORP identifies recreation needs by region rather than specific sites or project areas.

### **2.3 Nexus between Project Operations and Effects on Resources**

We are pleased to see a discussion of hydro operations and insufficient public access noted in this section as well as the need for adequate information about impacts. In addition to highlighting fluctuations in reservoir elevation, it is also necessary to consider water depths. Additional studies recommended by the NPS about bathymetry and sedimentation will help inform this nexus. We look forward to reviewing your other study plans and how the results will be integrated with recreational issues.

### **2.4 Study Area**

We recommend revising the first sentence in this section as follows:

The need for additional recreation sites and/or enhancements are not clear given the problematic informal ice fishing on Hayward Lake’s Bartz’s Bay and recent closure of two access areas in the upstream area of the Trego Flowage. These closures may cause additional demand on existing sites within the project area. The inventory and recreational use study will incorporate the recreation sites listed below in Table 2.4-1.

We are pleased to see inclusion of each site the NPS recommended for study including the Town of Trego Park Boat Landing and the Informal Ice Fishing Access site at Bartz’s Bay. We concur that the Bartz’s Bay site need only be surveyed during the January and February survey periods to capture ice fishing activity.

The proposed Recreation Study Plan and the resultant Recreation Study Report should state that the Town of Trego Park Boat Landing on the headwaters of Trego Lake would be omitted from Trego’s revised project boundaries if Xcel’s proposed project boundaries were approved.

### **2.5 Methodology**

#### **2.5.1 Recreation Inventory**

We are pleased that the Recreation Site Inventory Form (Appendix 1) includes all amenity types we recommended. In the interest of consistency, please add “signage” to the list of items to be inventoried under this section since signage is included on the inventory form in the Appendix.

### 2.5.2 Facility Condition Assessment

We concur with your rating categories (see below) to evaluate condition of each site and documentation of the need for further attention (enhancement) to the facility if warranted.

1) Not Usable and Needs Replacement 2) Needs Repair 3) Needs Maintenance or cleaning 4) Good Working Condition (does not need any attention) 5) Facility Lacking; need to install facility or otherwise add enhancement (identify item).

We note an inconsistency between the list provided in the text above and the list on the forms found in Appendix 1. The latter lacks item Number 5, “Facility Lacking; need to install facility or otherwise add enhancement (identify item).” We recommend that Number 5 be restored to the list of the other four condition types on the forms under both “Type of Amenity” and “Signage.” This option, for example, would be essential for evaluating Hayward’s Bartz’s Bay Informal Ice Fishing Access and identifying if other amenities, including signage, exist.

### 2.5.3 Recreation Use Survey

We are generally pleased with the sampling days per site during the peak season and appreciate inclusion of our suggestion to include measures to balance timing of interviews. We are concerned that one weekend day a month does not adequately cover the non-peak season use and recommend that at least two sampling days, one weekday and one weekend, be included per month at each surveyed site.

In addition, we are pleased that the Recreation Use Survey Interview Form (Appendix 2) is almost verbatim with the one NPS included in our study request. We suggest a few revisions. So that interviewees may fully understand the importance of providing input, please insert the following clarifying language into the introductory paragraph of the survey form:

First sentence: rephrase to read “Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is in the process of applying for *40-year* subsequent licenses...” (Italics indicate inserted text.)

Last sentence: rephrase to read “The purpose of this survey is to collect information about recreational use and visitors’ experiences at public recreation facilities around the Hayward and Trego Project reservoirs *so that we may better assess existing and future recreational needs to be included in the licenses.*” (Italics indicate inserted text.)

Under Question 2 insert among the list of activities “Ice fishing.”

Revise the ninth response option under Question 3.(C) “Which of the following reasons, if any, explain why you did not engage in the activity?” The ninth item currently states “Unsatisfactory

conditions or facilities.” We recommend revising this response to read “Unsatisfactory *facilities or conditions of land or water* (for example, navigability upon launching).” (Italics indicate inserted or reordered text.)

To provide a more amenable interview experience, we suggest following the order of questions recommended in our study guidance and returning the section regarding interviewee’s demographic details (zip code/country of origin; age; gender; ethnicity; additional comments question) to the end of the interview after item Number 9. This ordering of items allows initial focus on site specifics such as location, recreational use, etc., rather than a person’s demographics.

#### **2.5.4 Recreation Use Spot Count**

We appreciate the thoroughness of the Spot Count Form (Appendix 3) and recommend one change, moving “ATV/snowmobiling” next to “motorboating” so that motorized use is grouped together.

#### **2.5.5 Future and Potential Recreation**

We concur with the list of entities to which this questionnaire will be sent, including Trego Lake District. Please include the National Park Service St. Croix National Scenic Riverway in your list of recipients for both Hayward and Trego projects.

We recommend using the same introductory paragraph, including our suggested edits, found on the Recreation Use Survey Form (Section 2.5.3, above) as an introductory paragraph for the Future and Potential Recreation Questionnaire (Appendix 4). This would help readers understand the importance and context of the questionnaire.

We recommend adding to the questionnaire a map of each project with physical landmarks such as roads and recreation facilities so that participants are better able to focus their comments. In addition, respondents would be able to comply with one of the options for providing site location listed in Question 2.c., “Please provide the location of each site listed above using a map...”

As written, the questionnaire is targeted solely at land managing entities. However, this excludes important partners that help manage resources and/or have extensive knowledge about recreation use, trends, and potential enhancements. We recommend rewording questions to better suit the target audience. For example, Question 2 would read “Is your organization responsible for *or interested in* recreation sites, amenities, ....” (Italics indicate inserted text.)

We recommend editing Question 2.f. so that respondents can suggest enhancements to an existing amenity, “Do you believe additional recreation sites/amenities are needed *or are any enhancements needed at existing* recreation sites/amenities within the Project vicinity? (Additional information may be provided on the final sheet of this questionnaire.) ...”

We recommend rewording the directions for returning completed questionnaires to “Please return this questionnaire to Xcel Energy in the enclosed self-addressed, stamped envelope *or via*

*email at the email address below* within 30 days of receipt to allow for follow-up contact by Xcel or Xcel's representative, if needed." (Italics indicate inserted text.)

Lastly, we disagree with the conclusion found in Footnote 3, page 4, of this section that a separate Recreation Study Report is not necessary. While including all proposed mitigation and enhancement measures in the body of the license application provides a succinct summary, a separate Recreation Study Report provides a comprehensive review of the study plan, survey instruments, data, analysis, and resultant proposed mitigation and enhancement measures. Such a report is invaluable in providing clear access to the information above not only for license application review but also for review and use during the life of the license.

### **Conclusion**

Thank you for your consideration of these additional comments as you develop your final study plan. The NPS looks forward to the results of this study as well as the opportunity to continue to collaborate with you throughout the licensing process. If you have any questions about our response, please contact Susan Rosebrough at [susan\\_rosebrough@nps.gov](mailto:susan_rosebrough@nps.gov) or (206) 220-4121.

Sincerely,

**THERESA  
HOGAN**

Theresa L. Hogan  
Acting Superintendent

Digitally signed by THERESA  
HOGAN  
Date: 2021.12.04 09:06:56  
-06'00'

**Shawn Puzen**

---

**From:** Shawn Puzen  
**Sent:** Friday, November 5, 2021 8:07 AM  
**To:** angietomes@gmail.com; cheryl.laatsch@wisconsin.gov  
**Cc:** Darrin Johnson; Miller, Matthew J; Crotty, Scott A; Maurer, Brey J; Shawn Puzen  
**Subject:** Draft Hayward-Trego Recreation Study Plan for your Review  
**Attachments:** 20211104 Draft Hayward-Trego Recreation Use Study Plan Complete.pdf

Good Morning,

Attached for your review is the proposed Recreation Study Plan.

We are sending this study plan for your review right now because it requires the surveys to begin in January of 2022. Therefore, we need to move this plan through the review ahead of the other plans.

Please provide your comments as soon as possible, but no later than December 5, 2021.

Please do not hesitate to contact me if you have any questions.

Thanks,

---

**SHAWN PUZEN**

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt

Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



120 YEARS OF SHAPING THE FUTURE

# Agency Version

Maynard and Frog  
Hydroelectric Projects  
FERC Nos. 2417 and 2711

**Draft Study Plan**

**Recreation Study**

**Prepared for**



**Prepared by**



**November 2021**

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## **1. Introduction**

Northern States Power Company – Wisconsin (NSPW or Licensee), d/b/a Xcel Energy, currently holds licenses issued by the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the Hayward and Trego Hydroelectric Projects (Projects). The Projects are owned, operated, and maintained by the Licensee. The current licenses, which designate the Projects as FERC Nos. 2417 (Hayward) and 2711 (Trego), expire on November 30, 2025. To obtain subsequent licenses, the Licensee must submit final license applications to FERC no later than November 30, 2023. The final license applications, in part, must include an evaluation of the existing recreational facilities associated with each Project along with proposed recreation enhancements.

On March 11, 2021, the Licensee held a Joint Agency Meeting to present information about the Projects. At the meeting, and during the 60-day comment period immediately following, the Licensee received comments and study requests from several entities. The National Park Service (NPS) and Wisconsin Department of Natural Resources (WDNR) requested a study of recreation facilities and an investigation of recreation enhancements as part of the relicensing process.

NPS requested that the Licensee conduct an inventory of recreation opportunities and facilities including determining recreation demand using field observations, user surveys, and focus groups and estimating recreation needs based on the data gathered.

WDNR requested that the Licensee evaluate current recreational uses, including opportunities for low flow and high flow events, public access, natural scenic beauty, trails, water sports, and fishing, with consideration for the different seasonal uses.

This study plan is consistent with the NPS and WDNR requests.

## **2. Study Plan Elements**

### **2.1 Study Goals and Objectives**

The objective of this study is to provide a subjective assessment of existing recreation facility conditions as well as recommended enhancements. The study will also determine the capacity of existing facilities to help assess current and future user demand, produce sufficient information to evaluate such impacts, and provide the rationale for recommended recreation enhancements.

### **2.2 Background and Existing Information**

Recreation in the vicinity of the Projects is dominated by activity near the Projects' facilities. The existing recreational facilities within the Projects will be evaluated for recreational use and improvements.

The last recreation studies for the Projects were completed in 2020 and filed with FERC on February 24, 2021. The Hayward report indicated that "...the Lake Hayward area offers a sufficient amount of recreational opportunities for both land and water-based activities. The recreational facilities, while limited in number, are in good condition and receive regular maintenance and upgrades when required.

The number and size/capacity of the facilities appear sufficient to accommodate the current amount of use on all but the busiest of days" (NSPW, 2021).

The Trego report indicated that "...the Trego Flowage area offers reasonable opportunities for both water and land-based recreational activities, including opportunities for overnight recreation (i.e., camping, night fishing, etc.). Although the number of recreational facilities is limited, most are in good condition and receive routine maintenance. The number and capacity of the facilities appear sufficient to accommodate current recreational use on all but the busiest days, despite the apparent observed increase in recreational activity related to COVID-19."

In March 2019, the State of Wisconsin published its Statewide Comprehensive Outdoor Recreation Plan (SCORP) for 2019-2023. The SCORP did not identify any specific recreation needs in the immediate vicinity of the Projects.

The SCORP places an emphasis on nature-based recreational opportunities including hiking, fishing, and boating. For both Projects, the Licensee currently provides a carry-in access on the reservoir, a tailrace fishing area downstream of the powerhouse, and a canoe portage that helps fulfill recreation needs. These recreational opportunities are consistent with the SCORP.

### 2.3 Nexus between Project Operations and Effects on Resources

Hydro operations, including fluctuations in reservoir elevation, and insufficient public access can limit recreational opportunities. Adequate information is necessary to determine what impacts may be occurring from hydro operations as well as which recreational opportunities may be enhanced.

### 2.4 Study Area

Since it is believed no additional recreation sites are necessary, the inventory and recreational use study will incorporate the recreation sites listed below in Table 2.4-1.

**Table 2.4-1. Recreation Sites to be Inventoried and Surveyed for Existing Use**

Hayward Canoe Portage Take-Out and Carry-In Reservoir Access
Hayward Canoe Portage Trail and Put-In
Hayward Informal Tailwater Bank Fishing Area
Hayward City Boat Landing
Hayward City Beach & Barrier-Free Fishing Pier
Hayward Bartz's Bay Informal Ice Fishing Access <sup>1</sup>
Town of Trego Park Boat Landing
Town of Trego Boat Landing
Trego North Tailwater Access (Canoe Portage)
Trego South Tailwater Access

<sup>1</sup> Bartz's Bay Informal Ice Fishing Access will only be surveyed during the January and February survey periods.

## 2.5 Methodology<sup>2</sup>

### 2.5.1 Recreation Inventory

Each of the recreation sites listed in Table 2.4-1 will be inventoried during the summer using the forms attached as Appendix 1 to collect information on recreation amenities and capacity. The following types of information will be recorded:

- 1) The primary type(s) of recreation provided at the site.
- 2) Existing sanitation facilities (if any).
- 3) Type of vehicle access and parking capacity (if any).
- 4) The presence and type (if any) of barrier-free facilities.
- 5) The GPS location of the facility.
- 6) Photographs of the recreation site, amenities, signage, and entryways to the site from the main road(s), including photographs of any adverse impacts the site may have on environmental resources including shoreline erosion.

### 2.5.2 Facility Condition Assessment

During at least one visit to each of the recreation sites listed in Table 2.4-1, the condition of each amenity or feature (including recreational wayfinding signs and interpretive signs) and its immediate vicinity will be assessed. A rating for each site will be made according to the following scale:

- 1) Not Usable and Needs Replacement
- 2) Needs Repair
- 3) Needs Maintenance or cleaning
- 4) Good Working Condition (does not need any attention)
- 5) Facility Lacking; need to install facility or otherwise add enhancement (identify item).

If a rating is assigned indicating that additional attention is required, the specific item that needs additional attention will be noted on the form.

### 2.5.3 Recreation Use Survey

Recreation use surveys will be conducted during visits to each of the recreation sites listed in Table 2.4-1. The surveys will last at least one hour per site between the hours of 7:00 a.m. and 7:00 p.m. Surveying will be completed on a rotating schedule to avoid surveys from repeatedly being conducted at the same time of day and will also account for time-of-day use patterns. The recreation use survey form included in Appendix 2 will be administered to users to gather their opinion about the existing recreation facilities and opportunities. The survey will record the number of people in a party, their primary reason for visiting the site, their perception of level of use, and their opinions regarding the amount and types of recreation opportunities offered within

<sup>2</sup> Please note: The methodology does not include regional demand assessment or recreation needs assessment. These analyses will be completed as part of the License Application.

the proposed Project vicinity. The recreation use surveys will be conducted according to the following schedule in Table 2.5.3-1

**Table 2.5.3-1. Recreation Use Survey Schedule**

<b>Survey Month</b>	<b>Recurrence Interval</b>
January	One randomly selected weekend day.
February	One randomly selected weekend day.
April	One randomly selected weekend day.
May	One randomly selected weekend day. One day during Memorial Day weekend.
June	One randomly selected weekday. Two randomly selected weekend day.
July	One randomly selected weekday. Two randomly selected weekend day.
August	One randomly selected weekday. Two randomly selected weekend day.
September	One weekend day the weekend following Labor Day weekend.

#### **2.5.4 Spot Counts**

When first arriving at each recreation site where recreation use surveys will be collected, a spot count will be conducted using the recreation use spot count form enclosed in Appendix 3. This information will be statistically analyzed to develop recreational use figures for the Projects. This information will be summarized by season and activity for each type of use in the study report.

#### **2.5.5 Future and Potential Recreation**

To assess future recreation needs within the Project vicinity, the questionnaire enclosed in Appendix 4 will be sent to municipalities and other entities responsible for existing recreation within the Project vicinity. Specifically, the questionnaire will be sent to the City of Hayward, Hayward Area Chamber of Commerce, and Sawyer County for the Hayward Project and the Town of Trego, Trego Lake District, and Washburn County for the Trego Project.

Each entity will be allowed 30 days to respond to the questionnaire and their responses will be incorporated into the license application<sup>3</sup>.

## **2.6 Consistency with Generally Accepted Scientific Practice**

The overall design of the recreational survey is similar to that commonly used in relicensing proceedings and is consistent with generally accepted methods for recreation studies.

<sup>3</sup> Even though the original study summary indicated a report would be developed, NSPW has found the most-efficient way to display the data is in the license application because it can provide the full picture of proposed recreational mitigation and enhancement measures in context with all other proposed mitigation and enhancement measures included in the license application. Therefore, no study report will be developed for the recreation study.

## **2.7 Project Schedule and Deliverables**

NSPW anticipates that field work will begin in January 2022 (for winter surveys) and be completed by mid-September. The study results will be incorporated into the license application along with additional recreational mitigation and enhancement recommendations (if any).

## **3. Consultation**

The Recreation study was requested by the NPS and WDNR. As a result, the Licensee consulted with the NPS and WDNR on the study plan as discussed in the following sections.

### **3.1 National Park Service**

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Recreation Study Plan to the NPS for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED.** Documentation of Consultation is included in Appendix 5.

### **3.2 Wisconsin Department of Natural Resources**

On **DATE**, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Recreation Study Plan to the WDNR for comment. **ADDRESS COMMENTS HERE ONCE RECEIVED.** Documentation of Consultation is included in Appendix 5.

## **4. References**

EA Engineering. 2021a. Recreation Report for the Hayward Hydroelectric Project (FERC Project No. 2417). February 2021.

EA Engineering. 2021b. Recreation Report for the Trego Hydroelectric Project (FERC Project No. 2417). February 2021.

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## Appendix C - Recreation Site Inventory Form

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Recreation Inventory and Condition Assessment									
Location:								Date:	
Hayward Hydroelectric Project P-2417									
Survey Person:									
GPS Location:									
Amenity Photo Numbers:									
Shoreline Photo Numbers:									
Entryway Photo Number:									
Type of Amenity:		Quantity of Amenities:		Condition of Amenity:				Notes:	Barrier Free? (Y or N)
				-Not Usable (N)					
				-Needs Repair (R)					
				-Needs Maintenance (M)					
				-Good Working Condition (G)					
Boat Launch		Lanes: 1	Launches: 1	N	R	M	G		
Scenic Overlook				N	R	M	G		
Tailwater Access				N	R	M	G		
Restroom				N	R	M	G		
Trash Receptacles				N	R	M	G		NA
Other (picnic units, informal trails, camping, etc.)				N	R	M	G		
Parking		No. Spaces (each type):				Condition:		Notes:	
		Standard:	Barrier-Free:	Trailer:	Other (specify):	N	R	M	G
Signage:		Number:		Condition:		Comments: Provide Details on which signs need attention.			
FERC Project Sign				N R M G					
Regulations Signs				N R M G					
Directional				N R M G					
Interpretive				N R M G					
Additional Comments:									
Describe any signs of overuse or anything observed that is not already documented above.									

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Location: _____ Date: _____										
Trego Hydroelectric Project P-2711										
Survey Person: _____										
GPS Location: _____										
Amenity Photo Numbers: _____										
Shoreline Photo Numbers: _____										
Entryway Photo Number: _____										
Type of Amenity:		Quantity of Amenities		Condition of Amenity:				Barrier Free? (Y or N)		
				Not Usable (N)						
				Needs Repair (R)						
				Needs Maintenance (M)						
				Good Working Condition (G)				Notes:		
Boat Launch		Lanes: 1 Launches: 1		N R M G						
Scenic Overlook				N R M G						
Tailwater Access				N R M G						
Restroom				N R M G						
Trash Receptacles				N R M G				NA		
Other (picnic units, informal trails, camping, etc.)				N R M G						
Parking		No. Spaces (each type):				Condition:				Notes:
		Standard:		Barrier-Free:		Trailer:		Other (specify):		
								N R M G		
								Gravel?		
Signage:		Number:		Condition:		Comments: Provide Details on which signs need attention.				
FERC Project Sign				N R M G						
Regulations Signs				N R M G						
Directional				N R M G						
Interpretive				N R M G						
Additional Comments:										
Describe any signs of overuse or anything observed that is not already documented above.										

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## Appendix C -- Recreation Use Survey Form

# Agency Version

## ON-SITE/IN-PERSON RECREATION INTERVIEW

### Hayward & Trego Hydroelectric Projects (FERC Nos. 2417 and 2711)

#### NPS Recreation Survey Questionnaire

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is in the process of applying for subsequent licenses from the Federal Energy Regulatory Commission (FERC) to continue to operate and maintain the existing Hayward and Trego Hydroelectric Projects (Project or Projects). The Projects are owned, operated, and maintained by NSPW. To obtain a license for the Projects, NSPW must submit a final license application to FERC no later than November 30, 2023. As part of the relicensing process, NSPW is conducting several environmental studies which will enable FERC to prepare an environmental report. The purpose of this survey is to collect information about recreational use and visitors' experiences at public recreation facilities around the Hayward and Trego Project reservoirs.

What is the ZIP code where you live or country if not in the United States?

ZIP code: \_\_\_\_\_ or, country (if not the United States): \_\_\_\_\_

What is your age: \_\_\_\_\_

What is your gender? ☐ Male ☐ Female ☐ Non-binary

Which of these categories best indicates your race and ethnicity? Answer only for yourself.

Please select one or more.

- |  |   |                                     |
|--|---|-------------------------------------|
| <input type="checkbox"/> American Indian/Alaskan       | <input type="checkbox"/> Asian                  | <input type="checkbox"/> White      |
| <input type="checkbox"/> Native Hawaiian/other Pacific | <input type="checkbox"/> Hispanic or Latino     | <input type="checkbox"/> Don't know |
| <input type="checkbox"/> Black/African-American        | <input type="checkbox"/> Not Hispanic or Latino |                                     |

Please let us know if you have any additional comments regarding your recreation experience during your visit:  
(contact information)

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1. Check the box on the location where you received this survey:

#### Hayward Project:

- ☐ Hayward Canoe Portage Take-out and Carry-In Access
- ☐ Hayward Canoe Portage Trail and Put-in
- ☐ Informal Tailwater Bank Fishing Access
- ☐ City of Hayward Boat Landing
- ☐ City of Hayward Beach/Fishing Pier
- ☐ Bartz's Bay Informal Ice Fishing Access

#### Trego Project:

- ☐ Town of Trego Park Boat Landing
- ☐ Town of Trego Boat Landing
- ☐ Trego North Tailwater Access/Canoe Portage
- ☐ Trego South Tailwater Access

2. Below is a list of activities available. Please indicate:

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(A) Which of these activities have you participated in on your current visit to the area.

(B) Which ONE of these activities is your PRIMARY ACTIVITY on this trip to the area?

ACTIVITY	(A) Participated in <u>ON THIS TRIP</u> (Check <u>all</u> that apply)	(B) PRIMARY ACTIVITY (Check <u>only one</u> )
Shoreline/tailwater fishing		
Fishing from a boat		
Motorized boating		
Non-motorized boating		
Swimming		
Picnicking		
Wildlife Viewing		
Other (specify)		

3. (A): Were there any activities that you and your group wanted to do on this visit to (AREA) that you were not able to?

☐ YES ☐ NO

(B): If YES: What was it? \_\_\_\_\_

(C): Which of the following reasons, if any, explain why you did not engage in the activity?

- ☐ Rules or regulations did not allow for activity  
☐ Area was temporarily closed to the public  
☐ Not enough time  
☐ Safety concerns  
☐ Not enough information about the activity  
☐ Too crowded  
☐ Difficult road or trail access  
☐ No road or trail access  
☐ Unsatisfactory conditions of facilities  
☐ Resource damage due to overuse  
☐ No facilities or services  
☐ Bad weather  
☐ Flooding or other natural hazard  
☐ Other (please specify) \_\_\_\_\_

4. Does anyone in your personal group have a physical condition or personal limitation that made it difficult to access or participate in [site] activities or services?

☐ YES ☐ NO

If YES, on this visit what activities or services did the person(s) have difficulty accessing or participating in?

(Please describe): \_\_\_\_\_

5. (A) How crowded did you feel while recreating at these locations today at this recreation facility/reservoir?

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[Select one number for each or indicate it was not applicable to your visit.]

LOCATION / AREA	Not at all crowded	Slightly crowded	Moderately crowded	Very crowded	Extremely crowded	Not applicable
In parking areas	1	2	3	4	5	<input type="checkbox"/>
On the trails	1	2	3	4	5	<input type="checkbox"/>
At a developed campground	1	2	3	4	5	<input type="checkbox"/>
At a boat-in campsite	1	2	3	4	5	<input type="checkbox"/>
While fishing from the shoreline	1	2	3	4	5	<input type="checkbox"/>
While boating/fishing from a boat	1	2	3	4	5	<input type="checkbox"/>

(B) If you felt crowded, did you modify your recreation plans because you felt crowded?

☐ YES ☐ NO

(C) If YES, what did you do?

- ☐ Moved to a new location
 ☐ Chose not to recreate  
☐ Changed the time of day
 ☐ Continued with current plans  
☐ Changed your activity
 ☐ Other: \_\_\_\_\_

6. During the planning process for your visit, how did the possibility of crowds affect your trip plans?

(Please select one response)

- ☐ It did not affect my plans  
☐ I visited at a time of day I thought would be less crowded  
☐ I visited on a day of the week I thought would be less crowded  
☐ I avoided places here I thought would be crowded today  
☐ Other (please specify) \_\_\_\_\_

7. Did the actions or behavior of any other group or individual interfere with your enjoyment on this trip?

☐ YES ☐ NO

If yes, what type of group or person interfered with your enjoyment on this trip?

Group/Person	Reason(s)		
	Proximity	Loudness	Other (please specify)
Motorized boaters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Non-motorized watercraft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Vehicles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____

8. How satisfied were you with the following amenities at this recreation facility/reservoir today.

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**Important:** Please only circle a number for the items that you used during your current visit to this specific recreation facility/reservoir. Also, please **check** the "Did Not Use" box, if you did not use the item or it does not exist at the specific recreation facility.

	Very Satisfied	Satisfied	Neither	Dissatisfied	Very Dissatisfied	Did Not Use	If you were dissatisfied for any reason, please explain why:
Restroom	1	2	3	4	5	<input type="checkbox"/>	
Picnic sites	1	2	3	4	5	<input type="checkbox"/>	
Trash receptacles	1	2	3	4	5	<input type="checkbox"/>	
Vehicle parking areas	1	2	3	4	5	<input type="checkbox"/>	
Boat launch parking area	1	2	3	4	5	<input type="checkbox"/>	
Boat launch	1	2	3	4	5	<input type="checkbox"/>	
Boat dock	1	2	3	4	5	<input type="checkbox"/>	
Other:	1	2	3	4	5	<input type="checkbox"/>	
Roads to facility	1	2	3	4	5	<input type="checkbox"/>	
Signage to the facility	1	2	3	4	5	<input type="checkbox"/>	
Signage within the facility	1	2	3	4	5	<input type="checkbox"/>	
Other:	1	2	3	4	5	<input type="checkbox"/>	

9. How did you obtain information to plan your current trip? (Please select all that apply)

- |  |   |
|--|---|
| <input type="checkbox"/> Federal or State website          | <input type="checkbox"/> Word of mouth                                |
| <input type="checkbox"/> City, local, or municipal website | <input type="checkbox"/> Social media (e.g., Facebook, Twitter, etc.) |
| <input type="checkbox"/> Xcel website                      | <input type="checkbox"/> Travel guides and tour books                 |
| <input type="checkbox"/> Other websites                    | <input type="checkbox"/> Newspaper/magazine article                   |
| <input type="checkbox"/> Maps, brochures, pamphlets        | <input type="checkbox"/> Radio/TV broadcasts                          |
| <input type="checkbox"/> Visitor bureaus/centers           | <input type="checkbox"/> Other (specify): _____                       |
| <input type="checkbox"/> Previous visits                   |   |

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## Appendix C - Recreation Use Spot Count Form

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Recreation Observation Report Completion														
Date:											Time:			
Hayward Project P-2417														
Survey Person:											Note: Please list primary activity by placing a "P" in the box. Use and "S" for secondary activities.			
Temperature:			Weather:			Wind Speed:								
			Number of People	Recreation Activities										Notes
				ATV/Snowmobile	Shoreline Fishing	Boat Fishing	Swimming	Hiking/Walking/Jogging	Bicycling	Picnicking	Bird Watching	Wildlife Viewing	Non-Powered Boating	
Recreation Site														
Canoe Portage Take-Out & Carry-In Reservoir Access														
Canoe Portage Trail and Put-In														
Informal Tailwater Bank Fishing Area														
Hayward City Boat Landing														
Hayward City Beach/Barrier-Free Fishing Pier														
Bartz's Bay Informal Ice Fishing Access (Jan & Feb only)														
Additional Comments:														

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Date:		Recreation Observation (Spot or A) Form		Time:										
Trego Project P-2711														
Survey Person:		Note: Please list primary activity by placing a "P" in the box. Use and "S" for secondary activities.												
Temperature:		Weather:		Wind Speed:										
		Number of People	Recreation Activities										Notes	
			ATV/Snowmobile	Shore Fishing	Boat Fishing	Swimming	Hiking/Walking / Jogging	Bicycling	Picnicking	Bird Watching	Wildlife Viewing	Non-Powered Boating		Power Boating
Recreation Site														
Town of Trego Park Boat Landing														
Town of Trego Boat Landing														
Trego North Tailwater Access (Canoe Portage)														
Trego South Tailwater Access														
Additional Comments:														

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## Appendix C - Title and Potential Recreation Questionnaire



Hayward and Trego Hydroelectric Projects-- FERC Project Nos. 2417 & 2711  
Namekagon River- Sawyer and Washburn County, Wisconsin  
Future and Potential Recreation Questionnaire

## Agency Version

Xcel Energy is in the process of relicensing the Hayward and Trego Hydroelectric Projects (Projects) located on the Namekagon River in Sawyer and Washburn Counties, Wisconsin, respectively. Xcel Energy is gathering information about potential recreation needs in the vicinity of Projects.

The Hayward Project vicinity is defined as the area within  $\frac{1}{4}$  mile of the shoreline between  $\frac{1}{2}$  mile downstream of the Hayward Dam and  $2\frac{1}{2}$  miles upstream of the Hayward Dam. The Trego Project vicinity is defined as the area within  $\frac{1}{4}$  mile of the shoreline between  $\frac{1}{2}$  mile downstream of the Trego Dam and  $5\frac{3}{4}$  mile upstream of the Trego Dam.

If you have any questions, please contact Matthew Miller at [matthew.j.miller@xcelenergy.com](mailto:matthew.j.miller@xcelenergy.com) or 715-737-1353.

1. Information about person completing the questionnaire:

Name & Title: \_\_\_\_\_  
Organization: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_  
Phone: \_\_\_\_\_  
Email Address: \_\_\_\_\_

2. Is your organization responsible for recreation sites, amenities, formal access sites, or planning for recreation sites within the Project vicinity as defined above?

☐ Yes *(Please proceed to 2a below)* ☐ No *(No additional information is needed and thank you for your input)*

- a. Please describe your primary function pertaining to recreation and list any recreation sites or access sites (formal or informal) in the Project vicinity you are responsible for in the space provided below: *(Additional information may be provided on the final sheet of this questionnaire.)*

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Please proceed to question 2b on the next page.



Hayward and Trego Hydroelectric Projects-- FERC Project Nos. 2417 & 2711  
Namekagon River- Sawyer and Washburn County, Wisconsin  
Future and Potential Recreation Questionnaire

## Agency Version

- b. Please list all recreation amenities available at each recreation site or access site you manage (e.g. docks, restrooms, parking areas, interpretive signage, picnic tables, trails, etc.) below:  
(Additional information may be provided on the final sheet of this questionnaire.)

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- c. Please provide the location of each site listed above using a map, street address, or GPS location:  
(Additional information may be provided on the final sheet of this questionnaire.)

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- d. Have any of the sites or amenities listed in 2a and 2b exceeded capacity or not had sufficient parking? (Additional information may be provided on the final sheet of this questionnaire.)

☐ Yes (Please list location, amenity and when capacity is exceeded.) ☐ No

**Recreation Site/Amenity**

**Event(s) Exceeding Capacity**

<hr/>	<hr/>
<hr/>	<hr/>
<hr/>	<hr/>
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<hr/>	<hr/>
<hr/>	<hr/>

Please proceed to question 2e on the next page.



Hayward and Trego Hydroelectric Projects-- FERC Project Nos. 2417 & 2711  
Namekagon River- Sawyer and Washburn County, Wisconsin  
Future and Potential Recreation Questionnaire

## Agency Version

- e. Do you have any planned improvements for the recreation sites listed in 2a and amenities listed in 2b or any plans for development of new recreation sites? *(Additional information may be provided on the final sheet of this questionnaire.)*

☐ Yes *(Please list location, planned improvement, and anticipated opening date below.)*

☐ No

### Planned Improvements/Locations

### Anticipated Opening Date

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

- f. Do you believe additional recreation sites/amenities are needed within the Project vicinity? *(Additional information may be provided on the final sheet of this questionnaire.)*

☐ Yes *(Please list reasoning below.)*

☐ No

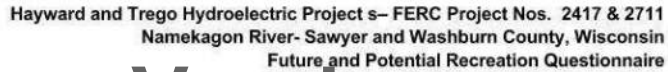
### Additional Recreation Sites/Amenities Reasoning

_____
_____
_____
_____
_____
_____

- g. Please indicate if there is a specific representative you wish to designate as a follow-up contact to be used by Xcel Energy or their representative *(Additional information may be provided on the final sheet of this questionnaire.)*

### Representative Contact Information

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_  
Email: \_\_\_\_\_



**Additional Information or Comments:**  
(Please indicate applicable section)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

**Comments, questions, and/or this completed questionnaire may also be sent via email to:**  
**Matthew.J.Miller@XcelEnergy.com**

File [Attachment D WQ Study.pdf] cannot be converted to PDF. (To download this file in its original format, please use the filename hyperlink from your search results. If you continue to experience difficulties, or to obtain a PDF generated version of files, please contact the helpdesk at [ferconlinesupport@ferc.gov](mailto:ferconlinesupport@ferc.gov), or, call 866-208-3676 from 9AM to 5PM EST, weekdays. Please allow at least 48 hours for your helpdesk request to be processed.)

**Hayward and Trego  
Hydroelectric Projects  
FERC Nos. 2417 and 2711**

**Study Plan  
Work Plan 22 THT  
Wood and Blanding's Turtle Nesting Habitat Study**

**Prepared for  
  
Northern States Power Company,  
a Wisconsin Corporation**

**Prepared by**



meadhunt.com

**March 2022**

## 1. Introduction

Northern States Power Company, a Wisconsin corporation (NSPW or Licensee), currently holds licenses issued by the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Hayward and Trego Hydroelectric Projects (Project or Projects). The current licenses, which designate the Projects as FERC Nos. P-2417 and P-2711, respectively, expire on November 30, 2025. To obtain subsequent licenses, the Licensee must submit a final license application to FERC no later than November 30, 2025. The final license application, in part, must include an evaluation of rare species within the Project vicinity.

On March 11, 2021, the Licensee held a Joint Agency Meeting to present information about the Projects. At the meeting, and during the 60-day comment period immediately following, the Licensee received comments and study requests from several entities. The Wisconsin Department of Natural Resources (WDNR) requested that the Licensee conduct wood turtle and Blanding's turtle studies as part of the relicensing process.

The WDNR requested that a wood turtle study be conducted to "determine whether any wood turtle nest sites occur within the Project boundary at either Hayward or Trego (WDNR, 2021)". The WDNR requested that a Blanding's turtle study be conducted to "...determine whether any Blanding's turtle nest sites occur within the Project boundaries (WDNR, 2021)".

Licensee is proposing to conduct a Wood and Blanding's Turtle Nesting Habitat Study to identify areas with suitable wood and Blanding's turtle nesting habitat within the existing and proposed Project boundaries for both Projects.

## 2. Study Plan Elements

### 2.1 Study Goals and Objectives

The objective of this study is to identify areas with suitable wood and Blanding's turtle nesting habitat within the existing and proposed Project boundaries.

### 2.2 Resource Management Goals

The resource management goal is to ensure compliance with Wisconsin Endangered Species Act of 1972 and the federal Endangered Species Act of 1973.

### 2.3 Public Interest

WDNR expressed interest in this study.

### 2.4 Background and Existing Information

WDNR indicated in their wood turtle study request that wood turtles are "known to be present within this Project boundary, however survey data is limited". WDNR indicated in their Blanding's turtle study request that Blanding's turtles were "known to be present near these Project boundaries but that survey data is limited (WDNR, 2021)".

The WDNR issued ER Review Log # 20-683 (ER Review) for the Hayward Project vicinity on September 10, 2020. The ER Review indicated that there was suitable habitat for state-threatened wood turtle and state special concerned Blanding's turtle in the Project vicinity (WDNR, 2020a).

The WDNR issued ER Review Log # 20-684 for the Trego Project vicinity on September 10, 2020. The ER Review indicated that there was suitable habitat for the wood turtle and Blanding's turtle in the Project vicinity (WDNR 2020b).

## 2.5 Project Nexus

The operations of the Hayward and Trego Dams may affect nesting wood and Blanding's turtles in areas with suitable habitat. Identifying areas with suitable wood and Blanding's turtle nesting habitat will help determine whether mitigation measures are necessary as part of relicensing.

## 2.6 Study Area

The study area will include all shorelines upstream and downstream of the Hayward and Trego Dams within both the existing and proposed Project boundaries as shown in Appendix 1.

Study results will be filed as privileged information as requested by WDNR to avoid disclosing specific threatened or endangered species location information.

## 2.7 Methodology

### 2.7.1 Nesting Habitat Survey, Nesting Survey & Presence/Absence Surveys

NSPW will survey all shorelines for the presence of wood and Blanding's turtle nesting habitat within the existing and proposed Project boundaries as shown in Appendix 1. The reservoir shoreline will be surveyed by boat or on foot as necessary. The bypassed reach (at Hayward) and Namekagon River downstream of both dams will be surveyed by boat, or on foot for those areas not accessible by boat. The surveys will take place during the month of June (preferably on a sunny day) when the air temperature is between 50-80 degrees Fahrenheit.

The surveyors will identify all areas with suitable nesting habitat. Suitable nesting habitat for both turtle species includes areas with a sand or gravel substrate that is either unvegetated or sparsely vegetated, receives sun exposure for most of the day during late spring or summer, and is within 200 feet of the river's edge for wood turtle and at least 984 feet for Blanding's turtle. Note that this can include gravel parking areas, roads, or shoulders of paved roads. GIS locations of all suitable nesting habitat identified will be collected to develop a map of suitable nesting sites within the study area.

In addition to identifying areas with suitable nesting habitat, the surveyors will conduct visual searches for the presence of any wood or Blanding's turtles or evidence of wood or Blanding's turtle activity within the survey area. GIS locations of any basking or nesting wood or Blanding's turtles or evidence of wood or Blanding's turtle nesting sites identified will also be recorded.

Since the wood and Blanding's turtles are known to be present within the vicinity of both Projects, it is assumed that the species are also present within the Project boundaries. Therefore, the presence/absence surveys (identifying individual turtles) and nesting surveys (identifying evidence of turtle nesting) will only be conducted once, concurrent with the nesting habitat surveys

The information provided by the study will help inform FERC in identifying any enhancement and mitigation measures necessary to minimize or avoid impacts to the species. The study also meets the WDNR's goals of determining whether there are suitable wood and Blanding's turtle nesting sites within the Project boundaries.

#### **2.7.2 Personnel Qualifications**

All surveys will be conducted by individuals qualified and approved by WDNR to identify wood and Blanding's turtles and their nesting habitat. The survey may require special permits from the WDNR and the National Park Service (NPS).

### **2.8 Consistency with Generally Accepted Scientific Practice**

This Wood and Blanding's Turtle Nesting Habitat Study follows generally accepted scientific practice regarding field data collection and reporting.

### **2.9 Project Schedule and Deliverables**

Results of this study will be summarized in a study report. The report will include the following elements:

- Project Information and Background
- Study Area
- Methodology
- Study Results
- Mapping
- Analysis and Discussion
- Agency Correspondence and/or Consultation
- Literature Cited

NSPW anticipates that field work will be completed in June 2022. The draft study report will be completed by August 30, 2022. Any information identifying the specific locations of wood and Blanding's turtles will be filed as privileged, non-public information per WDNR guidelines.

### 3. Consultation

Wood and Blanding's turtle studies were requested by the WDNR. As a result, the Licensee consulted with the WDNR and the NPS as discussed below.

#### 3.1 Wisconsin Department of Natural Resources

On February 3, 2022, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Wood and Blanding's Turtle Study plan to the WDNR for comment. The WDNR provided their comments verbally on February 21, 2022. The WDNR comments have been incorporated into the plan. Documentation of Consultation is included in Appendix 2.

#### 3.1 National Park Service

On February 3, 2022, the Licensee, through its consultant Mead & Hunt, provided a draft copy of the Wood and Blanding's Turtle Study plan to the NPS for comment. The NPS provided comments on March 4, 2022. The NPS comments have been addressed in Appendix 2.

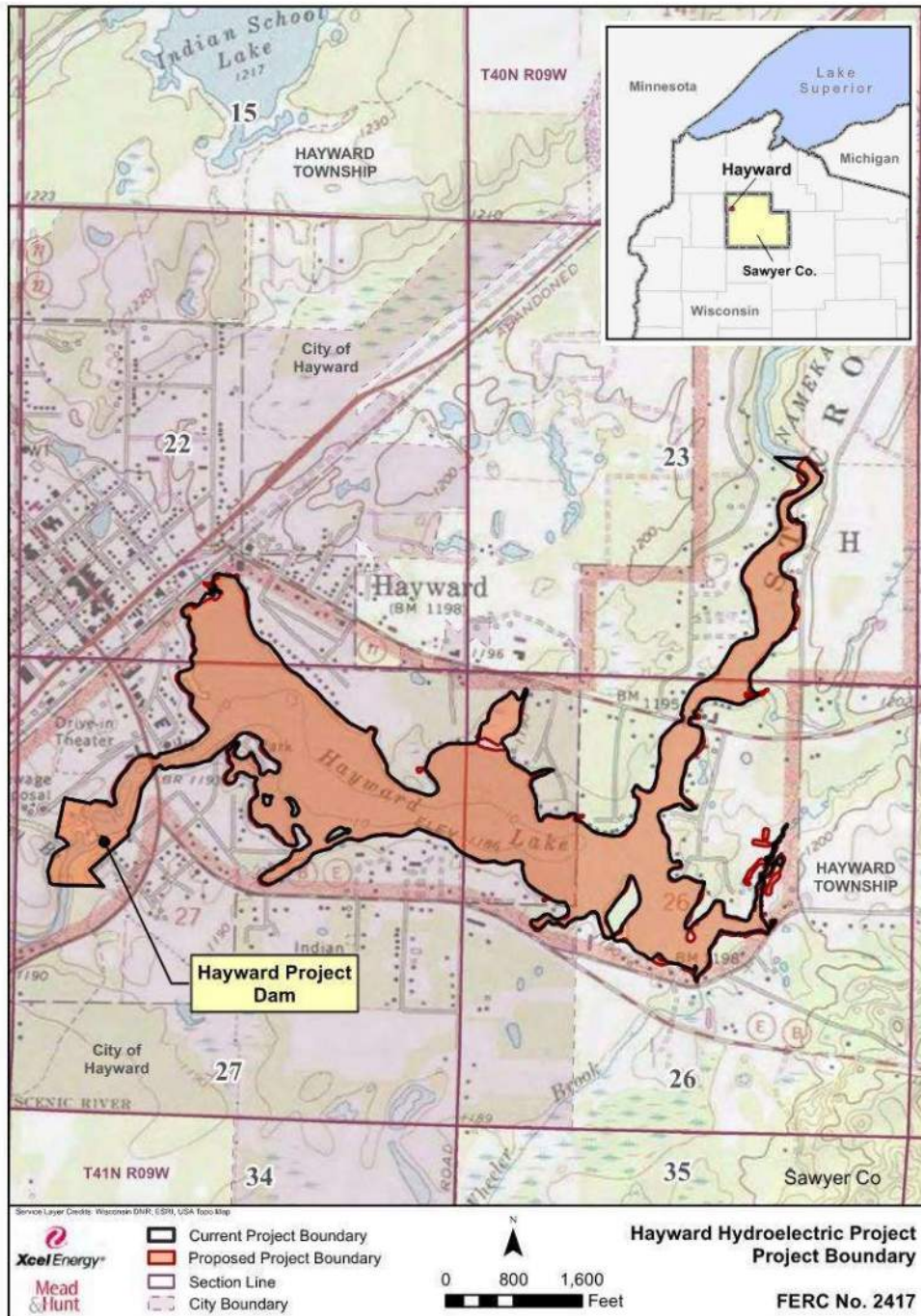
### 4. References

Endangered Resources Review (ERR Log # 20-683). 2020a. Proposed Hayward Hydroelectric Project Relicensing, Sawyer County, WI (ER Log # 20-683). September 10, 2020.

Endangered Resources Review (ERR Log # 20-684). 2020b. Proposed Trego Hydroelectric Project Relicensing, Washburn County, WI (ER Log # 20-683). September 10, 2020.

Wisconsin Department of Natural Resources. 2021. Study Requests- Relicensing of Hayward (P-2417) and Trego (P-2711) Projects. May 7, 2021

## **Appendix 1 – Wood Turtle Survey Area**





## **Appendix 2 – Documentation of Consultation**

**Shawn Puzen**

---

**From:** Shawn Puzen  
**Sent:** Thursday, February 3, 2022 10:45 AM  
**To:** cheryl.laatsch@wisconsin.gov; angietornes@gmail.com; susan\_rosebrough@nps.gov; Lisa\_Yager@nps.gov; Joan Harn  
**Cc:** Darrin Johnson; Miller, Matthew J; Shawn Puzen; brey.j.maurer@xcelenergy.com; Crotty, Scott A  
**Subject:** Hayward and Trego DRAFT Wood and Blanding's Turtle Nesting Habitat Study Plan  
**Attachments:** 20220203 Hayward-Trego Wood-Blandings Nesting Habitat DRAFT sent to Agencies.pdf

Good Morning,

Attached is a draft Hayward and Trego Wood and Blanding's Turtle Nesting Habitat Monitoring Plan for your review and comment. The intent is to complete this study during this field season.

By your initial comments on the relicensing of the Hayward and Trego Hydroelectric Project, you requested NSPW complete Wood and Blanding's Turtle Nesting Habitat monitoring.

Prior to executing the study, NSPW is requesting your comments on the enclosed draft study plan.

Please provide your comments as soon as possible, but no later than March 7, 2022.

Please feel free to contact me if you have any questions.

Thanks,

---

**SHAWN PUZEN**

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER

Mead & Hunt

Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files

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120 YEARS OF SHAPING THE FUTURE



## United States Department of the Interior

National Park Service  
St. Croix National Scenic Riverway  
401 N. Hamilton Street  
St. Croix Falls, Wisconsin 54024



IN REPLY REFER TO:  
1.A.1

March 4, 2022

Mr. Shawn Puzen  
[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)  
Mead & Hunt  
2440 Deming Way  
Middleton, Wisconsin 53562

Re: Hayward and Trego Hydroelectric Projects Draft Study Plans for Mussels, Water Quality, and Wood and Blanding's Turtle Nesting Habitat, FERC Nos. p-2417 and p-2711, Namekagon River

Dear Mr. Puzen:

The National Park Service (NPS) is consolidating our comments for the three aforementioned studies received by email dated February 2 and 3, 2022.

The NPS reiterates our request for information reflected in our original study requests on April 27, 2021 for shoreline surveys and hydraulics, sedimentation, and channel change, and our August 31, 2021 comments on your draft Study Summary and Responses. The study plans reviewed here have components that would contribute important information relating to our original study requests.

The NPS administers the Namekagon River as part of the National Wild and Scenic Rivers System (NWSRS) and the National Park System, as established by Congress in 1968 (Public Law 90-542). Under this law, the NPS is required by the Wild and Scenic Rivers Act to preserve the St. Croix River and its tributary, the Namekagon River, in a natural condition; to protect and enhance the exceptional natural, scenic, and cultural resources of the Riverway; and to provide high-quality recreational opportunities. River values identified in the hydropower project areas include aquatic, cultural, recreation, and scenic/aesthetic resources. The Namekagon River is managed as part of the St. Croix National Scenic Riverway and is protected under the Organic Act.

Prior to the FERC issuing a new license, the NPS will need to evaluate the proposed license under Section 7(a) of the Wild and Scenic Rivers Act and to determine whether it will have direct and adverse effects on the values for which the river was designated. If the NPS identifies direct and adverse effects, the license/project will need to be modified to ensure that park resources are protected. The NPS study requests are needed to provide information to enable timely completion of this NPS review as well as the FERC NEPA analysis. Continuing impacts on resource values must be identified so that protection and enhancement measures can be incorporated into a new license.

#### Comments on Draft Study Plans

Please contact Caitlin Nagorka, natural resources program manager, St. Croix National Scenic Riverway at [caitlin\\_nagorka@nps.gov](mailto:caitlin_nagorka@nps.gov) to obtain all required NPS scientific research and collecting permits prior to implementing the study plans.

## 1. Mussels

NSPW does not propose to change the operation of the Project from its current run-of-river operating mode and there is no need for routine or scheduled drawdowns. Any future drawdowns that "may" be needed during the subsequent license period will be required by the Commission to be completed in consultation with the resource agencies to assure any adverse impacts are avoided or mitigated at the time of the drawdown. The data being requested for a future event that "could" happen is better collected, if needed, once the scope of the proposed action is proposed and collected as needed and analyzed at that time. Therefore, the study being requested for the purpose of a potential future drawdown is not being conducted at this time as part of the relicensing process.

Mussels are a significant component of the aquatic resources Outstandingly Remarkable Value (ORV) for the Wild and Scenic River designation. It is our agency's understanding that drawdowns may be necessary during the proposed forty-year license period for maintenance and other purposes. Drawdowns have the potential to affect mussels that are present in the portion of riverbed that emerges during the drawdown. To better understand potential effects to mussels, additional reaches will need to be included within the impoundments, especially in the areas near the shoreline that would become exposed during a drawdown event. The study area as currently proposed includes only two riverine reaches at either end of the Project boundaries, which is inadequate to understand the presence, species, and density of mussels in the areas of the impoundments that would be most affected by a drawdown. Please add additional reaches within each impoundment to the study area. The NPS is available to consult further on identifying and prioritizing additional reaches for the purposes of this study.

The NPS concurs with the use of WDNR guidelines.

On page 3, include the NPS in the notification list, along with WDNR and USFWS, if any federally or state-listed species is observed, dead or alive. This will also be specified within the required NPS research and collecting permits.

The plan has been amended.

When assessing and characterizing mussel habitat, researchers should reference *Aquatic Habitat Classification on the St. Croix National Scenic Riverway* by Haibo Wan et al.

The plan has been amended

## 2. Water Quality Study

Water quality is a significant component of the aquatic resources Outstandingly Remarkable Value (ORV) for the Wild and Scenic River designation. The Wild and Scenic Rivers Act directs the NPS to protect water quality of the Namekagon (Sec. 1(b)) and work with the Environmental Protection Agency and the WDNR to eliminate or diminish water pollution of the river (Sec. 12(c)).

The NPS concurs with the use of WDNR protocols and the rationale for not monitoring cyanobacteria.

The NPS requests that sediment accumulation also be monitored. Results would provide useful baseline information and facilitate better understanding of sedimentation within the project boundaries.

Based upon existing information provided by the USACE, the accumulation of sediment in the upper end of the reservoir is due to sedimentation upstream and not due to operation of the Project-FERC Order Modifying and Approving Drawdown Needs Analysis issued October 31, 1995.

## 3. Wood and Blanding's Turtle Nesting Habitat Study

- This is another example, like the Aquatic and Terrestrial Invasive Plant study, where the effort that goes into the study could provide shoreline survey information outlined in the NPS study request; however, the draft plan does not provide enough detail on shoreline survey methods to determine if NPS needs would be met through this work.
- The NPS-requested shoreline study would provide current information on the status of the shoreline and identify problem areas and the need for potential management attention. It would provide a baseline for monitoring conditions and change over the life of the license. The NPS has responsibility to review shoreline alteration activities such as bank stabilization and small boat docks as water resources projects under Section 7 of the Wild and Scenic Rivers Act.
- The NPS Shoreline Survey request Method 1<sup>1</sup> recommended a longitudinal survey of the river and its banks, using georeferenced photographic equipment (video or still) and cited the High-

<sup>1</sup> NPS comments on the Pre-Application Document and Study Requests, dated 4/28/21, <https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020CF9CB-66E2-5005-8110-C31FAFC91712>

The HDSS method described by NPS was only used at the RL Harris Hydroelectric Project (FERC No. 2628), a 135 MW peaking facility, to determine the impacts of project operations (peaking) in a 44 mile stretch of the Tallapoosa River downstream of the dam. This method was not used to evaluate erosion or sedimentation within the RL Harris Project Reservoir. Erosion and sedimentation sites within the reservoir were identified by stakeholders and by examining available aerial photography and LIDAR data. Only sites identified by this analysis were then surveyed in the field during the fall/winter pool drawdown. Since the Trego Project is operated in a run-of-river mode that does not conduct seasonal drawdowns, this survey method is not possible at the Project. The Licensee has proposed to evaluate the entire shoreline, and document all erosion sites within the Project rather than just in pre-determined locations. The HDSS study is not necessary to evaluate the Namekagon River downstream of the Project since all inflow is passed downstream of the Project. Project operation does not cause flow fluctuations downstream.

Definition Stream Survey (HDSS) method (Trutta, 2019)<sup>2</sup> used in recent FERC hydropower licensing proceedings, which enables mapping, a visual record of stream and shoreline characteristics, and data collection from multiple sensors. For any planned boat surveys of the shoreline (e.g., turtle, cultural resources, vegetation), please reconsider adopting study Method 1 proposed in the NPS shoreline survey study request to systematically evaluate, quantify, and photograph shoreline conditions including streambank conditions, bank stabilization types and conditions, docks/piers, and public access locations.

The Section 7(a) evaluation to evaluate the effects of the proposed operation of the Project on the Wild and Scenic River. NSPW has proposed studies that provide the data that is not already available to assess the impact of the proposed operation of the Project. The question of 4(e) authority for the Project was previously addressed in the issuance of the current license by order dated June 3, 1994.

#### Outstanding Study Requests

Our agency requests that the Licensee reconsider the additional study requests outlined in our April 27, 2021 letter, including the shoreline survey and hydraulics, sedimentation, and channel change. As previously described, the proposed license will require a Section 7(a) evaluation by the NPS under the Wild and Scenic Rivers Act. These studies are necessary to the timely completion of our agency's review. They are also needed to satisfy Section 4(e) of the Federal Power Act, which directs FERC to "give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality." Equal consideration is not possible without adequate information on these important and relevant topics.

#### Conclusion

Thank you for your consideration of our agency's comments as you develop your final study plan. The NPS looks forward to the results of the three studies reviewed in this letter, as well as the opportunity to continue to collaborate with you throughout the licensing process. Please distribute future communications through Lisa Yager, chief of resource stewardship and education at the St. Croix National Scenic Riverway. Information will be distributed to the NPS team as appropriate through Lisa.

If you have any questions about our response, please contact Lisa Yager at [lisa\\_yager@nps.gov](mailto:lisa_yager@nps.gov).

Sincerely,

**CRAIG  
HANSEN**

Craig Hansen  
Superintendent

Digitally signed by  
CRAIG HANSEN  
Date: 2022.03.04  
13:13:56 -06'00'

<sup>2</sup> Trutta Environmental Solutions, *Tallapoosa River High Definition Stream Survey Final Report*, December 2019, included in Alabama Power filing, draft Erosion and Sedimentation Study Report for the R.L. Harris Project under P-2628-065, December 2020. Last accessed 3/31/2021:  
[https://elibrary.ferc.gov/eLibrary/filelist?document\\_id=14850582&accessionnumber=20200410-5091](https://elibrary.ferc.gov/eLibrary/filelist?document_id=14850582&accessionnumber=20200410-5091)

**The Wisconsin Department of Natural Resources provided their comments verbally on February 21, 2022.**

## Document Content(s)

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Attachment E Wood-Blanding's Trtle Nest Hab Stdy.pdf.....	216

## Darrin Johnson

---

**From:** Laatsch, Cheryl - DNR <Cheryl.Laatsch@wisconsin.gov>  
**Sent:** Monday, July 11, 2022 1:44 PM  
**To:** Shawn Puzen  
**Subject:** RE: Limited Invasive Control Measures at Gile, Hayward, Trego and White River

No vouchers needed.

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Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Cheryl Laatsch  
Statewide FERC Coordinator  
Bureau of Environmental Analysis and Sustainability  
Wisconsin Dept of Natural Resources  
N7725 Hwy 28  
Horicon WI 53032  
(T) 920-387-7869 (Fax) 920-387-7888  
[Cheryl.laatsch@wisconsin.gov](mailto:Cheryl.laatsch@wisconsin.gov)



---

**From:** Shawn Puzen <Shawn.Puzen@meadhunt.com>  
**Sent:** Monday, July 11, 2022 1:40 PM  
**To:** Laatsch, Cheryl - DNR <Cheryl.Laatsch@wisconsin.gov>  
**Cc:** Miller, Matthew J <matthew.j.miller@xcelenergy.com>; Darrin Johnson <Darrin.Johnson@meadhunt.com>; Mary Rohde <M.Rohde@gaiconsultants.com>; Laura Sass <L.Sass@gaiconsultants.com>  
**Subject:** RE: Limited Invasive Control Measures at Gile, Hayward, Trego and White River

**CAUTION: This email originated from outside the organization.  
Do not click links or open attachments unless you recognize the sender and know the content is safe.**

Hi Cheryl,

GAI will collect vouchers when they visit the areas starting next week and deliver them to the WDNR AIS Regional Coordinator. [Please let us know ASAP if you do not want voucher specimens.](#)

The early detection forms will be sent to the WDNR AIS Regional Coordinator, Alex Selle, today, with a copy to you.

Regarding limited control:

**Hayward**

Yellow iris – The population is persistent and thick throughout the entirety of the project area shoreline. Removal would be difficult, expensive, and likely not effective as it is likely to be present upstream of the flowage. It would take one week to clip the plants with a handheld string trimmer. [Therefore, this will not be conducted.](#)

Aquatic forget-me-not – Hand removal may be an option, but it is on private property. The two locations are on either side of a dock and may require a crew to walk on shore to reach it all.

If the WDNR can obtain approval from the landowner, GAI has agreed to remove the plants during the August studies at no additional cost.

### **Trego**

Yellow iris – The population is persistent and spread sporadically throughout the entirety of the project area. Removal would be difficult, expensive, and likely not effective as it is known to be present upstream of the Project boundary. It would take one week to clip the plants with a handheld string trimmer. *Therefore, this will not be conducted.*

### **White River**

Aquatic forget-me-not – Hand removal may be an option. The crew hand-removed the first plant, but then saw more than they had time to remove that day. The locations were not monotypic but were fairly isolated.

GAI has agreed to remove the plants during the August studies at no additional cost.

### **Gile Flowage**

Aquatic forget-me-not – This was an incidental observation noted during the wood turtle presence/absence surveys. GAI feels it may be difficult to find and remove all plants due to the size of the flowage, but they are happy to keep our eyes peeled during our next survey and hand-remove any plants observed.

Thanks,

---

### **SHAWN PUZEN**

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER  
Mead & Hunt  
Direct: 920-593-6865 | Cell: 920-639-2480 | Transfer Files  
meadhunt.com | LinkedIn | Twitter | Facebook | Instagram



---

**From:** Laatsch, Cheryl - DNR <[Cheryl.Laatsch@wisconsin.gov](mailto:Cheryl.Laatsch@wisconsin.gov)>

**Sent:** Monday, July 11, 2022 9:44 AM

**To:** Shawn Puzen <[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)>

**Cc:** Miller, Matthew J <[matthew.j.miller@xcelenergy.com](mailto:matthew.j.miller@xcelenergy.com)>; Darrin Johnson <[Darrin.Johnson@meadhunt.com](mailto:Darrin.Johnson@meadhunt.com)>

**Subject:** RE: New Findings in Hayward, Trego and White River

Can you hand pull any of the plants that are found? I am reaching out to our statewide coordinator for input.

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Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Cheryl Laatsch  
Statewide FERC Coordinator  
Bureau of Environmental Analysis and Sustainability  
Wisconsin Dept of Natural Resources  
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(T) 920-387-7869 (Fax) 920-387-7888

[Cheryl.laatsch@wisconsin.gov](mailto:Cheryl.laatsch@wisconsin.gov)



---

**From:** Shawn Puzen <[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)>

**Sent:** Monday, July 11, 2022 9:38 AM

**To:** DNR Invasive Species <[DNRIInvasiveSpecies@wisconsin.gov](mailto:DNRIInvasiveSpecies@wisconsin.gov)>

**Cc:** Laatsch, Cheryl - DNR <[Cheryl.Laatsch@wisconsin.gov](mailto:Cheryl.Laatsch@wisconsin.gov)>; Miller, Matthew J <[matthew.j.miller@xcelenergy.com](mailto:matthew.j.miller@xcelenergy.com)>; Darrin Johnson <[Darrin.Johnson@meadhunt.com](mailto:Darrin.Johnson@meadhunt.com)>

**Subject:** FW: New Findings in Hayward, Trego and White River

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Good Morning,

NSPW is completing aquatic and terrestrial invasive species monitoring on the White River, Hayward, Trego, and Gile Flowages as part of its relicensing process for the hydroelectric projects.

As part of the recent monitoring, several new occurrences of newly established invasive aquatic and terrestrial species were identified (Please see below).

The online WDNR Early Detection Form will be completed in short order.

Please let us know if you have any additional questions.

Thanks,

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**SHAWN PUZEN**

FERC HYDROPOWER LICENSING AND COMPLIANCE, WATER

Mead & Hunt

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**From:** Mary Rohde <[M.Rohde@gaiconsultants.com](mailto:M.Rohde@gaiconsultants.com)>

**Sent:** Monday, July 11, 2022 7:01 AM

**To:** Darrin Johnson <[darrin.johnson@meadhunt.com](mailto:darrin.johnson@meadhunt.com)>; Shawn Puzen <[shawn.puzen@meadhunt.com](mailto:shawn.puzen@meadhunt.com)>

**Cc:** Laura Sass <[L.Sass@gaiconsultants.com](mailto:L.Sass@gaiconsultants.com)>

**Subject:** New Findings in Hayward, Trego and White River

Good Morning, Darrin and Shawn. I hope you both had a nice weekend!

While our field staff were out conducting the aquatic portion of the June ATIS surveys, they found new AIS findings. At the Hayward and Trego Hydroelectric Projects, yellow iris (*Iris pseudacorus*) plants were observed along the shoreline

throughout both Projects. In both areas, the species is so prevalent that capturing specific Latitude/Longitude for individual plants/areas would be very time consuming and general populations will be captured in the August Shoreline survey.

One of the Trego areas:



One of the Hayward areas:



In addition, aquatic forget-me-not was observed in two locations on the Hayward Project (approximately 46.0084727, -91.4587382 and 46.0085591, -91.4586935), and in several locations on the Gile flowage and the White River Flowage.



All of these species were found on the shoreline and will be documented again when our staff are out in August doing the terrestrial portion of the ATIS survey. We felt it important to document them during the aquatic survey as they are new to the project area and were in bloom at the time of the June survey. *Following notification to you we will submit our findings to Wisconsin DNR.*

If you have any questions about these findings, please let us know.

Regards,

**Mary K. Rohde**

Senior Environmental Manager

**GAI Consultants**, 515 S. Washburn Street, Suite 104, Oshkosh, WI 54904

**M** 920.344.8912

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## Darrin Johnson

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**From:** Laura Sass <L.Sass@gaiconsultants.com>  
**Sent:** Monday, July 11, 2022 3:53 PM  
**To:** Alexander.Selle@wisconsin.gov  
**Cc:** Mary Rohde; Shawn Puzen; Darrin Johnson; Laatsch, Cheryl - DNR; Miller, Matthew J  
**Subject:** Incident Report Forms for invasive species not previously documented at Hayward, Trego, and White River Flowages  
**Attachments:** AIS Incident Report Form\_3200-125\_Hayward\_PYL.pdf; AIS Incident Report Form\_3200-125\_Trego\_PYL.pdf; AIS Incident Report Form\_3200-125\_WhiteRiver\_FMN.pdf; AIS Incident Report Form\_3200-125\_Hayward\_FMN.pdf

Good afternoon Alex,

We have observed populations of yellow iris (*Iris pseudacorus*) on the Hayward and Trego Flowages and aquatic forget-me-not (*Myosotis scorpioides*) on the Hayward and White River flowages. Please find attached the respective AIS incident report forms. The populations of yellow iris are already well established and wide-spread at both Hayward and Trego Flowages. The forget-me-not plants were more sparse and isolated to the areas reported. We will be visiting all three areas again in late July/early August and will attempt to hand-remove the forget-me-not plants. Please feel free to reach out if you have any questions or would like us to gather more information when we are on the systems next.

Thanks,  
Laura

**Laura L. Sass, MS**

Senior Project Environmental Specialist

**GAI Consultants**, 3313 S. Packerland Drive, Suite E, De Pere, WI 54115

**T** 920.328.0980 **M** 608.215.0186

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**The purpose of this form is to notify DNR of a new species of AIS in a waterbody. Only use if you found an aquatic invasive plant on a lake where it hasn't been found previously.**

To find where aquatic invasives have already been found, visit: <http://dnr.wi.gov/lakes/ais>.

**Notice:** Information on this voluntary form is collected under ss. 33.02 and 281.11, Wis. Stats. Personally identifiable information collected on this form will be incorporated into the DNR Surface Water Integrated Monitoring System (SWIMS) Database. It is not intended to be used for any other purposes, but may be made available to requesters under Wisconsin's Open Records laws, ss. 19.32 - 19.39, Wis. Stats.

Primary Data Collector				
Name Laura Sass		Phone Number 920-328-0980		Email L.Sass@gaiconsultants.com
Monitoring Location				
Waterbody Name Hayward Lake		Township Name Hayward		County Sawyer
Boat Landing (if you only monitor at a boat landing)				
Date and Time of Monitoring or Discovery				
Monitoring Date 6-8-2022	Start Time	End Time		
Information on the Aquatic Invasive Plant Found (Fill out one form for each species found.)				
Which aquatic invasive plant did you find?: <input type="checkbox"/> Curly-leaf Pondweed <input type="checkbox"/> Eurasian Water-milfoil <input type="checkbox"/> Purple Loosestrife <input type="checkbox"/> Brittle Naiad <input type="checkbox"/> Hydrilla <input type="checkbox"/> Brazilian Waterweed <input type="checkbox"/> Yellow Floating Heart				
Where did you find the invasive plant? This is to report aquatic forget-me-not; found in 2 locations along shore, nearby to GPS coordinates below. Photo documentation not feasible due to				
Latitude: 46.00855915795532		Longitude: -91.45869357790528    access limitations.		
Approximately how large an area do the plants occupy? <input checked="" type="checkbox"/> A Few Plants <input type="checkbox"/> One or a few beds <input type="checkbox"/> Many beds <input type="checkbox"/> A Whole Bay or Portion of Lake <input type="checkbox"/> Widespread, covering most shallow areas of lake <input type="checkbox"/> Don't know (e.g. didn't check the whole lake)				
Was the plant floating or rooted? <input type="checkbox"/> Floating <input checked="" type="checkbox"/> Rooted				
Estimated percent cover in the area where the invasive was found (optional)				
Substrate cobble, %	Substrate muck, %	Substrate boulders, %	Substrate sand, %	Bottom covered with plants, %
Voucher Sample				
Did you collect a sample of the plant (a voucher specimen) and bring it to your local DNR office? If so, which office? <input type="checkbox"/> Rhinelander <input type="checkbox"/> Spooner <input type="checkbox"/> Green Bay <input type="checkbox"/> Oshkosh <input checked="" type="checkbox"/> Did not take plant sample to a DNR office <input type="checkbox"/> Fitchburg <input type="checkbox"/> Waukesha <input type="checkbox"/> Eau Claire <input type="checkbox"/> Superior <input type="checkbox"/> Other Office _____				

Please collect up to 5-10 intact specimens. Try to get the root system, all leaves as well as seed heads and flowers when present. Place in ziplock bag with no water. Place on ice and transport to refrigerator. Bring samples, a copy of this form, along with a map showing where you found the suspect plants to your regional AIS or Citizen Lake Monitoring Coordinator at the DNR.

For DNR AIS Coordinator to fill out	
AIS Coordinator(s) or qualified field staff who verified the occurrence: _____	
Statewide taxonomic expert who verified the occurrence: _____ (for list see <a href="http://dnr.wi.gov/invasives/aquatic/whattodo/staff/AisVerificationExperts.pdf">http://dnr.wi.gov/invasives/aquatic/whattodo/staff/AisVerificationExperts.pdf</a> )	
Was the specimen confirmed as the species indicated above?	<input type="checkbox"/> Yes <input type="checkbox"/> No    If no, what was it? _____
Herbarium where specimen is housed: _____	Herbarium Specimen ID: _____
Have you entered the results of the voucher in SWIMS?	<input type="checkbox"/> Yes <input type="checkbox"/> No
AIS Coordinator: Please enter the incident report in SWIMS under the Incident Report project for the county the AIS was found in. Then, keep the paper copy for your records.	

**The purpose of this form is to notify DNR of a new species of AIS in a waterbody. Only use if you found an aquatic invasive plant on a lake where it hasn't been found previously.**

To find where aquatic invasives have already been found, visit: <http://dnr.wi.gov/lakes/ais>.

**Notice:** Information on this voluntary form is collected under ss. 33.02 and 281.11, Wis. Stats. Personally identifiable information collected on this form will be incorporated into the DNR Surface Water Integrated Monitoring System (SWIMS) Database. It is not intended to be used for any other purposes, but may be made available to requesters under Wisconsin's Open Records laws, ss. 19.32 - 19.39, Wis. Stats.

Primary Data Collector				
Name Laura Sass		Phone Number 920-328-0980		Email L.Sass@gaiconsultants.com
Monitoring Location				
Waterbody Name Hayward Lake		Township Name Hayward		County Sawyer
Boat Landing (if you only monitor at a boat landing)				
Date and Time of Monitoring or Discovery				
Monitoring Date 6-7-2022	Start Time	End Time		
Information on the Aquatic Invasive Plant Found (Fill out one form for each species found.)				
Which aquatic invasive plant did you find?:				
<input type="checkbox"/> Curly-leaf Pondweed <input type="checkbox"/> Eurasian Water-milfoil <input type="checkbox"/> Purple Loosestrife <input type="checkbox"/> Brittle Naiad <input type="checkbox"/> Hydrilla <input type="checkbox"/> Brazilian Waterweed <input type="checkbox"/> Yellow Floating Heart				
Where did you find the invasive plant? Pale yellow iris - observed in many shoreline locations throughout the lake (photo available on the next page)				
Latitude:		Longitude:		
Approximately how large an area do the plants occupy?				
<input type="checkbox"/> A Few Plants <input type="checkbox"/> One or a few beds <input checked="" type="checkbox"/> Many beds <input type="checkbox"/> A Whole Bay or Portion of Lake <input type="checkbox"/> Widespread, covering most shallow areas of lake <input type="checkbox"/> Don't know (e.g. didn't check the whole lake)				
Was the plant floating or rooted?				
<input type="checkbox"/> Floating <input checked="" type="checkbox"/> Rooted				
Estimated percent cover in the area where the invasive was found (optional)				
Substrate cobble, %	Substrate muck, %	Substrate boulders, %	Substrate sand, %	Bottom covered with plants, %
Voucher Sample				
Did you collect a sample of the plant (a voucher specimen) and bring it to your local DNR office? If so, which office?				
<input type="checkbox"/> Rhinelander <input type="checkbox"/> Spooner <input type="checkbox"/> Green Bay <input type="checkbox"/> Oshkosh <input checked="" type="checkbox"/> Did not take plant sample to a DNR office <input type="checkbox"/> Fitchburg <input type="checkbox"/> Waukesha <input type="checkbox"/> Eau Claire <input type="checkbox"/> Superior <input type="checkbox"/> Other Office _____				

Please collect up to 5-10 intact specimens. Try to get the root system, all leaves as well as seed heads and flowers when present. Place in ziplock bag with no water. Place on ice and transport to refrigerator. Bring samples, a copy of this form, along with a map showing where you found the suspect plants to your regional AIS or Citizen Lake Monitoring Coordinator at the DNR.

For DNR AIS Coordinator to fill out	
AIS Coordinator(s) or qualified field staff who verified the occurrence: _____	
Statewide taxonomic expert who verified the occurrence: _____ (for list see <a href="http://dnr.wi.gov/invasives/aquatic/whattodo/staff/AisVerificationExperts.pdf">http://dnr.wi.gov/invasives/aquatic/whattodo/staff/AisVerificationExperts.pdf</a> )	
Was the specimen confirmed as the species indicated above?	<input type="checkbox"/> Yes <input type="checkbox"/> No    If no, what was it? _____
Herbarium where specimen is housed: _____	Herbarium Specimen ID: _____
Have you entered the results of the voucher in SWIMS?	<input type="checkbox"/> Yes <input type="checkbox"/> No
AIS Coordinator: Please enter the incident report in SWIMS under the Incident Report project for the county the AIS was found in. Then, keep the paper copy for your records.	



**The purpose of this form is to notify DNR of a new species of AIS in a waterbody. Only use if you found an aquatic invasive plant on a lake where it hasn't been found previously.**

To find where aquatic invasives have already been found, visit: <http://dnr.wi.gov/lakes/ais>.

**Notice:** Information on this voluntary form is collected under ss. 33.02 and 281.11, Wis. Stats. Personally identifiable information collected on this form will be incorporated into the DNR Surface Water Integrated Monitoring System (SWIMS) Database. It is not intended to be used for any other purposes, but may be made available to requesters under Wisconsin's Open Records laws, ss. 19.32 - 19.39, Wis. Stats.

Primary Data Collector				
Name Laura Sass		Phone Number 920-328-0980		Email L.Sass@gaiconsultants.com
Monitoring Location				
Waterbody Name Trego Lake		Township Name Trego		County Washburn
Boat Landing (if you only monitor at a boat landing)				
Date and Time of Monitoring or Discovery				
Monitoring Date 6-6-2022	Start Time	End Time		
Information on the Aquatic Invasive Plant Found (Fill out one form for each species found.)				
Which aquatic invasive plant did you find?: <input type="checkbox"/> Curly-leaf Pondweed <input type="checkbox"/> Eurasian Water-milfoil <input type="checkbox"/> Purple Loosestrife <input type="checkbox"/> Brittle Naiad <input type="checkbox"/> Hydrilla <input type="checkbox"/> Brazilian Waterweed <input type="checkbox"/> Yellow Floating Heart				
Where did you find the invasive plant? Pale yellow iris; Observed in many shoreline locations throughout the lake (photo on next page)				
Latitude:		Longitude:		
Approximately how large an area do the plants occupy? <input type="checkbox"/> A Few Plants <input type="checkbox"/> One or a few beds <input checked="" type="checkbox"/> Many beds <input type="checkbox"/> A Whole Bay or Portion of Lake <input type="checkbox"/> Widespread, covering most shallow areas of lake <input type="checkbox"/> Don't know (e.g. didn't check the whole lake)				
Was the plant floating or rooted? <input type="checkbox"/> Floating <input checked="" type="checkbox"/> Rooted				
Estimated percent cover in the area where the invasive was found (optional)				
Substrate cobble, %	Substrate muck, %	Substrate boulders, %	Substrate sand, %	Bottom covered with plants, %
Voucher Sample				
Did you collect a sample of the plant (a voucher specimen) and bring it to your local DNR office? If so, which office? <input type="checkbox"/> Rhinelander <input type="checkbox"/> Spooner <input type="checkbox"/> Green Bay <input type="checkbox"/> Oshkosh <input checked="" type="checkbox"/> Did not take plant sample to a DNR office <input type="checkbox"/> Fitchburg <input type="checkbox"/> Waukesha <input type="checkbox"/> Eau Claire <input type="checkbox"/> Superior <input type="checkbox"/> Other Office _____				

Please collect up to 5-10 intact specimens. Try to get the root system, all leaves as well as seed heads and flowers when present. Place in ziplock bag with no water. Place on ice and transport to refrigerator. Bring samples, a copy of this form, along with a map showing where you found the suspect plants to your regional AIS or Citizen Lake Monitoring Coordinator at the DNR.

For DNR AIS Coordinator to fill out	
AIS Coordinator(s) or qualified field staff who verified the occurrence: _____	
Statewide taxonomic expert who verified the occurrence: _____ (for list see <a href="http://dnr.wi.gov/invasives/aquatic/whattodo/staff/AisVerificationExperts.pdf">http://dnr.wi.gov/invasives/aquatic/whattodo/staff/AisVerificationExperts.pdf</a> )	
Was the specimen confirmed as the species indicated above?	<input type="checkbox"/> Yes <input type="checkbox"/> No    If no, what was it? _____
Herbarium where specimen is housed: _____	Herbarium Specimen ID: _____
Have you entered the results of the voucher in SWIMS?	<input type="checkbox"/> Yes <input type="checkbox"/> No
AIS Coordinator: Please enter the incident report in SWIMS under the Incident Report project for the county the AIS was found in. Then, keep the paper copy for your records.	



**The purpose of this form is to notify DNR of a new species of AIS in a waterbody. Only use if you found an aquatic invasive plant on a lake where it hasn't been found previously.**

To find where aquatic invasives have already been found, visit: <http://dnr.wi.gov/lakes/ais>.

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Primary Data Collector				
Name Laura Sass		Phone Number 920-328-0980		Email L.Sass@gaiconsultants.com
Monitoring Location				
Waterbody Name White River Flowage		Township Name White River		County Ashland
Boat Landing (if you only monitor at a boat landing)				
Date and Time of Monitoring or Discovery				
Monitoring Date 6-29-2022	Start Time	End Time		
Information on the Aquatic Invasive Plant Found (Fill out one form for each species found.)				
Which aquatic invasive plant did you find?:				
<input type="checkbox"/> Curly-leaf Pondweed <input type="checkbox"/> Eurasian Water-milfoil <input type="checkbox"/> Purple Loosestrife <input type="checkbox"/> Brittle Naiad <input type="checkbox"/> Hydrilla <input type="checkbox"/> Brazilian Waterweed <input type="checkbox"/> Yellow Floating Heart				
Where did you find the invasive plant?				
This is to report aquatic forget-me-not; found in 3 shoreline locations on the flowage. One location was pulled out by root: (46.493351, -90.917109)				
Latitude: (46.492208, -90.921865) and (46.492463, -90.922219)		Longitude: Photo attached of plant that was pulled.		
Approximately how large an area do the plants occupy?				
<input checked="" type="checkbox"/> A Few Plants <input type="checkbox"/> One or a few beds <input type="checkbox"/> Many beds <input type="checkbox"/> A Whole Bay or Portion of Lake <input type="checkbox"/> Widespread, covering most shallow areas of lake <input type="checkbox"/> Don't know (e.g. didn't check the whole lake)				
Was the plant floating or rooted?				
<input type="checkbox"/> Floating <input checked="" type="checkbox"/> Rooted				
Estimated percent cover in the area where the invasive was found (optional)				
Substrate cobble, %	Substrate muck, %	Substrate boulders, %	Substrate sand, %	Bottom covered with plants, %
Voucher Sample				
Did you collect a sample of the plant (a voucher specimen) and bring it to your local DNR office? If so, which office?				
<input type="checkbox"/> Rhinelander <input type="checkbox"/> Spooner <input type="checkbox"/> Green Bay <input type="checkbox"/> Oshkosh <input checked="" type="checkbox"/> Did not take plant sample to a DNR office <input type="checkbox"/> Fitchburg <input type="checkbox"/> Waukesha <input type="checkbox"/> Eau Claire <input type="checkbox"/> Superior <input type="checkbox"/> Other Office _____				

Please collect up to 5-10 intact specimens. Try to get the root system, all leaves as well as seed heads and flowers when present. Place in ziplock bag with no water. Place on ice and transport to refrigerator. Bring samples, a copy of this form, along with a map showing where you found the suspect plants to your regional AIS or Citizen Lake Monitoring Coordinator at the DNR.

For DNR AIS Coordinator to fill out	
AIS Coordinator(s) or qualified field staff who verified the occurrence: _____	
Statewide taxonomic expert who verified the occurrence: _____ (for list see <a href="http://dnr.wi.gov/invasives/aquatic/whattodo/staff/AisVerificationExperts.pdf">http://dnr.wi.gov/invasives/aquatic/whattodo/staff/AisVerificationExperts.pdf</a> )	
Was the specimen confirmed as the species indicated above?	If no, what was it?
<input type="checkbox"/> Yes <input type="checkbox"/> No	
Herbarium where specimen is housed: _____	Herbarium Specimen ID: _____
Have you entered the results of the voucher in SWIMS?	
<input type="checkbox"/> Yes <input type="checkbox"/> No	
AIS Coordinator: Please enter the incident report in SWIMS under the Incident Report project for the county the AIS was found in. Then, keep the paper copy for your records.	



B-624

## Darrin Johnson

---

**From:** Darrin Johnson  
**Sent:** Friday, January 27, 2023 11:32 AM  
**To:** Beranek, Ashley E - DNR  
**Cc:** Laatsch, Cheryl - DNR; Shawn Puzen; Darrin Johnson  
**Subject:** RE: Temperature Standard for Hayward and Trego Reservoirs

Thank you Ashley.

## Darrin Johnson

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**From:** Beranek, Ashley E - DNR <Ashley.Beranek@wisconsin.gov>  
**Sent:** Friday, January 27, 2023 11:29 AM  
**To:** Darrin Johnson <Darrin.Johnson@meadhunt.com>  
**Cc:** Laatsch, Cheryl - DNR <Cheryl.Laatsch@wisconsin.gov>; Hudak, Andrew J - DNR <Andrew.Hudak@wisconsin.gov>  
**Subject:** RE: Temperature Standard for Hayward and Trego Reservoirs

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Hi Darrin,

I can confirm these two impoundments, Hayward and Trego, should be using the criteria outlined in NR102 Table 2. They both have water residence times of less than 14 days, which we term Impounded Flowing Waters (NR 102.03(1q)) and apply the river/stream criteria for most metrics.

Please let me know if you have any additional questions. Thanks!

**Ashley Beranek** (Pronouns: she/her/hers; learn [why this is done](#))  
Integrated Report / Surface Water Quality Assessments Coordinator  
Phone: 608-400-6519  
[ashley.beranek@wisconsin.gov](mailto:ashley.beranek@wisconsin.gov)

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---

**From:** Laatsch, Cheryl - DNR <[Cheryl.Laatsch@wisconsin.gov](mailto:Cheryl.Laatsch@wisconsin.gov)>  
**Sent:** Friday, January 27, 2023 10:54 AM  
**To:** Hudak, Andrew J - DNR <[Andrew.Hudak@wisconsin.gov](mailto:Andrew.Hudak@wisconsin.gov)>; Beranek, Ashley E - DNR <[Ashley.Beranek@wisconsin.gov](mailto:Ashley.Beranek@wisconsin.gov)>  
**Subject:** FW: Temperature Standard for Hayward and Trego Reservoirs

Hi Ashley – Please see the email below. Can you help Darrin with his question?

Cheryl Laatsch

Statewide FERC Coordinator  
Bureau of Environmental Analysis and Sustainability  
Wisconsin Dept of Natural Resources  
N7725 Hwy 28  
Horicon WI 53032  
**NEW (Work Cell) 920-382-9975**  
[Cheryl.laatsch@wisconsin.gov](mailto:Cheryl.laatsch@wisconsin.gov)

**From:** Darrin Johnson <[Darrin.Johnson@meadhunt.com](mailto:Darrin.Johnson@meadhunt.com)>  
**Sent:** Friday, January 27, 2023 10:41 AM  
**To:** Laatsch, Cheryl - DNR <[Cheryl.Laatsch@wisconsin.gov](mailto:Cheryl.Laatsch@wisconsin.gov)>  
**Cc:** Shawn Puzen <[Shawn.Puzen@meadhunt.com](mailto:Shawn.Puzen@meadhunt.com)>; Darrin Johnson <[Darrin.Johnson@meadhunt.com](mailto:Darrin.Johnson@meadhunt.com)>  
**Subject:** Temperature Standard for Hayward and Trego Reservoirs

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Hi Cheryl,

I just wanted to confirm the temperature standards we should be using for the Hayward and Trego reservoirs.

Below is from WDNR's comment on the PAD:

- Trego Project should be subject to the Warm-Large temperature criteria (see table below from Chapter N 102.2 – Water Quality Standards for Wisconsin Surface Waters)
- Hayward Project should be subject to Coldwater temperature criteria (see table below from Chapter N 102.2 – Water Quality Standards for Wisconsin Surface Waters)

Table 2 Ambient Temperatures and Water Quality Criteria for Temperature for Non-Specific Waters (All values are expressed as degrees Fahrenheit)												
Month	Cold <sup>4</sup>			Warm – Large <sup>5</sup>			Warm – Small <sup>6</sup>			LFF <sup>7</sup>		
	Ta <sup>1</sup>	SL <sup>2</sup>	A <sup>3</sup>	Ta	SL	A	Ta	SL	A	Ta	SL	A
JAN	35	47	68	33	49	76	33	49	76	37	54	78
FEB	36	47	68	33	50	76	34	50	76	39	54	79
MAR	39	51	69	36	52	76	38	52	77	43	57	80
APR	47	57	70	46	55	79	48	55	79	50	63	81
MAY	56	63	72	60	65	82	58	65	82	59	70	84
JUN	62	67	72	71	75	85	66	76	84	64	77	85
JUL	64	67	73	75	80	86	69	81	85	69	81	86
AUG	63	65	73	74	79	86	67	81	84	68	79	86
SEP	57	60	72	65	72	84	60	73	82	63	73	85
OCT	49	53	70	52	61	80	50	61	80	55	63	83
NOV	41	48	69	39	50	77	40	49	77	46	54	80
DEC	37	47	69	33	49	76	35	49	76	40	54	79

1 Ta = ambient temperature  
2 SL = sub-lethal criteria  
3 A = acute criteria  
4 Cold = waters with a fish and aquatic life use designation of "cold water community"  
5 Warm – Large = waters with a fish and aquatic life use designation of "warm water sport fish community" or "warm water forage fish community" and unidirectional 7Q10 flows ≥ 200 cfs (129 mgd)  
6 Warm – Small = waters with a fish and aquatic life use designation of "warm water sport fish community" or "warm water forage fish community" and unidirectional 7Q10 flows < 200 cfs (129 mgd)  
7 LFF = waters with a fish and aquatic life use designation of "limited forage fish community"

I just wanted to confirm that we don't need to use the Inland lake/impoundment temperature table (Table 4) for the deep hole reservoir monitoring sites at each Project.

Just let me know if you have any questions. Thank you.

## **Darrin Johnson**

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