Appendix C – Aquatic & Terrestrial Invasive Species Study

Gile Flowage Storage Project
FERC No. 15055

Study Plan

Aquatic and Terrestrial Invasive Species Study

Prepared for

Prepared by

Mead & Hunt

meadhunt.com

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1. Introduction

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is currently seeking to obtain an original license from the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Gile Flowage Storage Project (Gile Flowage or Project) under FERC Docket Number P-15055-000. The Project is owned, operated, and maintained by the Applicant. To obtain an original license, the Applicant must submit a Final License Application (FLA) to FERC no later than August 18, 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 January 19, 2021, FERC issued Scoping Document 1 and requested that stakeholders provide comments on the Pre-Licensing Application (PAD) and study requests within 60 days. During the 60-day comment period, the Applicant received comments and study requests from several entities. The Friends of the Gile Flowage (FOG), River Alliance of Wisconsin (RAW), and Wisconsin Department of Natural Resources (WDNR) requested the Applicant to complete an invasive species study as part of relicensing.

The FOG requested that the Applicant conduct an aquatic and terrestrial invasive species (ATIS) study to develop strategies to mitigate impacts of spiny water fleas and other invasive species including Eurasian watermilfoil, quagga, zebra mussels, and purple loosestrife.

The RAW requested that the Applicant conduct an ATIS study in the Gile Flowage to identify what ATIS species are present within the Project.

The WDNR recommended that the Applicant conduct an ATIS study using the WDNR Early Detection Early Response Protocols. They 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. They noted that detection protocols for spiny water flea do not need to be conducted, since their presence is known. The WDNR also requested in-water plant community data within the Project boundary 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 species and aquatic and terrestrial invasive 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 Resource Management Goals

WDNR lists the state resource management goal of compliance with Wisconsin Administrative Code NR40 Invasive Species Identification, Classification, and Control in their study request. The purpose of

the rule is to identify, classify, and control invasive species. Control includes minimizing the transport and spread of existing invasive species and preventing the introduction of new invasive species.

2.3 Public Interest

FOG, RAW, and WDNR expressed interest in this study.

2.4 Background and Existing Information

The WDNR Lakes and AIS Mapping Tool identified three invasive invertebrate species in the Gile Flowage: the prohibited spiny water flea (*Byrthotrephes cederstoemi*), first identified in 2003, the restricted Chinese mystery snail (*Cipangopaludina chinensis*), first identified in 2004, and the restricted banded mystery snail (*Vivaparus georgianus*), first identified in 2011. The WDNR also noted that purple loosestrife (*Lythrum salicaria*) was also found in 2018.

The Iron County Land and Water Conservation Department noted that the spiny water flea was identified in the West Fork of the Montreal River (West Fork) downstream of the Gile Flowage dam for the first time in 2018. WDNR also has documented movement of spiny water flea downstream of the impoundment in the West Fork. The spiny water flea extent is unknown, but WDNR indicated that they disappeared from WDNR sampling by the next road crossing downstream after State Highway 77.

2.5 Project Nexus

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.

2.6 Study Area

The ATIS Study will encompass the upstream and downstream areas inundated by the West Fork and contained within the proposed Project boundary as outlined in the Pre-Application Document (PAD). It will also encompass upland areas owned in fee by the Applicant within the Project boundary that include Project facilities and/or Applicant owned formal recreation sites. The study area will also include all shoreline areas adjacent to the reservoir, including the shorelines of islands within the reservoir. The Study Area is depicted in Appendix 1.

2.7 Methodology

2.7.1 Upstream and Downstream Inundated Areas

Samples will be collected in locations outlined in a point intercept grid provided by the WDNR. Sampling will be 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 completed by boat using either a pole-mounted or rope-mounted rake approximating the WDNR Recommended Baseline Monitoring of Aquatic Plants in Wisconsin protocol (point-intercept protocol) including 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[1]. 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 Applicant);
- 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).

Vouchers shall be collected for all NR40 listed aquatic and terrestrial invasive species populations not currently verified within the Project. Steps for Vouchering Invasive Plant Species are listed below:

- 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 ziplock 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 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, and rock. In order to help assist determining habitat within the littoral zone that has the potential to be impacted by drawdowns (reservoir elevations 1,490 feet NGVD

[1] https://dnr.wi.gov/topic/invasives/documents/NR40plantlist.pdf

to 1,475 feet NGVD), bed substrates will be classified into one of the following nine substrate types: clay, silt, sand, gravel, cobble, boulder, bedrock, wood, or organic.

Water depth information collected during the survey will also be used to develop a bathymetric map of the reservoir.

Any areas not included in the point intercept grid will be monitored for the aquatic invasive rapid response species listed in Appendix 3. If any rapid response species are identified in any of the surveying efforts, WDNR notification as described in Section 2.7.5 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 zebra mussel (*Dreissena polymnorpha*). WDNR indicated in their study request that there is no need to monitor for spiny water fleas.

In order to determine the presence/absence of Asian clam and other invasive macroinvertebrates, the Applicant will conduct sediment samples at all existing public boat landings 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.

2.7.2 Upland Shorelines

Upland shoreline areas will be surveyed from a boat (or on foot where the use of a boat is not feasible, i.e., tailrace area) while moving slowly along the shoreline. During the survey, an overall characterization of the terrestrial plant community will be made. Invasive terrestrial plants listed in NR40 will be noted and their locations on the shoreline identified by latitude and longitude. An estimate of relative abundance and the length of shoreline where each species is present will also be recorded in the Terrestrial Invasive Monitoring Form located in Appendix 4. The information will be used for future mapping.

2.7.3 Upland Meander Survey

A meander survey will be utilized for the upland areas owned in fee by the Applicant within the Project boundary containing Project facilities or recreation sites. During the meander survey, 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 relative abundance and the extent of the area where the species is present will be recorded for future mapping. The route traveled during the meander survey will also be recorded for future mapping. No meander surveys will occur on islands, all sampling for terrestrial invasive species on islands will be conducted according to Section 2.7.2.

2.7.4 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.

2.7.5 Information Reporting

Should monitoring reveal a new occurrence of an invasive species listed on the rapid response sheet contained in Appendix 3, the WDNR shall be notified at invasive.species@wisconsin.gov as soon as possible, but no later than five working days after its discovery[2]. The notification shall include photographs and submittal of the online WDNR Early Detection Form.

Information collected during the study will be summarized in a study report. Completed survey sheets will be appended to the study report. Based upon the data collected, additional invasive species mitigation and enhancement recommendations (if any) may be included in the DLA and/or FLA.

2.8 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.

2.9 Project Schedule and Deliverables

Results of 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 report will include a summary of 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. Corresponding maps will show the locations of the point intercept survey locations and the meander survey routes. The survey locations depicting the presence of aquatic invasive species listed in NR40 will be differentiated from the locations with negative sample results. Several maps will be developed and presented in the report including: 1) a map showing the overall predominant species in shoreline areas; 2) a map showing the locations and identities of invasive species observed during the surveys; 3) a map showing the substrates identified during the point-intercept survey; and 4) a bathymetric map of the reservoir. The report will also include all field sheets and completed forms for any observed new occurrences of aquatic or terrestrial invasive species as identified in the Rapid Response List as well as verification photographs.

NSPW anticipates that field work will be completed by the end of August 2022. The study report will be included in the Initial Study Report no later than September 28, 2022 when it is filed with FERC.

[2] In addition to notifying the WDNR, the consultant shall notify the Applicant representative.

2.10 Level of Effort and/or Cost

NSPW estimates that this study will cost approximately $50,000 to complete.

2.11 Discussion of Alternative Approaches

NSPW has generally incorporated RAW and WDNR comments on their request for aquatic and terrestrial species and aquatic plant surveys. NSPW has provided reasoning in Section 3.0 of the Proposed Study Plan as to why the FOG request to monitor spiny water flea was not adopted into this study. The proposed methods for this study are consistent with accepted professional practices. The overall approach has been used in other relicensing proceedings and is consistent with generally accepted methods used by federal and state agencies. In addition, the proposed methods for this study are consistent with FERC's study requirements under the ILP. No alternative approaches to this study are warranted.

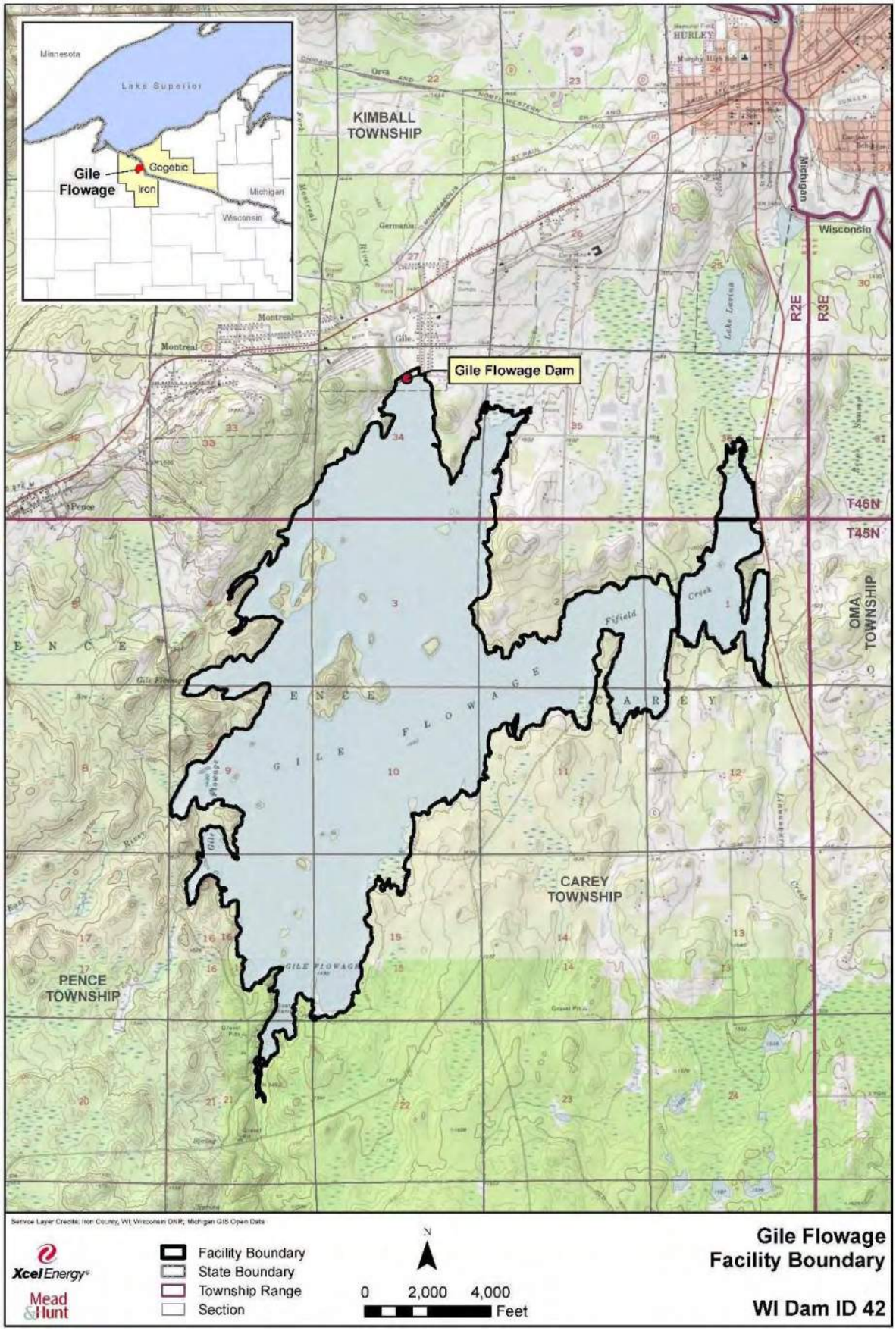
3. References

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 Service, PUB-SS-1068 2010. Madison, Wisconsin, USA.

WDNR Bureau of Science Services, PO Box 7921, Madison, WI 53707-7921. Selected Regulated Aquatic Invasive Species PUB-SS-1162 2016.

Wisconsin Administrative Code Chapter NR40 Invasive Species Identification, Classification and Control, April 2017.

Appendix 1 – Invasive Species Study Area


Minnesota
Lake Superior
Gile Flowage
Gogebic
Iron
Michigan
Wisconsin
KIMBALL TOWNSHIP
HURLEY
Michigan
Wisconsin
Montreal
Gile Flowage Dam
R2E
R3E
T46N
T45N
PENCE TOWNSHIP
CAREY TOWNSHIP
OMA TOWNSHIP
Service Layer Credits: Iron County, WI; Wisconsin DNR; Michigan GIS Open Data
Xcel Energy®
Mead & Hunt
Facility Boundary
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0 2,000 4,000
Feet
Gile Flowage
Facility Boundary
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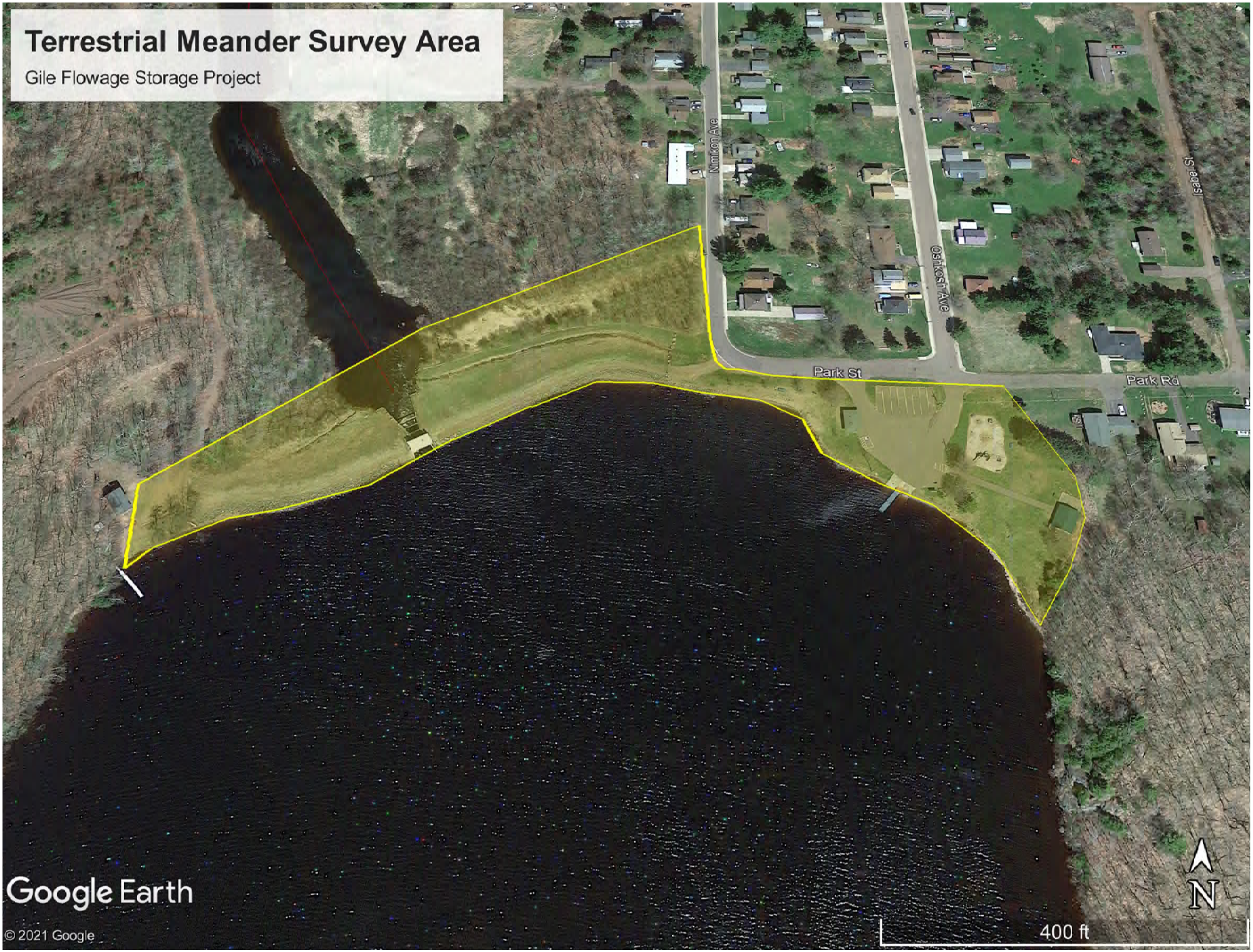
Terrestrial Meander Survey Area
Gile Flowage Storage Project
Nimikon Ave
Oshkosh Ave
Park St
Park Rd
Google Earth
© 2021 Google
400 ft
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Appendix 2 – Point Intercept Protocol

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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J. Hauxwell, Wisconsin Department of Natural Resources
B. Korth, University of Wisconsin-Extension
F. Koshere, Wisconsin Department of Natural Resources
A. Mikulyuk, Wisconsin Department of Natural Resources

Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis, and Applications

Jennifer Hauxwell[1], *Susan Knight*[2], *Kelly Wagner*[1], *Alison Mikulyuk*[1], *Michelle Nault*[1], *Meghan Porzky*[1], *and Shaunna Chase*[1]

[1]Wisconsin Department of Natural Resources
Bureau of Science Services
Fisheries and Aquatic Sciences Research Section
2801 Progress Road
Madison, WI 53716

[2]University of Wisconsin – Madison
Trout Lake Station
10810 County Hwy N
Boulder Junction, WI 54512

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).

CONTENTS

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[1].

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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[1] 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[2]. 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[2,3]. 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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[2] 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.

[3] 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[4].

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.

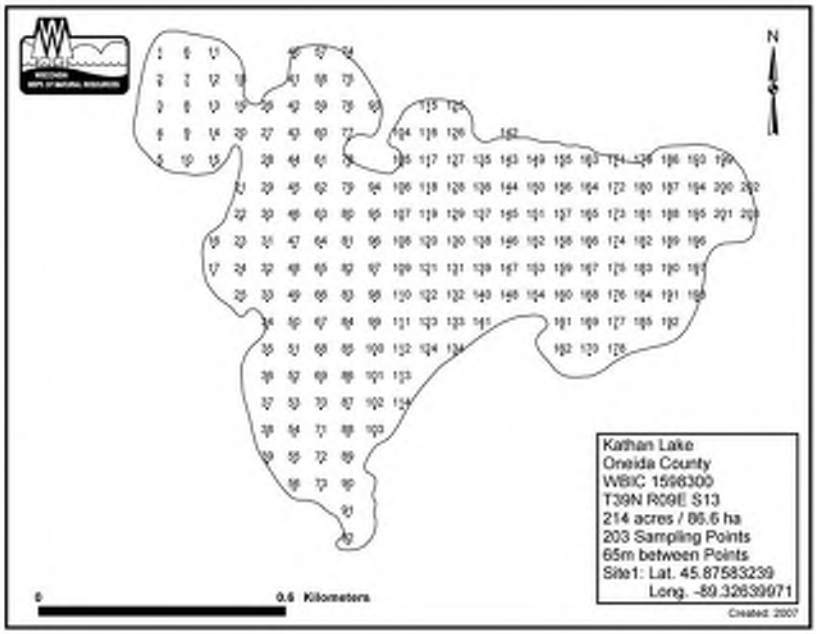


Figure 1: The point-intercept grid for Kathan Lake, Oneida County, WI, with 203 sampling sites.

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

[4] 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[2]; 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-senescing 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[5]. 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.**

[5] 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.

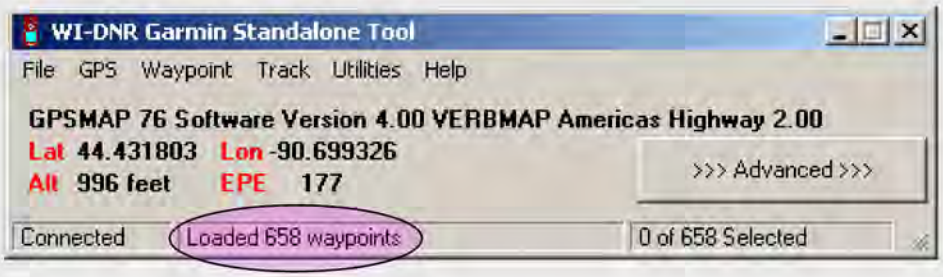
3. Plug the round end of the PC interface cable into the external data/auxiliary power port under the rubber panel on the back of the GPS receiver.

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

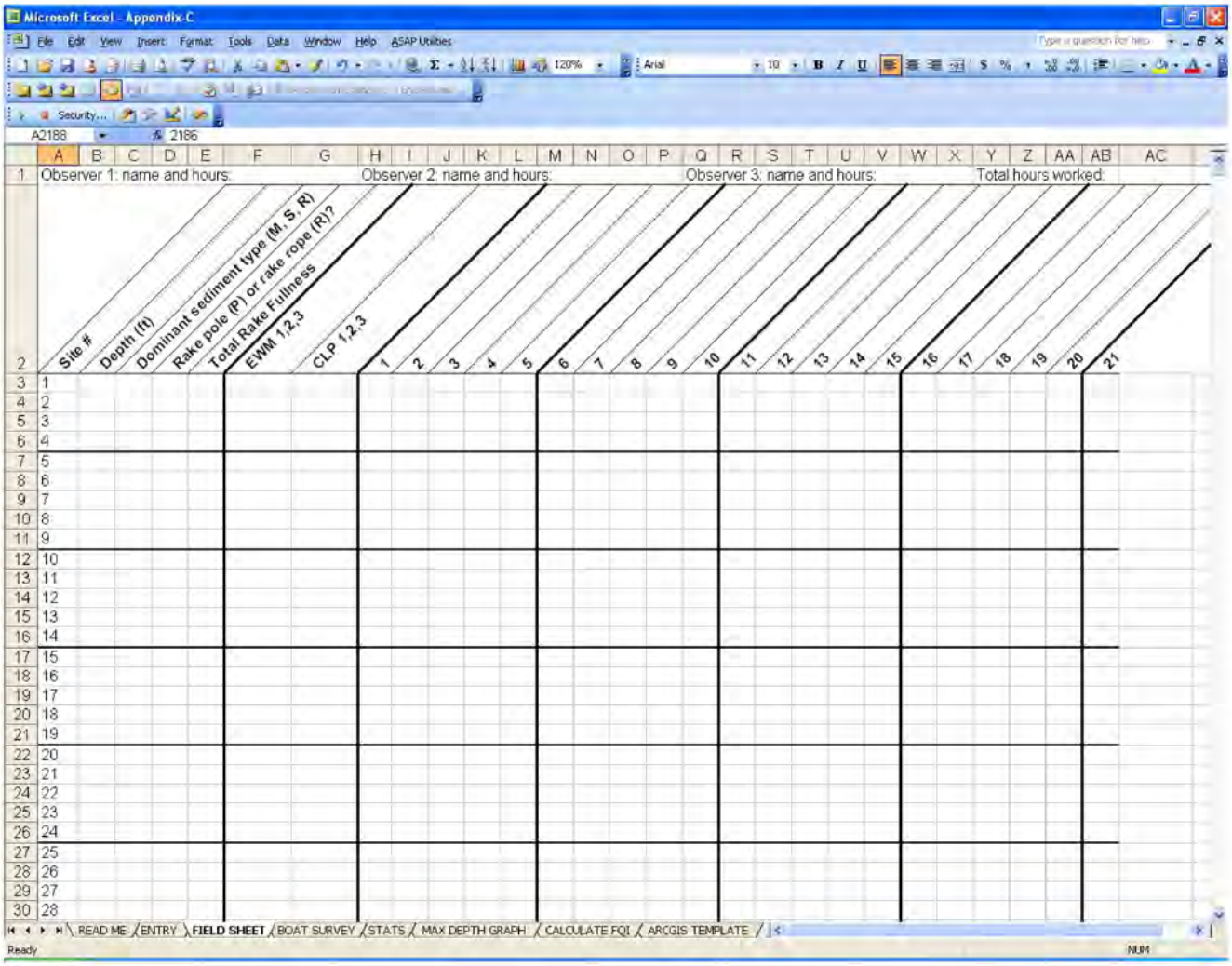
2. A pop-up window will indicate the completion of a successful upload. Click OK.

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.



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).

Pole Sampler

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.

Rope Sampler

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.

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 ≤ 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 (≤ 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 (≤ 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, accidently 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 were 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).

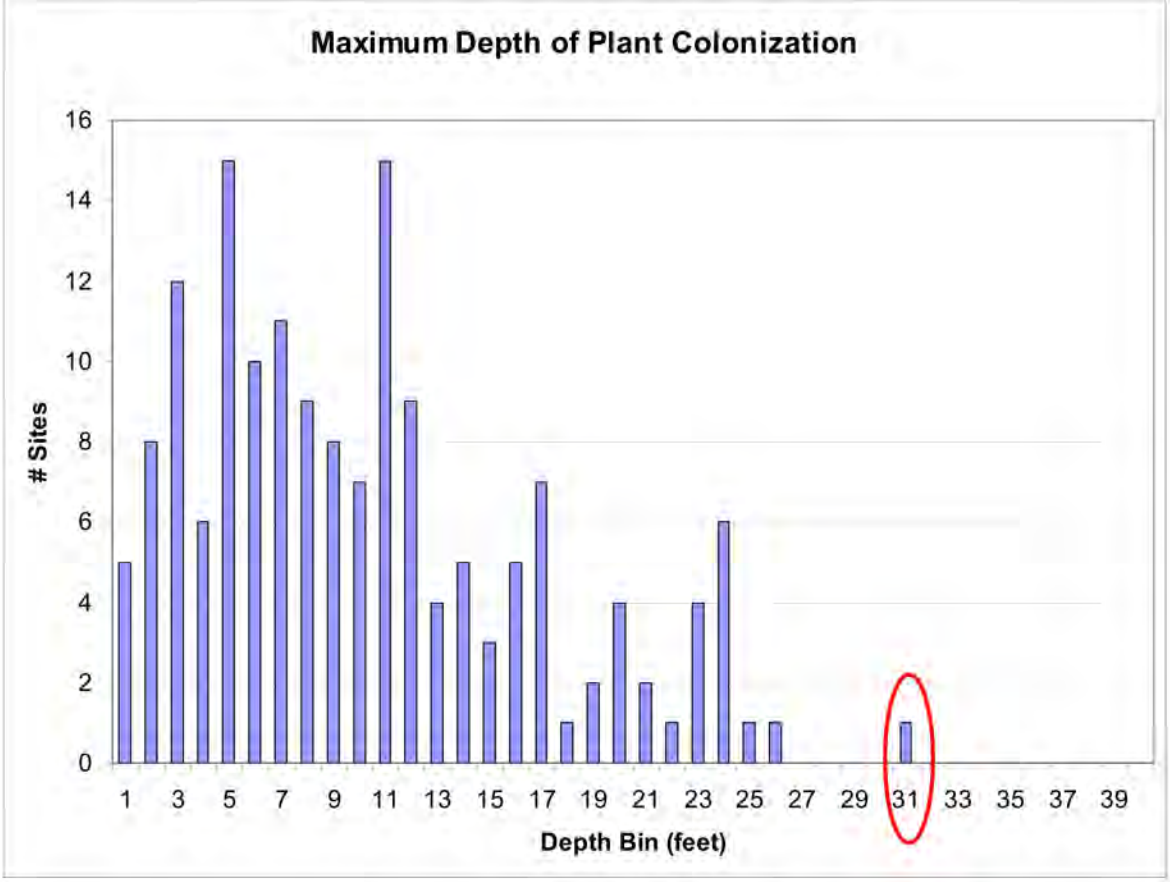


Figure 4: Distribution of plant occurrences versus water column depth. The value circled in red is more than 2 feet deeper than all other plants found during the survey, and is considered an outlier. Outliers should be omitted when determining the maximum depth of plant colonization.

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".

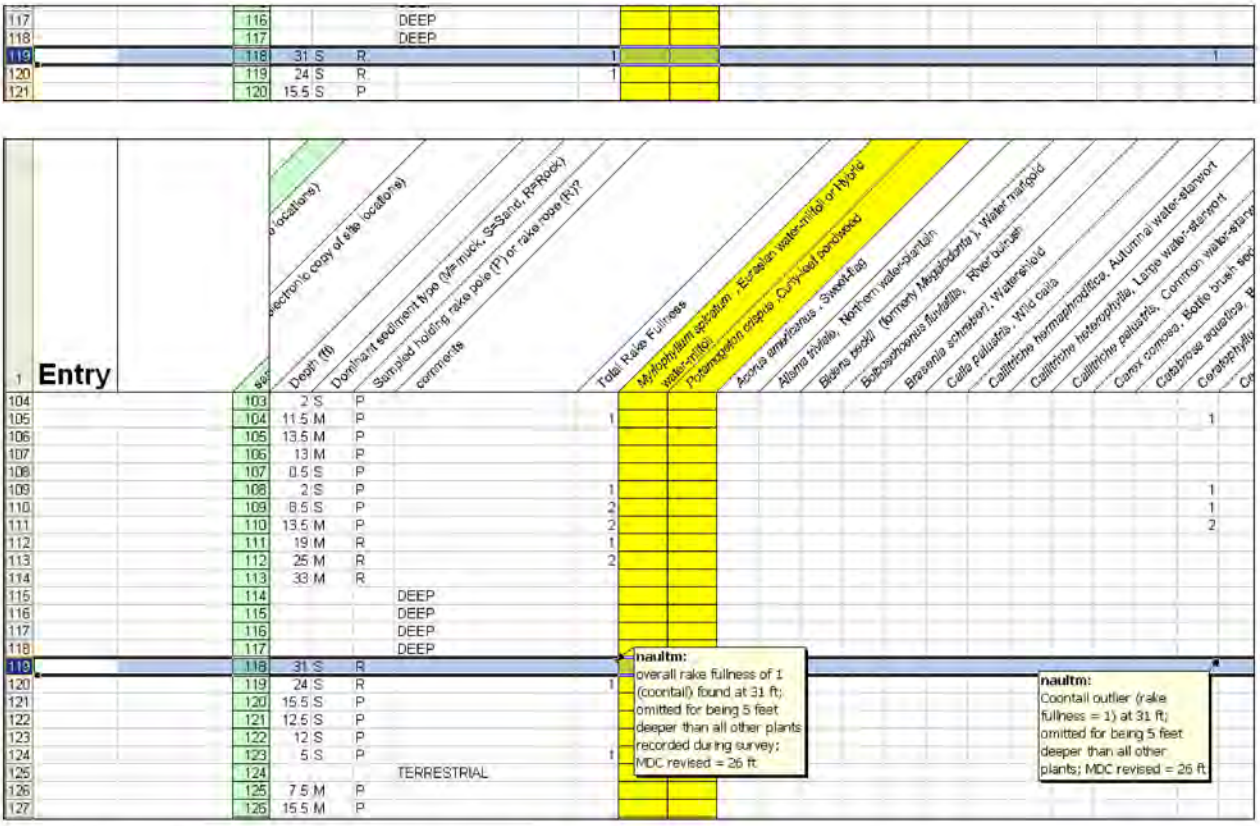


Figure 5: ***Top*** **- Ceratophyllum demersum outlier at 31 feet (sampling point #118).** ***Bottom*** **- C. demersum outlier at 31 feet deleted from both C. demersum and total rake fullness columns. Brief descriptive comments should be inserted in cells where outliers have been deleted.**

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[6]. The species list considered in this calculation is that which Nichols[6] originally considered, and the "C values" used in this spreadsheet reflect those currently accepted by the Wisconsin State Herbarium[7]. 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.

[6] 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.

[7] University of Wisconsin-Madison, 2001. Wisconsin Floristic Quality Assessment (WFQA). Retrieved October 27, 2009 from: http://www.botany.wisc.edu/WFQA.asp

Saving the File

Once the data is electronically entered into the Aquatic Plant Survey Data Workbook (http://www.uwsp.edu/cnr/uwexlakes/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). 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/uwexlakes/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; 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 4th 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) for the Madison herbarium or to Robert Freckmann (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/

Dr. Robert Freckmann
Robert Freckmann Herbarium
0310 CNR Addition
1900 Franklin Street
Stevens Point, WI 54481
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.

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).

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 Kathan Lake, Oneida County. The data was collected during a survey conducted August 21-22, 2007.

Table 1. Summary Statistics

Total number of sites set-up	**203**
Total number of sites visited	**171**
Total number of sites with vegetation	**149**
Total number of sites shallower than maximum depth of plants	**165**
Frequency of occurrence at sites shallower than maximum depth of plants	**90.30**
Simpson Diversity Index	**0.94**
Maximum depth of plants (ft)	**9.50**
Number of sites sampled using rake on Rope (R)	**0**
Number of sites sampled using rake on Pole (P)	**171**
Average number of all species per site (shallower than max depth)	**3.96**
Average number of all species per site (veg. sites only)	**4.39**
Average number of native species per site (shallower than max depth)	**3.56**
Average number of native species per site (veg. sites only)	**3.95**
Species Richness	**37**
Species Richness (including visuals)	**38**
Species Richness (including visuals & boat survey)	**40**

Table 2. Individual species frequency of occurrences

Common Name	Scientific Name	% Frequency (Littoral)	% Frequency (Whole lake)	% Frequency (in vegetated areas)	Relative Frequency (%)
Bushy pondweed	*Najas flexilis*	41.2	39.8	45.6	10.4
Common waterweed	*Elodea canadensis*	40.6	39.2	45.0	10.2
Eurasian water milfoil*	*Myriophyllum spicatum**	40.0	38.6	44.3	10.1
Filamentous algae	*Algae* spp.	26.1	25.1	28.9	6.6
Coontail	*Ceratophyllum demersum*	23.0	22.2	25.5	5.8
Stoneworts	*Nitella* spp.	21.8	21.1	24.2	5.5
Watershield	*Brasenia schreberi*	20.6	19.9	22.8	5.2
Small bladderwort	*Utricularia minor*	17.6	17.0	19.5	4.4
Small pondweed	*Potamogeton pusillus*	17.0	16.4	18.8	4.3
Common bladderwort	*Utricularia vulgaris*	16.4	15.8	18.1	4.1
Wild celery	*Vallisneria americana*	15.2	14.6	16.8	3.8
Flat stem pondweed	*Potamogeton zosteriformis*	13.9	13.5	15.4	3.5
Stiff pondweed	*Potamogeton strictifolius*	11.5	11.1	12.8	2.9
Ribbon leaf pondweed	*Potamogeton epihydrus*	9.1	8.8	10.1	2.3
White water lily	*Nymphaea odorata*	7.9	7.6	8.7	2.0
Muskgrasses	*Chara* 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	*Potamogeton amplifolius*	5.5	5.3	6.0	1.4
Spiny-spored quillwort	*Isoetes echinospora*	4.9	4.7	5.4	1.2
Waterwort	*Elatine minima*	4.2	4.1	4.7	1.1
Creeping spikerush	*Eleocharis palustris*	4.2	4.1	4.7	1.1
Water horsetail	*Equisetum fluviatile*	4.2	4.1	4.7	1.1
Northern water milfoil	*Myriophyllum sibiricum*	4.2	4.1	4.7	1.1
Thin floating-leaf bur-reed	*Sparganium* sp.	4.2	4.1	4.7	1.1
Spatterdock	*Nuphar variegata*	3.6	3.5	4.0	0.9
Spiral-fruited pondweed	*Potamogeton spirillus*	3.6	3.5	4.0	0.9
American bur-reed	*Sparganium americanum*	3.6	3.5	4.0	0.9
Shoreweed	*Littorella uniflora*	3.0	2.9	3.4	0.8
Brown-fruited rush	*Juncus pelocarpus* f. *submersus*	2.4	2.3	2.7	0.6
Variable pondweed	*Potamogeton gramineus*	2.4	2.3	2.7	0.6
Twin-stemmed bladderwort	*Utricularia geminiscapa*	1.8	1.8	2.0	0.5
Pipewort	*Eriocaulon aquaticum*	0.6	0.6	0.7	0.2
Clasping leaf pondweed	*Potamogeton richardsonii*	0.6	0.6	0.7	0.2
Broad-leaved arrowhead	*Sagittaria latifolia*	0.6	0.6	0.7	0.2
Thin-leaved pondweed	*Potamogeton* sp.	0.6	0.6	0.7	0.2
Flat-leaved bladderwort	*Utricularia intermedia*	0.6	0.6	0.7	0.2
Cattail	*Typha* sp.	Visual	Visual	Visual	Visual
Needle spikerush	*Eleocharis acicularis*	Boat Survey	Boat Survey	Boat Survey	Boat Survey
Three-way sedge	*Dulichium arundinaceum*	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	*Najas flexilis*	68	68	1.28
Common waterweed	*Elodea canadensis*	67	67	1.28
Eurasian water milfoil*	*Myriophyllum spicatum**	66	71	1.47
Filamentous algae	*Algae* spp.	43	43	1.00
Coontail	*Ceratophyllum demersum*	38	38	1.37
Stoneworts	*Nitella* spp.	36	36	1.00
Watershield	*Brasenia schreberi*	34	58	1.68
Small bladderwort	*Utricularia minor*	29	29	1.10
Small pondweed	*Potamogeton pusillus*	28	28	1.14
Common bladderwort	*Utricularia vulgaris*	27	27	1.30
Wild celery	*Vallisneria americana*	25	26	1.36
Flat stem pondweed	*Potamogeton zosteriformis*	23	25	1.22
Stiff pondweed	*Potamogeton strictifolius*	19	19	1.16
Ribbon leaf pondweed	*Potamogeton epihydrus*	15	18	1.27
White water lily	*Nymphaea odorata*	13	42	1.69
Muskgrasses	*Chara* spp.	12	12	1.25
Freshwater sponge	Sponge spp.	10	11	1.00
Moss	Moss spp.	10	10	1.20
Large-leaf pondweed	*Potamogeton amplifolius*	9	10	1.33
Spiny-spored quillwort	*Isoetes echinospora*	8	11	1.00
Waterwort	*Elatine minima*	7	8	1.00
Creeping spikerush	*Eleocharis palustris*	7	9	1.14
Water horsetail	*Equisetum fluviatile*	7	15	1.43
Northern water milfoil	*Myriophyllum sibiricum*	7	7	1.00
Thin floating-leaf bur-reed	*Sparganium* sp.	7	7	1.00
Spatterdock	*Nuphar variegata*	6	22	1.17
Spiral-fruited pondweed	*Potamogeton spirillus*	6	6	1.00
American bur-reed	*Sparganium americanum*	6	11	1.50
Shoreweed	*Littorella uniflora*	5	5	1.00
Brown-fruited rush	*Juncus pelocarpus* f. *submersus*	4	5	1.25
Variable pondweed	*Potamogeton gramineus*	4	5	1.00
Twin-stemmed bladderwort	*Utricularia geminiscapa*	3	3	1.00
Pipewort	*Eriocaulon aquaticum*	1	2	1.00
Clasping leaf pondweed	*Potamogeton richardsonii*	1	1	2.00
Broad-leaved arrowhead	*Sagittaria latifolia*	1	1	1.00
Thin-leaved pondweed	*Potamogeton* sp.	1	1	1.00
Flat-leaved bladderwort	*Utricularia intermedia*	1	1	1.00
Cattail	*Typha* sp.	Visual	3	n/a
Needle spikerush	*Eleocharis acicularis*	Boat Survey	Boat Survey	n/a
Three-way sedge	*Dulichium arundinaceum*	Boat Survey	Boat Survey	n/a

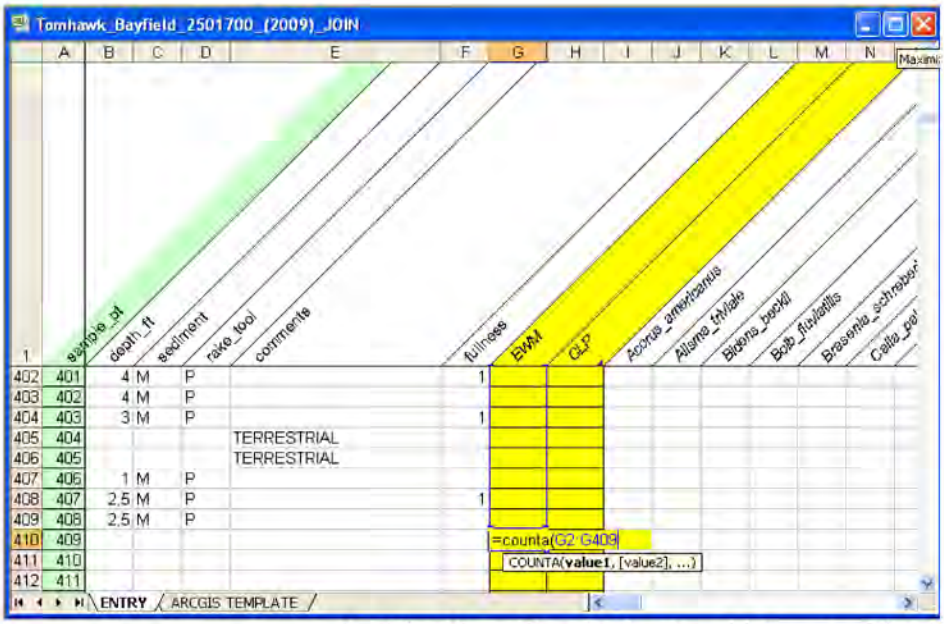
Appendix 3

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.

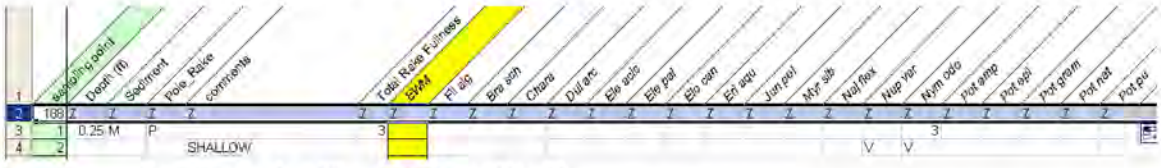
1. After entering the PI survey data into the Aquatic Plant Survey Data Workbook (Appendix-C.xls), save the file using a unique name. We recommend the convention: Lake_County_WBIC_(YYYY).xls

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_country_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
        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

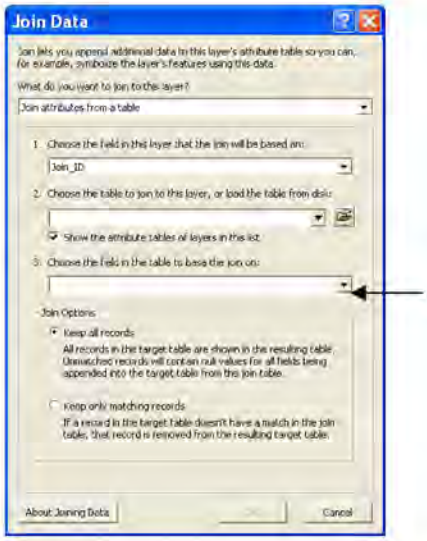
7. Edit Attribute Table for point shapefile
   a. Open Attribute Table
      i. Right click on point shapefile in ArcMap table of contents
      ii. Select "Open Attribute Table"
   b. Add a Field
      i. Select the "Options" button → "Add Field"
      ii. Name: Join_ID
      iii. Type: Double
      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.)

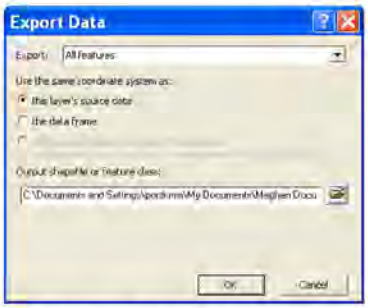
8. Join shapefile to <Lake_County_WBIC_(YYYY)_JOIN.xls>
   a. Right click on point shapefile in ArcMap table of contents
   b. Select Joins and Relates → Join…
   c. Set the following options:
      i. Join Attributes from a table
      ii. Join will be based on "Join_ID"
      iii. Choose the table 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"



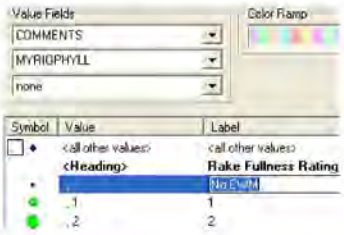
9. Export joined shapefile to make it permanent
   a. Right click on joined point shapefile in ArcMap table of contents
   b. Select Data → Export Data
   c. Set the following options:
      i. Export: All Features
      ii. Use the same coordinate system as: this layer's source data
      iii. Output 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.

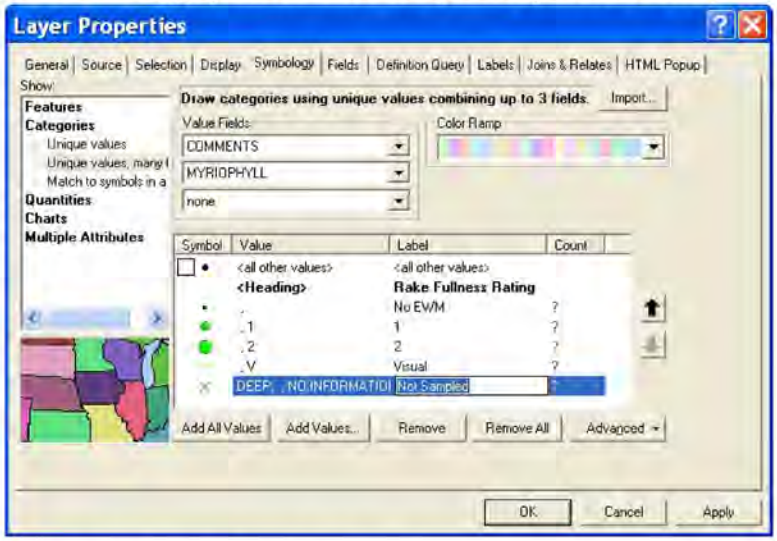
10. Check Join Results
    a. Right click on the Joined Point Shapefile in the table of contents
    b. Select "Open Attribute Table"
    c. Verify that Join was successful
       i. All data present in Excel file should now be located in the Joined Point Shapefile attribute table, and the Join_ID and 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

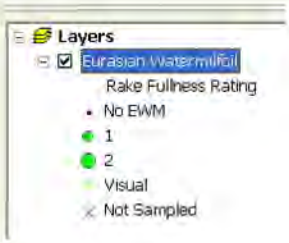
12. Map Page Layout
    a. Verify that the coordinate system is defined correctly for the Data Frame
        i. Select View → Data Frame Properties → Coordinate System Tab
        ii. If the coordinate system is incorrectly defined, browse for the correct coordinate system
            1. Predefined → 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
        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

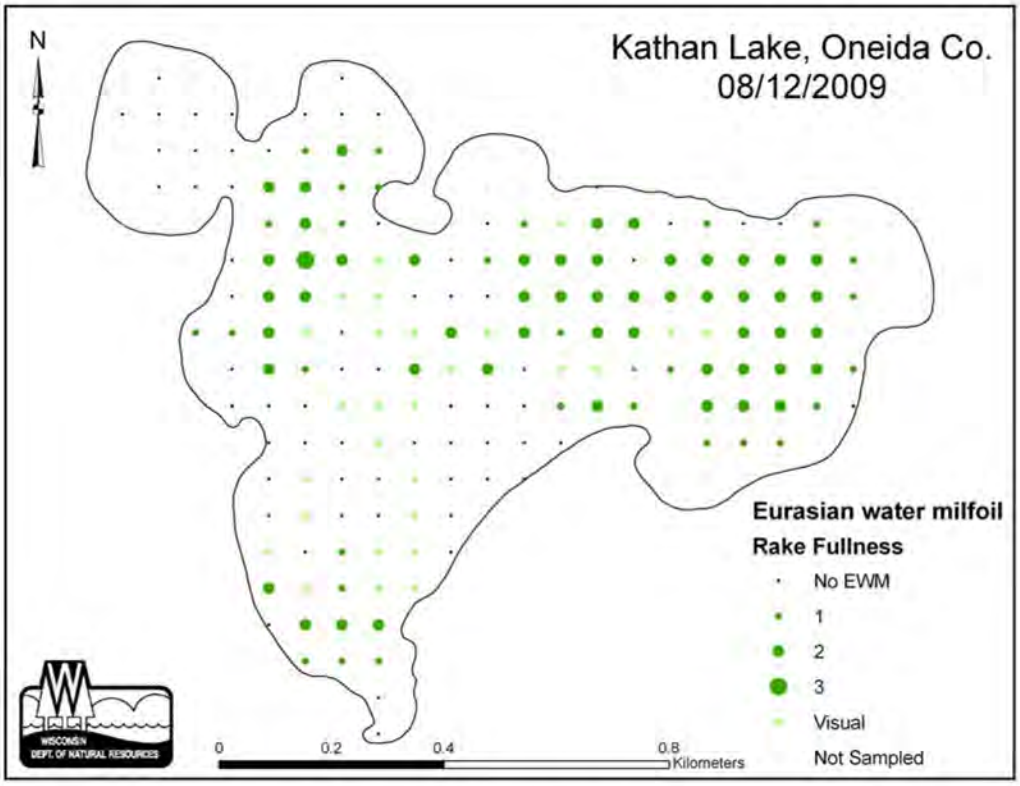


Figure 6: Example plant distribution map created using point-intercept data and ArcGIS 9.3 software for Kathan Lake, Oneida County.

Appendix 4

Creating a Plant Distribution Map Using Point Intercept Data in ArcGIS 3.3

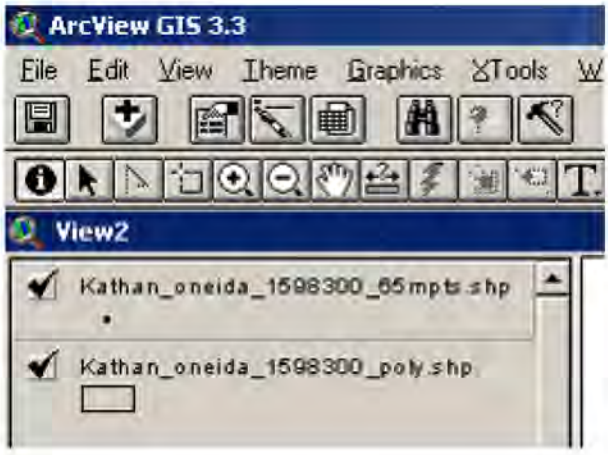
This is a protocol for making plant maps using ArcView GIS 3.3 and the Aquatic Plant Survey Data Workbook Excel file <Appendix-C.xls.>. This protocol can be changed in a number of different ways and still produce a similar product. The best way to make PI-based maps depends on the particular dataset; 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

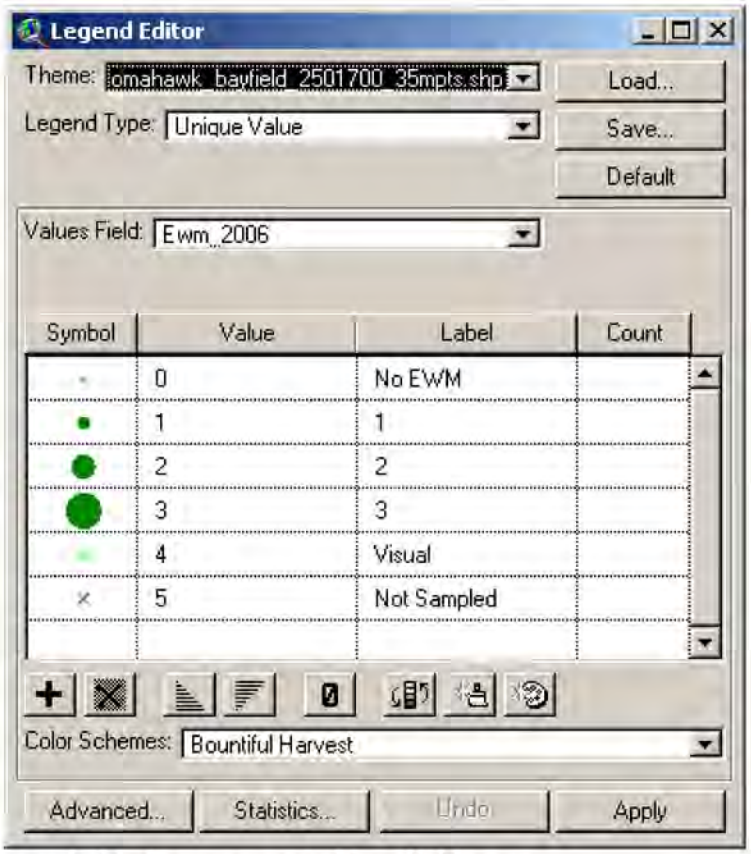
11. Open file saved in step 8 with Excel
    a. Open excel; Open a file, when prompted to find the file, navigate to MapFolder
    b. In "Files of type" option bar select "All files"
    c. Open <table1.dbf>

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

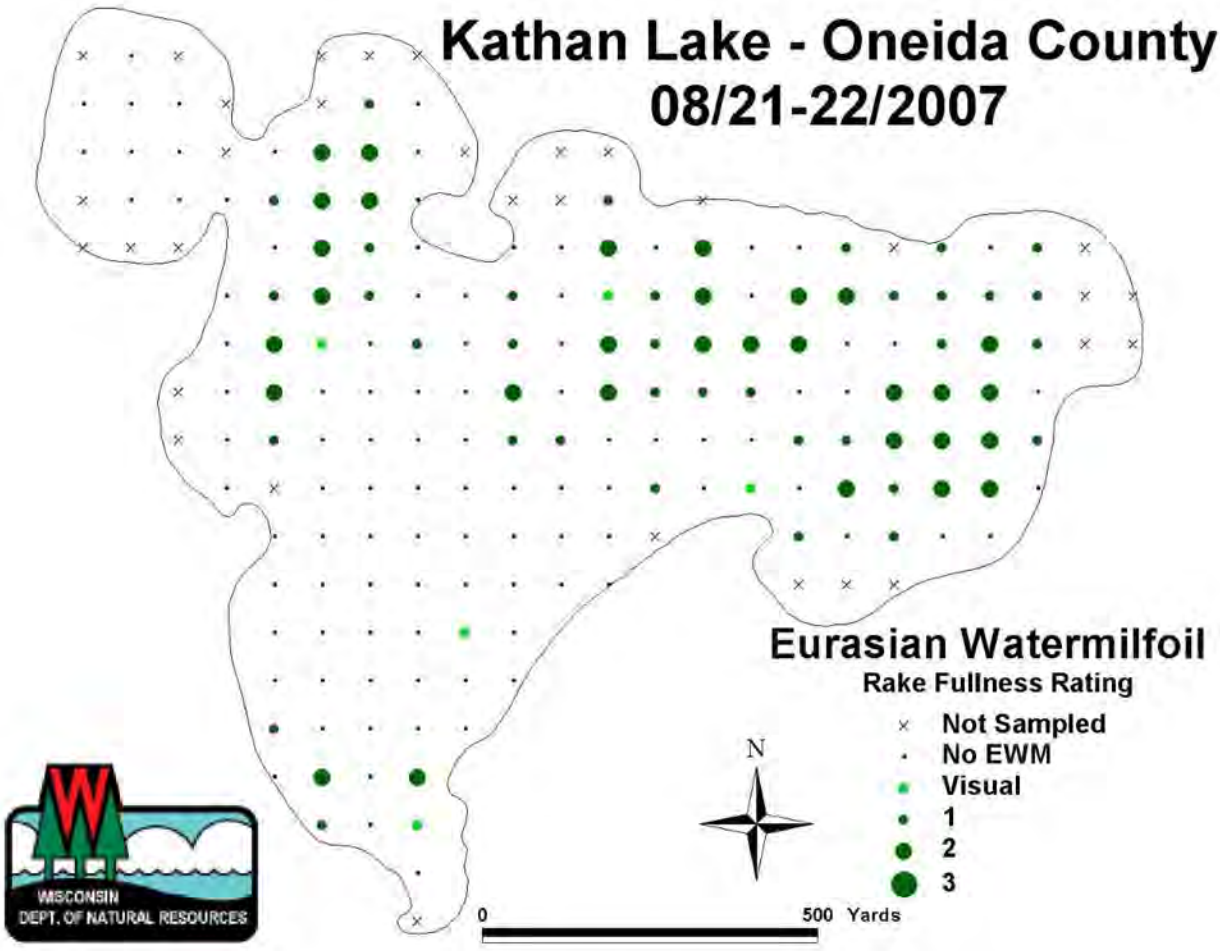


Figure 7: Example plant distribution map created using point-intercept data and ArcGIS 3.3 software for Kathan Lake, Oneida County.

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.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Science Services

Center for Excellence –
providing expertise for science-based decision-making

We develop and deliver science-based information, technologies, and applications to help people make well-informed decisions about natural resource management, conservation, and environmental protection.

Our Mission: The Bureau of Science Services supports the Wisconsin Department of Natural Resources and its partners by:

- conducting research and acquiring original knowledge.
- 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.

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Appendix 3 – Rapid Response Species

Selected Regulated Aquatic Invasive Species in WI

Floating water hyacinth
(Eichhornia crassipes)

Starry stonewort
(Nitellopsis obtusa)

Hydrilla
(Hydrilla verticillata)

Anchored water hyacinth
(Eichhornia azurea)

Water lettuce
(Pistia stratiotes)

Faucet snail
(Bithynia tentaculata)

European frog-bit
(Hydrocharis morsus-ranae)

Brittle naiad
(Najas minor)

New Zealand mud snail
(Potamopyrgus antipodarum)

Spiny water flea
(Bythotrephes cederstroemi)

Malaysian trumpet snail
(Melanoides tuberculata)

Duck lettuce
(Ottelia alismoides)

Java waterdropwort
(Oenanthe javanica)

Quagga mussel
(Dreissena rostriformis)

Yellow floating heart
(Nymphoides peltata)

Brazilian waterweed
(Egeria densa)

Report any **prohibited** species as soon as possible by emailing: **Invasive.Species@wi.gov.**
This publication does not list all the regulated species. For the full list of Prohibited or Restricted species please visit:
www.dnr.wi.gov keyword: **invasives**

Asian clam
(Corbicula fluminea)

Floating marsh pennywort
(Hydrocotyle ranunculoides)

Didymo
(Didymosphenia geminata)

Giant salvinia
(Salvinia molesta)

Red swamp crayfish
(Procambarus clarkii)

Water spinach
(Ipomoea aquatica)

Killer algae
(Caulerpa taxifolia)

Asian marshweed
(Limnophila sessiliflora)

Indian swampweed
(Hygrophila polysperma)

Aquatic forget-me-not
(Myosotis scorpioides)

Spiny naiad
(Najas marina)

Curly-leaf pondweed
(Potamogeton crispus)

Zebra mussel
(Dreissena polymorpha)

Rusty crayfish
(Orconectes rusticus)

Chinese mystery snail
(Cipangopaludina chinensis)

Yellow Iris
(Iris pseudacorus)

Prohibited Species **Restricted Species**

www.dnr.wi.gov keyword: invasives

Bureau of Science Services
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison, WI 53707-7921

PUB-SS-1162 2016

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	Saw-toothed 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																						
					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																						
		9			Relative Abundance																						
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		28			Relative Abundance																						
					Length of Shoreline																						
		29			Relative Abundance																						
					Length of Shoreline																						
		30			Relative Abundance																						
					Length of Shoreline																						

Appendix D – Cultural Resources Study

Gile Flowage Storage Project
FERC No. 15055

Study Plan

Cultural Resources Study

Prepared for

Prepared by

Mead & Hunt

meadhunt.com

August 2021

1. Introduction

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is currently seeking to obtain an original license from the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Gile Flowage Storage Project (Gile Flowage or Project). The Project is owned, operated, and maintained by the Applicant.

On January 19, 2021, FERC issued Scoping Document 1 and requested that stakeholders provide comments on the Pre-Licensing Application (PAD) and study requests within 60 days. During the 60-day comment period, the Applicant received comments and study requests from several entities. FERC requested that NSPW include a Phase 1 archaeological survey of the Project's area of potential effect (APE) and consult with the Wisconsin Historical Society – Division of Historic Preservation Office (SHPO) and federally recognized tribes who have an interest in the Project prior to conducting any surveys.

Friends of the Gile Flowage (FOG) requested that a historic/cultural study be completed to identify sites within or adjacent to the Gile Flowage and the Montreal River corridor to be evaluated for their National Register of Historic Places (NRHP) eligibility.

The Licensee is proposing to conduct a Cultural Resources Study to evaluate potential impacts to cultural resources caused by continued Project operations within the Project APE.

2. Study Plan Elements

2.1 Study Goals and Objectives

The objective of the Cultural Resources Study and associated consultation is to determine if National Register eligible properties are present in the APE, assess the potential effects of proposed undertakings on any resource that is listed on or is eligible for the listing in the National Register, and consult on ways to avoid, minimize, or mitigate any potential adverse Project effects on any eligible properties.

2.2 Resource Management Goals

FERC's issuance of an original license for the continued operation of the Gile Flowage Storage Project is subject to the requirements of Section 106 of the National Historic Preservation Act (16 USC § 470f), and the implementing regulations at 36 CFR Part 800, requiring federal agencies, applicants, and those receiving federal permits, to consider the effects of proposed undertaking on any resource that is listed as or is eligible for the National Register.

In accordance with FERC's regulations, 18 CFR § 5.5(e), the NSPW requested that FERC authorize NSPW as the non-federal representative to conduct informal consultation associated with this Project subject to Section 106. The assessment of historic properties will be conducted in consultation with FERC, Wisconsin SHPO, any federally recognized tribes which express an interest in the Project and other interested parties.

2.3 Public Interest

FERC and FOG expressed interest in this study. Per the Commission's telephone memo dated April 14, 2021, no additional federally recognized tribes expressed interest.

2.4 Background and Existing Information

The Project dam was authorized by the Wisconsin Public Service Commission in 1937. The dam was built at the site of the former Montreal River Log Company Dam dating back to the late 1800's. Lake Superior District Power Company, which was later acquired by NSPW, was the initial owner. The dam was completed in 1940 and the reservoir began filling in 1941 with the spring snowmelt (FOG, 2019).
The Wisconsin SHPO maintains a Wisconsin Historic Preservation Database (WHPD) that includes information on the locations of historic buildings, historic sites, and archaeological sites in the National Register of Historic Places (NRHP). NSPW conducted a thorough literature search of the WHPD to identify known historic and archaeological resources within the proposed boundaries of the Project when preparing the Pre-Licensing Application Document (PAD). This review did not identify any historic structures or archaeological sites or history of surveys within the Project APE (NSPW, 2020).

2.5 Project Nexus

The proposed Cultural Resources Study will provide information on archaeological and historic resources potentially eligible for the National Register that could be located within the Project APE and will identify any potential adverse effect to historic properties resulting from continued operation of the Project. If any adverse effects on historic properties are identified, NSPW will use the study results as a basis to prepare a Historic Properties Management Plan (HPMP), which will be filed with FERC after consultation with the Wisconsin SHPO, interested federally recognized tribes, and other interested parties.

2.6 Project Description

The Gile Flowage Storage Project is a headwater storage reservoir located on the West Fork of the Montreal River (West Fork) in the towns of Carey and Pence in Iron County Wisconsin. The Project consists of (1) a 3,317-acre reservoir with a usable storage capacity of 37,064 acre-feet at a water surface elevation of 1,490.0 feet NGVD; (2) a 30 foot-high by 899 foot-long dam consisting of, from west to east: (a) a 300 foot-long, 30 foot-high earthen embankment with a crest elevation of 1,495 feet NGVD; (b) a 24 foot-long, 30 foot-high concrete spillway section with a crest elevation of a 6 foot-wide, 6 foot-high sluice gate with an invert elevation of 1,465.5 feet NGVD and a 16 foot-wide by 12 foot-high Tainter gate with a crest elevation of 1,478 feet NGVD; and (c) a 575 foot-long, 30 foot-high earthen embankment with a crest elevation of 1,495 feet NGVD; and (3) appurtenant facilities. The Project does not contain any generating facilities. The Project is operated to augment flows in the Montreal River during summer and winter low-flow periods for hydroelectric power generation downstream Saxon Falls (P-2610) and Superior Falls (P-2587) Projects. The Project has a maximum drawdown of 15 feet, but typically operates with a summer drawdown that averages 5.2 feet and a winter drawdown that averages 6.8 feet.

2.7 Project APE

The APE for the Gile Flowage Storage Project is defined as all lands and waters enclosed within the proposed Project boundary and any other lands or waters outside the proposed Project boundary where Project operation may affect historic properties. The Project APE includes all project facilities, dam, reservoir, and shoreline areas to the maximum allowed reservoir elevation of 1,490 feet NGVD and includes approximately 43 islands within the project reservoir. The APE also includes Applicant owned lands and the portion of the West Fork, extending approximately 1760 feet downstream of the Project dam to the snowmobile trail bridge. The APE is shown in Appendix 1.

2.8 Methodology

2.8.1 Programmatic Agreement (PA)

The proposed Cultural Resources Study will follow the Pre-Licensing Procedure identified in the *Programmatic Agreement Among the Federal Energy Regulatory Commission, the Advisory Council on Historic Preservation, the State of Wisconsin, State Historic Preservation Officer and the State of Michigan, State Historic Preservation Officer, for Managing Historic Properties that may be Affected By New and Amended Licenses Issuing for the Continued Operation of Existing Hydroelectric Projects in the State of Wisconsin and Adjacent Portions of the State of Michigan* (Programmatic Agreement), executed in December 1993 (ACHP, 1993).

2.8.2 Identification of Historic Buildings, Structures, and Objects

The Applicant's archaeologist will utilize a literature search to identify historic buildings, structures and objects associated historically, structurally, spatially, or functionally within the Project and Project APE. Upon completing this identification, the Applicant will submit two copies of resulting reports prepared in accordance with the guidelines, *Architecture/History Survey Report Specification for Compliance Driven Surveys to the Wisconsin SHPO* pursuant to 36 CFR Part 800 at § 800.4.

2.8.3 Identification of Archaeological Properties

Per the terms of the PA, the Applicant's archaeologist will conduct a Phase 1 survey of Project shoreline areas within the APE to identify archaeological sites currently subject to erosion in accordance with the *Wisconsin Archaeological Survey Guideline for Conservation Archaeology in Wisconsin,* prepare reports based on the results of the surveys and submit reports along with appropriate documentation to SHPO for review and comment. All supporting photographic documentation will be submitted as original prints.

2.8.4 Evaluation of Identified Properties

If archaeological properties are identified to be impacted by Project operations, the Applicant's archaeologist will apply the Criteria of Evaluation, 36 CFR Part 60 at § 60.4, and as appropriate, the principles set forth in *Hydroelectric Development in the United States, 1880-1940*, to every historic building, structure, object, and archaeological property identified in accordance with 36 CFS Part 800 at § 800.4.

- For each property to which the Criteria of Evaluation is applied the Applicant will report its results in written form. For each individual property that the Applicant finds to be eligible for listing on the National Register, the results will be reported on a *National Park Service Form 10-900* (Form).
- The Applicant will complete the Forms according to the National Register Bulletin Nos. 15 and 16, and the *Wisconsin Supplementary Manual*, and submit to the Wisconsin SHPO an original and two copies of each Form completed along with other supporting materials. Other supporting materials include the following:
    - For archaeological properties, a professionally written report detailing the results of the Phase 1 Survey, describing any analysis and interpretation of the data undertaken subsequent to the Phase 1 Survey.
    - All supporting photographic documentation will be included as original prints, for each of the three copies submitted to the Wisconsin SHPO, submitted as physically separate documents.
    - A cover letter summarizing the Applicant's determination of eligibility for each of the properties documented on the Forms.
- On eroding sites, the requirement to conduct an evaluation may be avoided by consulting with the Wisconsin SHPO and employing means acceptable to the SHPO for stabilizing the property in place.
- Once the SHPO deems the documentation completed, two signed copies will be returned to the Applicant, who will then file one copy with the Commission with all of the supporting materials.

2.9 Consistency with Generally Accepted Scientific Practice

This Cultural Resources Study follows the terms of the Programmatic Agreement which is the generally accepted scientific practice in place regarding cultural resources at hydropower projects in Wisconsin.

2.10 Project Schedule and Deliverables

NSPW anticipates the research, field work, evaluation of eligible properties, and analysis of potential Project impacts will be completed in the spring and summer of 2022. Two draft reports (one for historic properties and one for archaeological properties) will be prepared for comment by the Wisconsin SHPO and interested federally recognized tribes and will be included in the Initial Study Report. A final report will be provided to the Wisconsin SHPO and included in the Updated Study Report, if necessary. The report will be kept confidential and filed with FERC and other consulting parties as a "privileged," non-public document.

NSPW anticipates that the field work, evaluation of properties eligible for listing on the National Register, analysis of potential project impacts, and study reports will be completed by early September 2022. Study reports will be included in the Initial Study Report.

For future reference, within one year of license issuance and per the terms of the PA, the Applicant will develop a HPMP meeting the standards set forth in the PA. The HPMP will address the following items:

- Identification of the APE for the Project and inclusion of a map or maps that clearly show the APE in relation to the Project boundary;
- Completion, if necessary, of identification of historic properties within the Project's APE; continued use and maintenance of historic properties;
- Treatment of historic properties threatened by project-induced shoreline erosion, other project-related ground disturbing activities, and vandalism;
- Consideration and implementation of appropriate treatment that would minimize or mitigate unavoidable adverse effects on historic properties;
- Treatment and disposition of human remains that may be discovered, considering any applicable state laws and the Advisory Council's "Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects," February 23, 2007, and the Native American Graves Protection and Repatriation Act (24 USC § 3001);
- Discovery of previously unidentified properties during Project operation;
- Public interpretation of the historic and archaeological properties at the Project;
- A list of activities (i.e., routine repair, maintenance, and replacement in kind at the Project) not requiring consultation with the Wisconsin SHPO because these activities would have little or no potential effect on historic properties;
- A procedure to address effects on historic properties in the event of a Project emergency; and
- A review of the HPMP by the Applicant, the Wisconsin SHPO, and consulting parties to ensure that the information continues to assist the applicant in managing historic properties and updating the HPMP based on agency and tribal consultations.

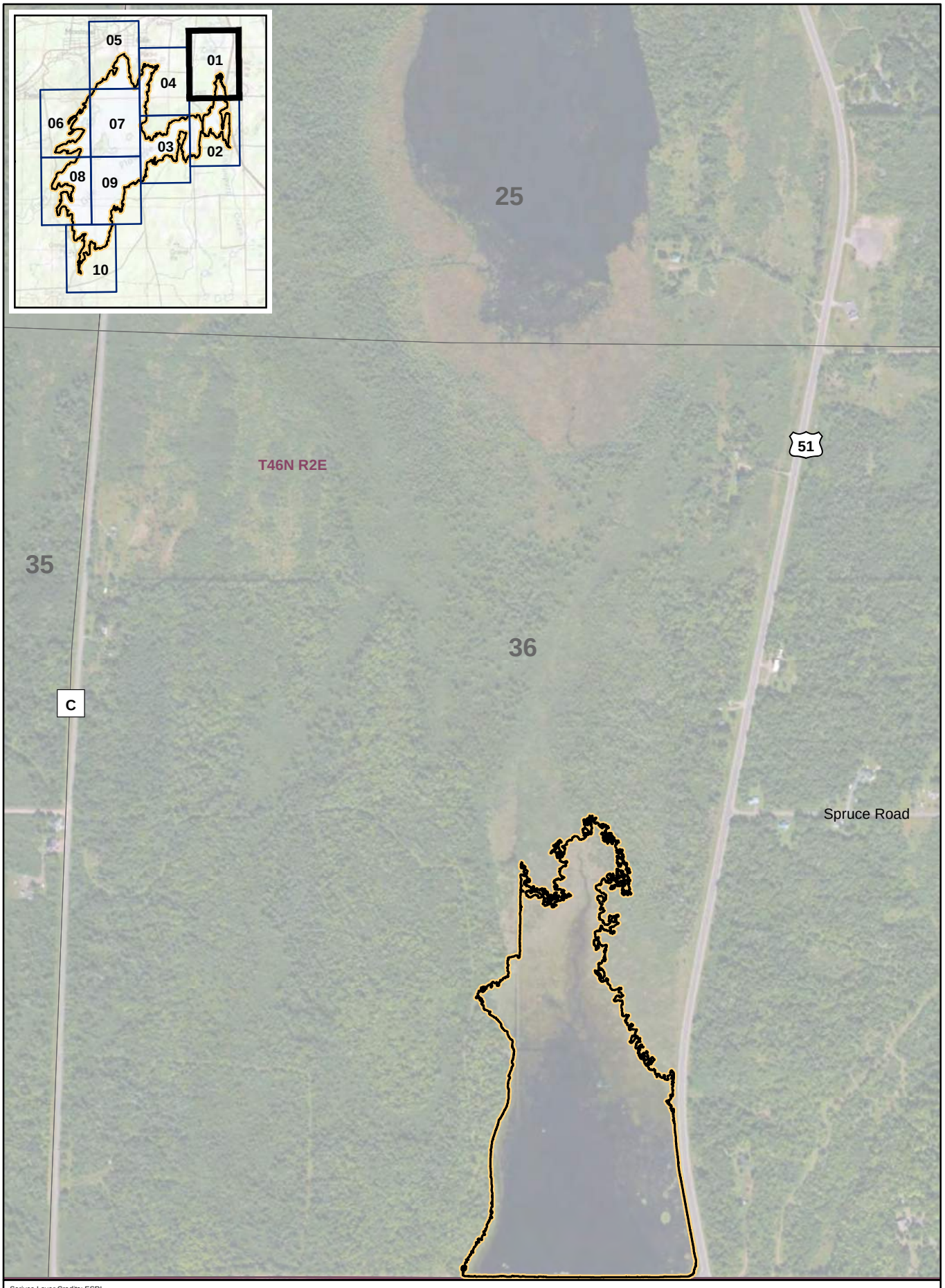
2.11 Level of Effort and/or Cost

NSPW estimates that this study will cost approximately $25,000 to complete.

2.12 Discussion of Alternative Approaches

NSPW has generally incorporated FERC comments on their request to provide additional detail on the Cultural Resources Study. The proposed methods for this study are based on the Programmatic Agreement described in Section 2.8.1 and are consistent with accepted professional practices. The overall approach is used in all Wisconsin relicensing proceedings. No alternative approaches to this study are warranted.

Appendix 1 – Project APE



Serivce Layer Credits: ESRI

Xcel Energy

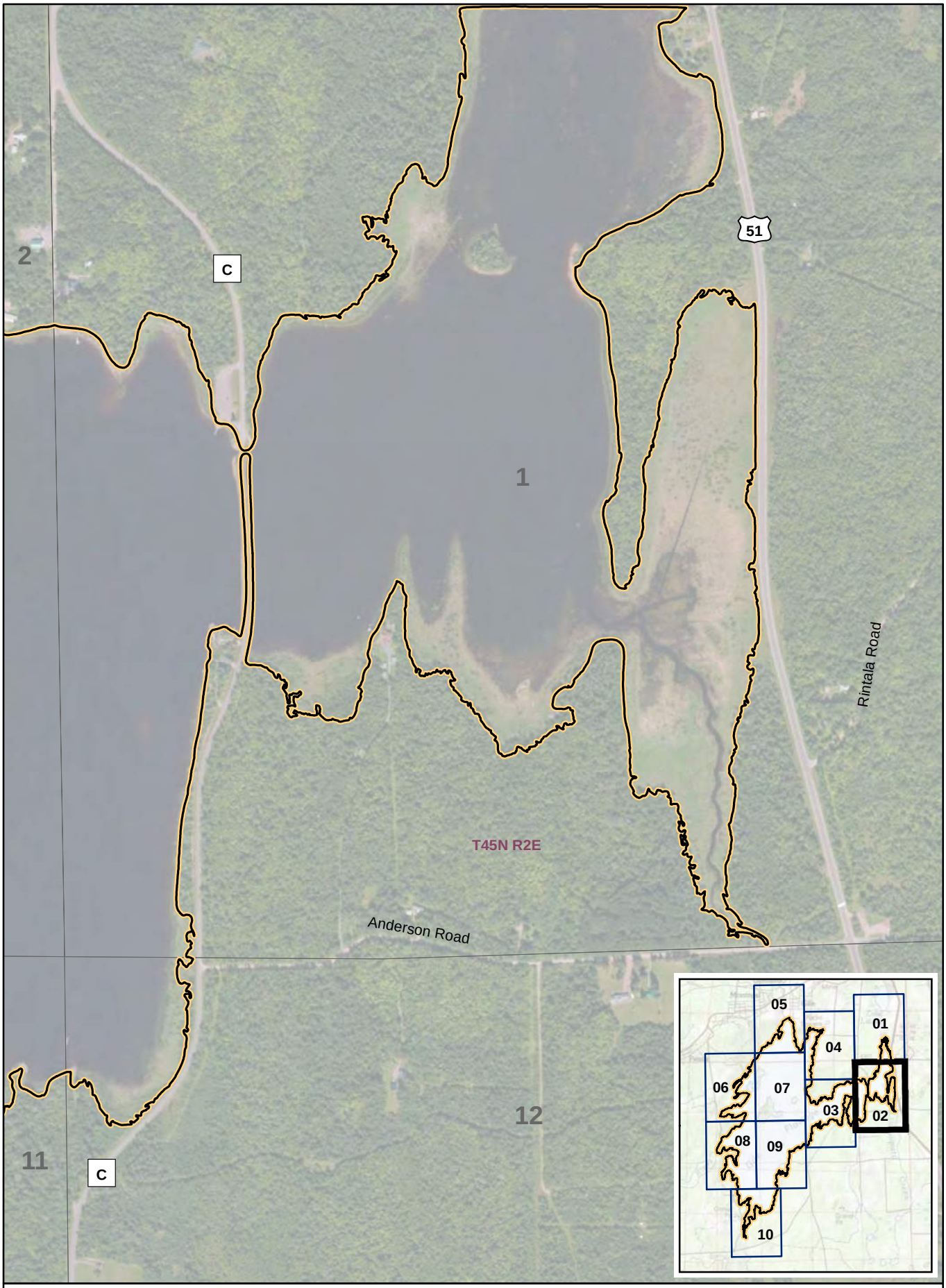
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 01 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

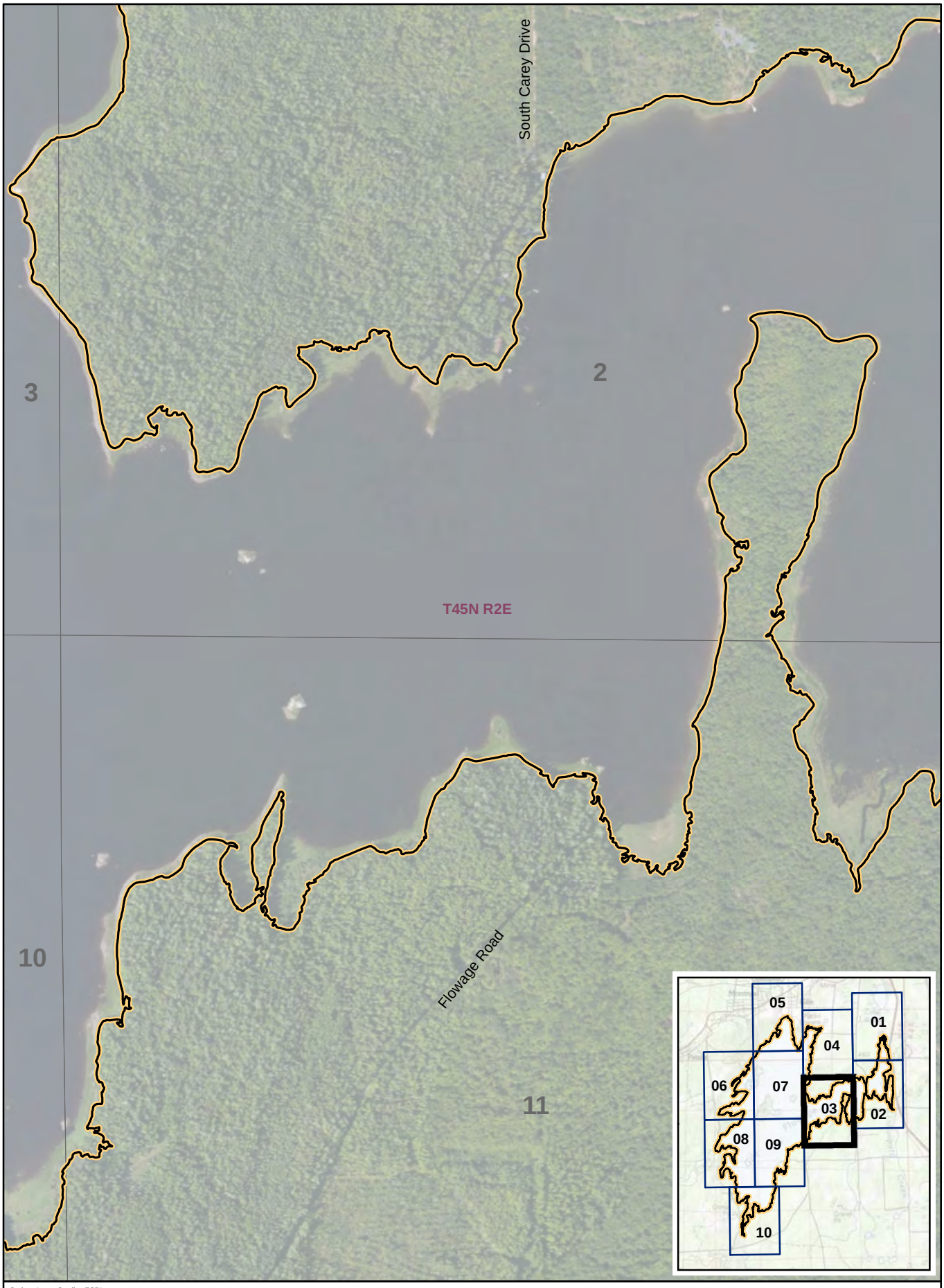
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 02 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

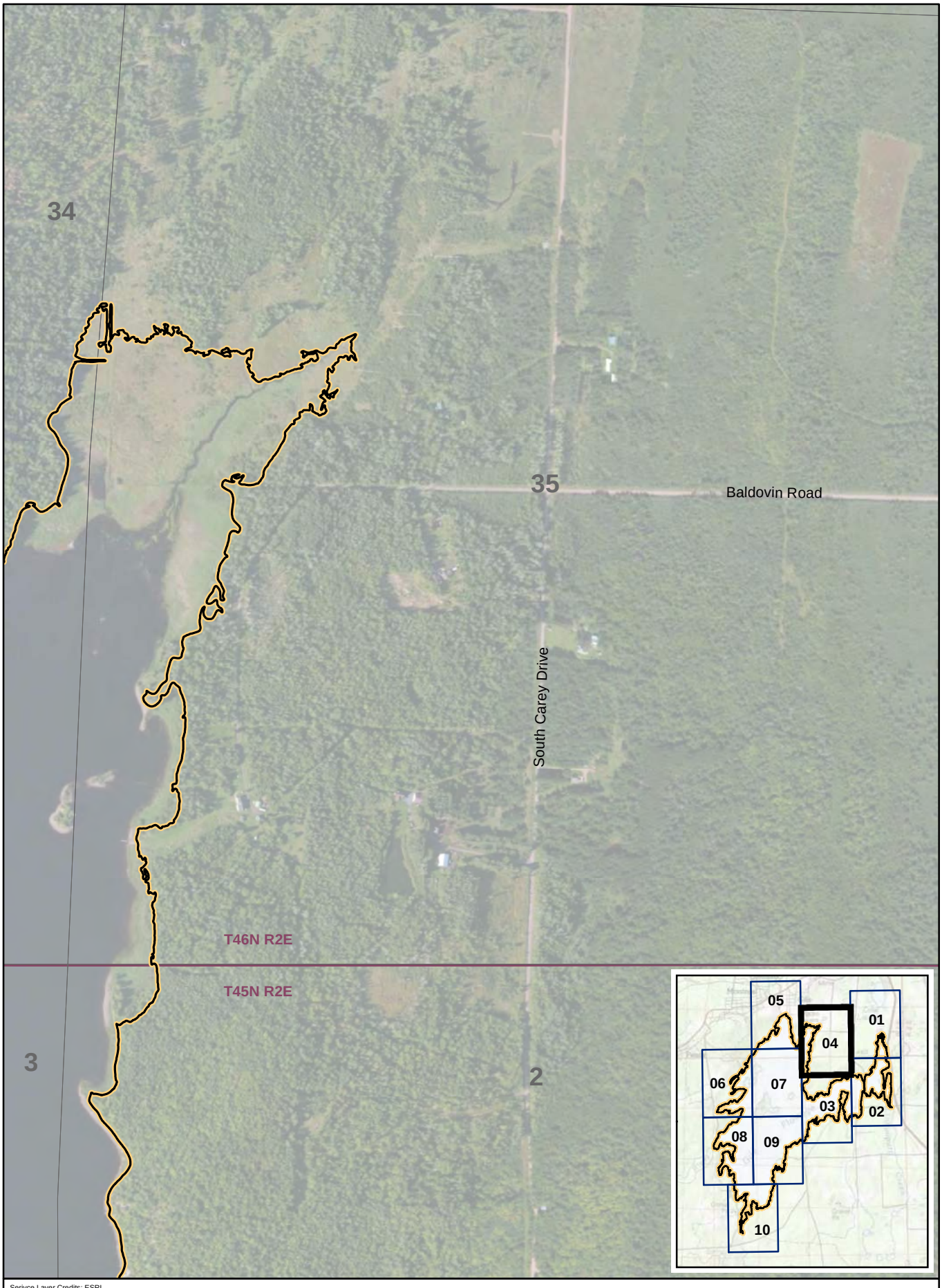
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 03 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 04 of 10
FERC No. 15055

Serivce Layer Credits: ESRI

Xcel Energy

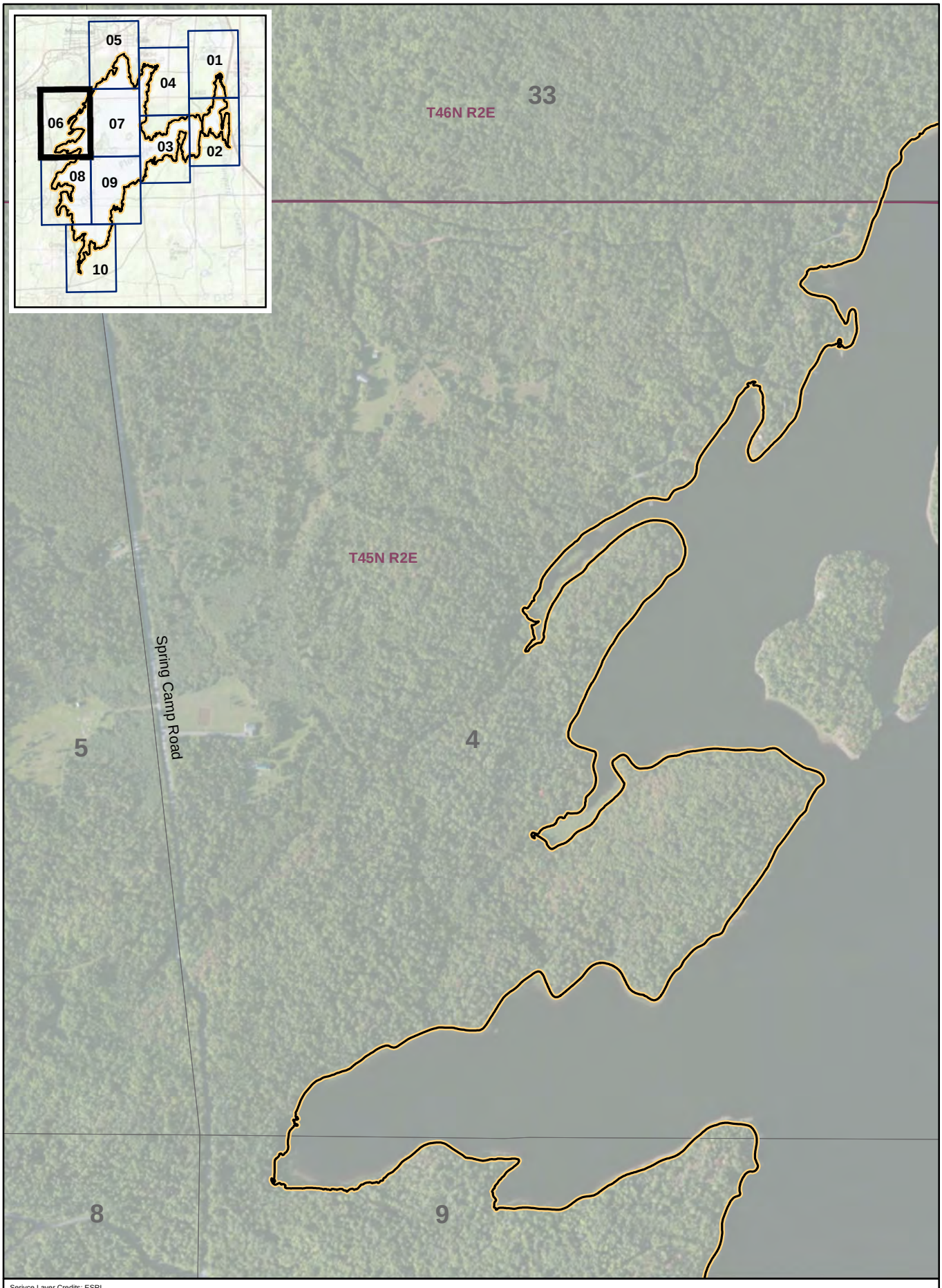
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 05 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

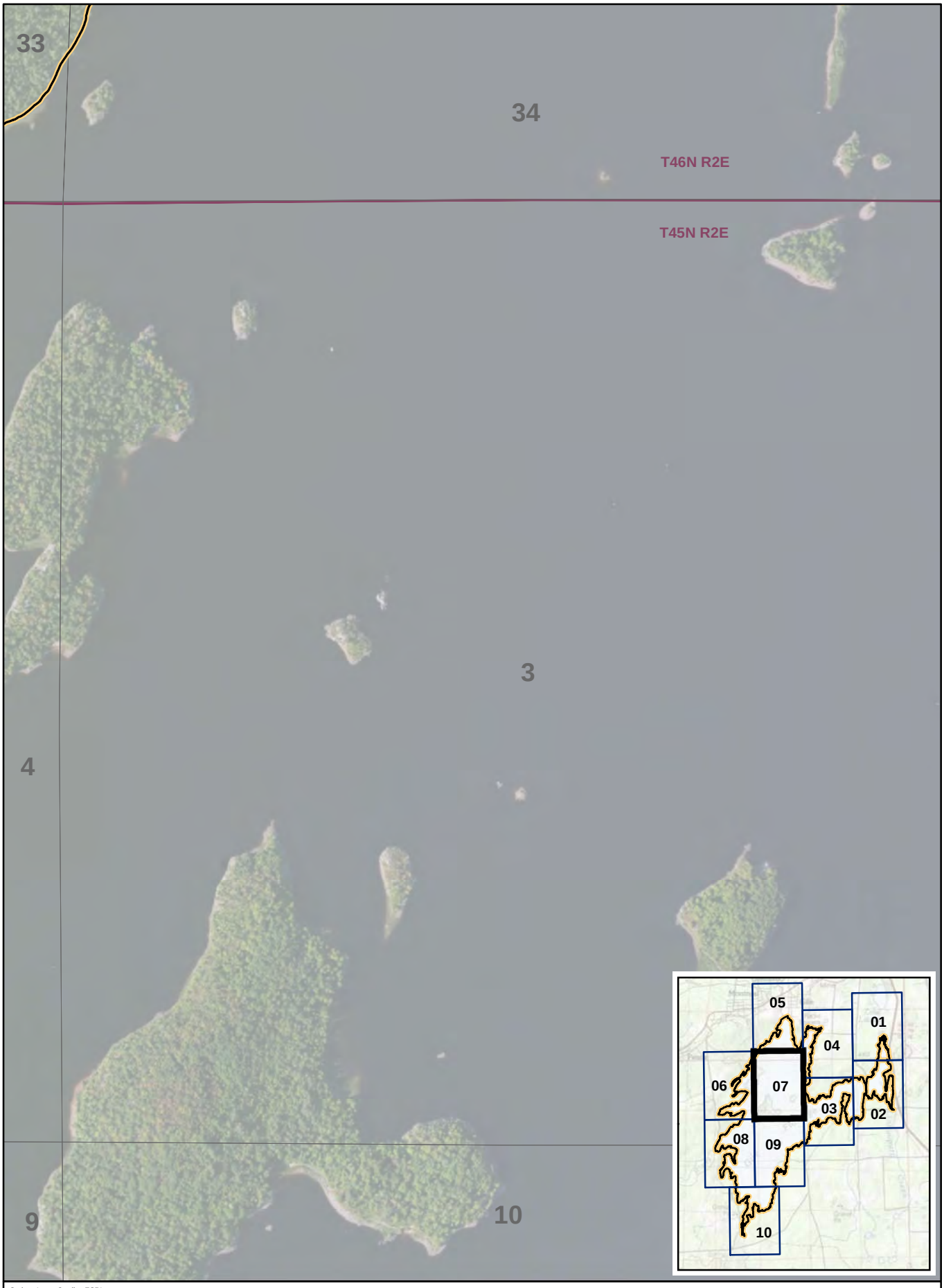
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 06 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

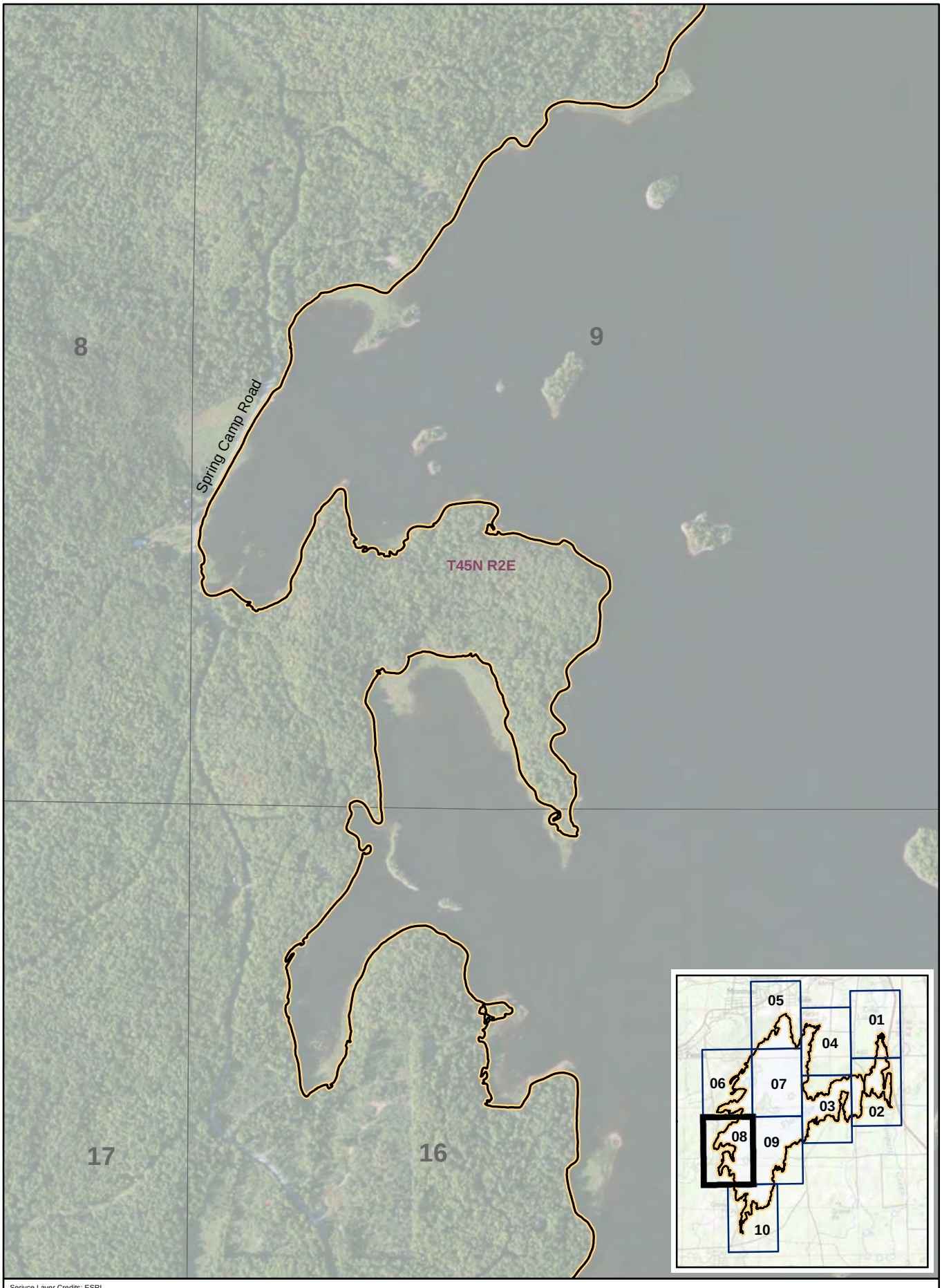
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 07 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy®

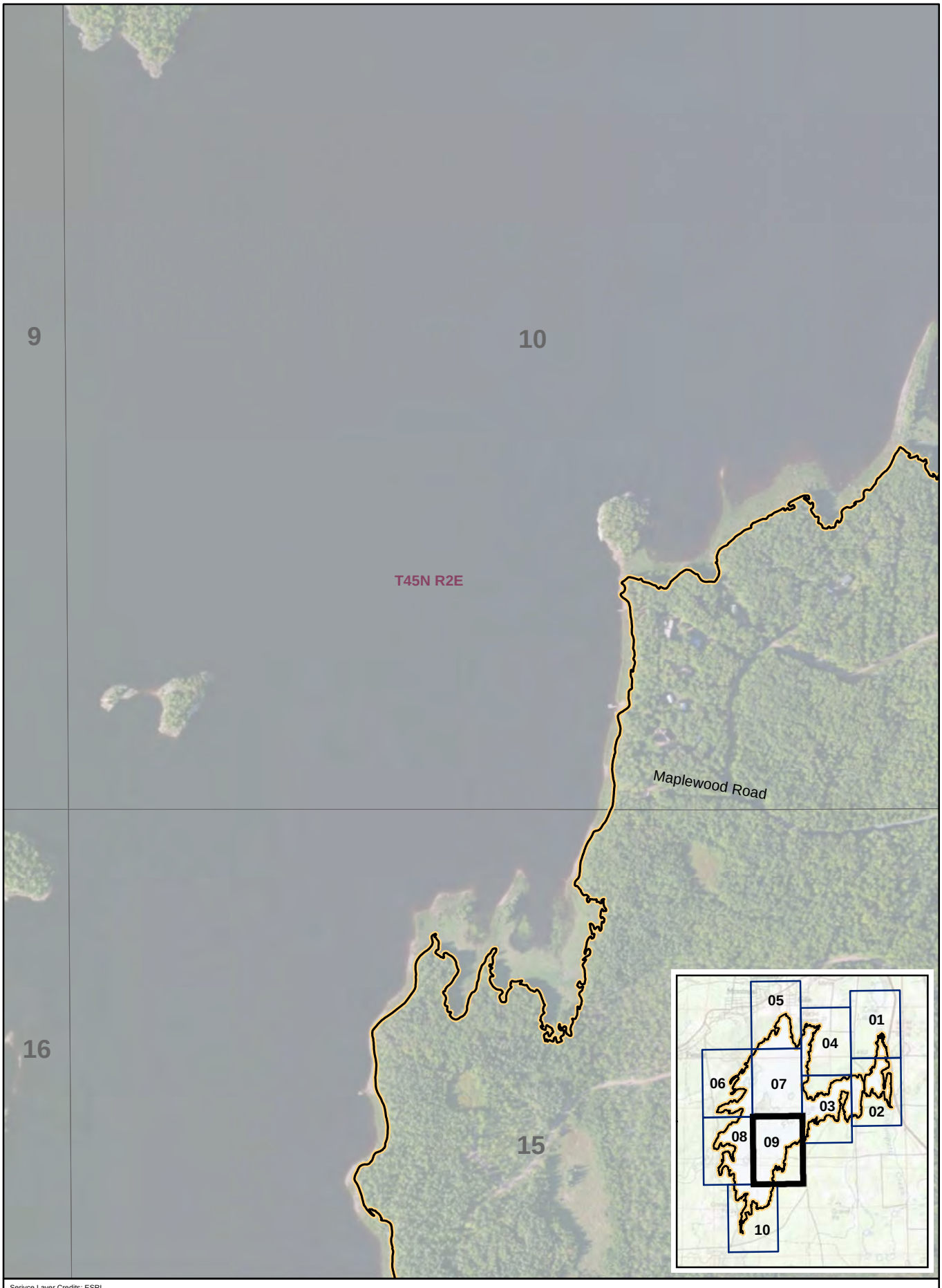
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 08 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy®

Mead & Hunt

Proposed Project Boundary

Proposed Project APE

Township Range Line

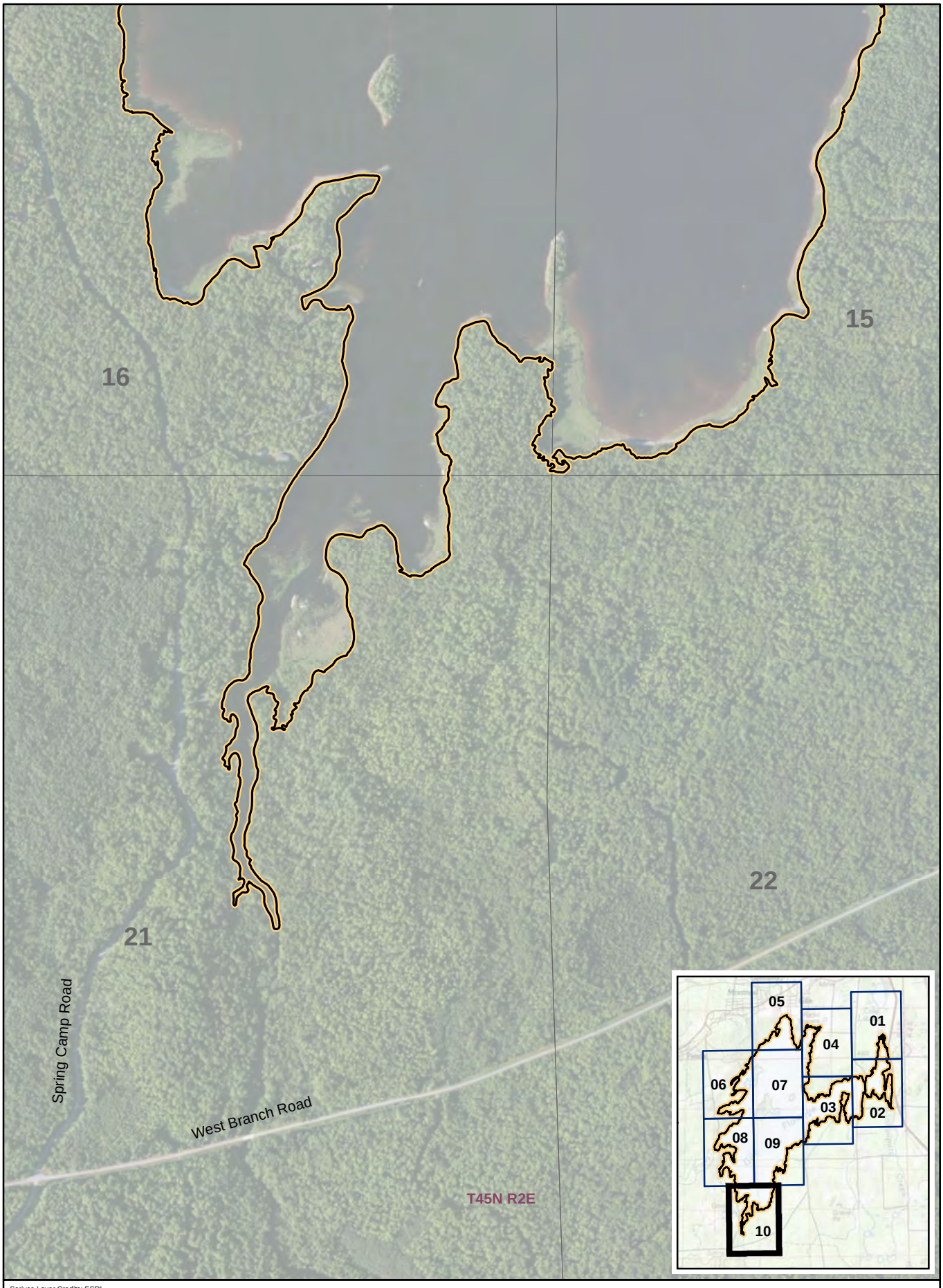
Section Line

N

0 375 750

Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 09 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 10 of 10
FERC No. 15055

Appendix E – Minimum Flow Habitat Evaluation Study

Gile Flowage Storage Project
FERC No. 15055

Study Plan

Minimum Flow Habitat Evaluation Study

Prepared for

Prepared by

Mead & Hunt

meadhunt.com

August 2021

1. Introduction

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is currently seeking to obtain an original license from the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Gile Flowage Storage Project (Gile Flowage or Project) under FERC Docket Number P-15055-000. The Project is owned, operated, and maintained by the Applicant.

On January 19, 2021, FERC issued Scoping Document 1 and requested that stakeholders provide comments on the Pre-Licensing Application (PAD) and study requests within 60 days. During the 60-day comment period, the Applicant received comments and study requests from several entities. Only the Wisconsin Department of Natural Resources (WDNR) requested that the Applicant complete a study to assess the effect of minimum flows on aquatic resources downstream of the Project dam.

WDNR requested two studies that address the impacts of minimum flows on aquatic resources downstream of the Project dam on the West Fork of the Montreal River. The first request was for an assessment of minimum flow, drawdowns, and resource impacts. The goal of this study request is to determine if the minimum flow of 10 cfs, a maximum drawdown of 15 feet, and drawdowns during the summer and winter are providing sufficient flows for aquatic resources. The second request was for an assessment of stream flows channel dimensions and linear gradient. The goal of the study request is to determine the impact the Project has on the existing stream flows, channel dimensions, and linear gradient on the West Fork, downstream of the Project dam.

The applicant is proposing to conduct a Minimum Flow Habitat Evaluation Study to determine if the current minimum flow is sufficient to protect aquatic resources in the West Fork of the Montreal River (West Fork) downstream of the Project dam.

2. Study Plan Elements

2.1 Study Goals and Objectives

The objective of this Minimum Flow Habitat Evaluation Study is to evaluate whether the existing minimum flow at the Project is sufficient to provide aquatic resources in the West Fork downstream of the Project dam.

2.2 Resource Management Goals

Provide equal consideration to non-power resources such as aquatic resources that could potentially be impacted by Project operations.

2.3 Public Interest

WDNR expressed interest in this study.

2.4 Background and Existing Information

There is no existing data available regarding the amount of habitat available in the West Fork during minimum flows. A minimum flow of 10 cfs has historically been passed in accordance with an agreement with the City of Montreal (NSPW, 2020). A review of flows released from the Project dam from April 29, 2017 to February 1, 2021 was conducted. The minimum flow released during this timeframe was 12 cfs, which is 20% higher than the required minimum flow. The mean flow during this time period was approximately 113 cfs. A review of the data showed that flows of at least 30 cfs (300% of minimum flow requirements) was released approximately 63% of the time (Xcel, 2021).

In the WDNR study request for assessment of fisheries at Gile Flowage, the WDNR indicates a 2017 fish survey was completed downstream of the Gile on the Montreal River. WDNR provided the Applicant with the 2017 fish survey data on April 28, 2021. The 2017 survey data provides the fish species that are present in the river downstream of the dam.

2.5 Project Nexus

Project operations may affect the impact of the aquatic resources downstream of the Project dam.

2.6 Study Area

The study will survey two representative reaches (stations) downstream of the Project dam. Exact reaches will be determined in the field by the group completing the survey, upon review of the 2017 WDNR fishery data, using the guidelines outlined in WDNR's Guidelines for Evaluating Habitat of Wadable Streams (WDNR Guidelines).

2.7 Methodology

2.7.1 General Sampling Procedures

The sampling methodology for each station will follow the general sampling procedures outlined in WDNR Guidelines. However, no fishery data will be collected because fishery data was collected in 2017 by the WDNR.

2.7.2 Data Collection

The Applicant proposes, as the WDNR guidelines recommend, the following three sheets (Station Summary, Station Flow Data, and Transect Data) be used in the habitat evaluation.

2.7.2.1 Station Summary Sheet

The data recommended by the WDNR Guidelines will be collected for one station summary sheet for each station except for the following parameters which the WDNR Guideline lists as optional and would require additional equipment to gather the data or is being collected by other proposed studies:

1) Water Conductivity;
2) Water Turbidity;
3) Total Dissolved Solids;

4) Dissolved Oxygen;
5) Dissolved Oxygen Saturation, and;
6) pH.

The Applicant also proposes to use a modern method to determine the Site Mile instead of the map wheel method recommended in the WDNR Guidelines.

The Applicant also intends to collect representative photos of the Station.

2.7.2.2 Station Flow Data Sheet

The data recommended by the WDNR Guidelines will be collected for each station except for the data being collected solely to determine flow. This data is not necessary because the flow in the stream in cfs will be determined by the flow release from the dam based upon gate opening.

Depth data will be collected and will be used to determine the amount of aquatic habitat available at varying flows.

2.7.2.3 Transect Data Sheet

The data recommended by the WDNR Guidelines will be collected for each transect station except for bank erosion. The bank erosion information is being collected as part of the Applicant-proposed Shoreline Stability Study.

Each transect will be displayed on a scaled cross-section drawing with the habitat and water depth displayed on each drawing. This information will be combined with the additional water depth measurements collected at the various flows described in Section 2.7.2 to scale changes in inundated aquatic habitat at various minimum flows.

2.7.2 Additional Data Collection

The objective of this Minimum Flow Habitat Evaluation Study is to evaluate whether the existing minimum flow at the Project is sufficient to provide aquatic resources in the West Fork downstream of the Project dam. Therefore, the Applicant proposes to collect water depth information in each of the stations while releasing various flows at 12 cfs intervals (i.e. 12 cfs, 24 cfs, and 36 cfs). The water depth information can be collected by hand measurements or continuous water level monitoring devices.

2.8 Consistency with Generally Accepted Scientific Practice

This Minimum Flow Habitat Evaluation 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 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/or Consultation
- Literature Cited

NSPW anticipates that field work will be completed by early September 2022. The study report will be included in the ISR when it is filed with FERC, no later than September 28, 2022.

2.10 Level of Effort and/or Cost

NSPW estimates that this study will cost approximately $30,000 to complete.

2.11 Discussion of Alternative Approaches

NSPW has generally incorporated WDNRs requests but added additional data collection steps where the WDNR methodology has fallen short in providing the data required to meet the study objectives. No alternative approaches to this study are warranted.

3. References

Northern States Power Company – Wisconsin, dba Xcel Energy. 2020. Pre-Application Document-Gile Flowage Storage Reservoir Project. Prepared by Mead & Hunt. October 27, 2020.

Wisconsin Department of Natural Resources. 2021. American Whitewater. 2021. Comments on Notice of Intent, Scoping Document 1, Preliminary Application Document, and Studies Request for the Gile Flowage Storage Reservoir Project (P-15055-000) Licensing. March 5, 2021.

Wisconsin Department of Natural Resources. 2015. Nutrient Chemistry Grab Sampling (V3.3). WDNR-PUB-WY-019-2015. February 26, 2015.

Wisconsin Department of Natural Resources. 2022. Wisconsin Consolidated Assessment and Listing Methodology (WisCALM) 2022. Guidance # 3200-2021-01. January 14, 2021.

Appendix F – Mussel Study

Gile Flowage Storage Project
FERC No. 15055

Study Plan

Mussel Study

Prepared for

Prepared by

Mead & Hunt

meadhunt.com

August 2021

1. Introduction

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is in the process of applying for an original license from the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Gile Flowage Storage Project (Gile Flowage or Project). The Project is owned, operated, and maintained by NSPW.

On January 19, 2021, FERC issued Scoping Document 1 and requested that stakeholders provide comments on the Pre-Licensing Application (PAD) and study requests within 60 days. During the 60-day comment period, the Licensee received comments and study requests from several entities. The River Alliance of Wisconsin (RAW) and Wisconsin Department of Natural Resources (WDNR) requested the Applicant to complete a mussel study as part of relicensing.

The RAW and WDNR requested that the Applicant complete a mussel study to determine mussel species density and diversity, including characterizing mussel habitat in the reservoir.

The Applicant has proposed this mussel study to provide the requested information.

2. Study Plan Elements

2.1 Study Goals and Objectives

Provide freshwater mussel density and diversity baseline data, with a focus upon state and federally threatened or endangered freshwater mussel species that could be adversely impacted by Project operations (see Section 2.2). This also includes characterizing mussel habitat within the proposed Project boundary.

2.2 Resource Management Goals

The WDNR provided the following statement for goals in their request: *"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 enhance the existing freshwater mussel populations."* RAW deferred to the resource agencies on the management goals. Neither the WDNR nor the RAW provided a clear resource management goal as required in their request. Since there are no clear management goals for species that are not listed as protected, NSPW believes the study should be focused upon avoiding adverse impacts to threatened or endangered freshwater mussel species if they are present and being impacted by Project operations.

2.3 Public Interest

RAW and WDNR expressed interest in this study.

2.4 Background and Existing Information

There is no recent survey information on freshwater mussel species in or near the Project area. Cylindrical papershell *(Anodontoides ferusscianus)* and eastern elliptio *(Elliptio complanata)* have been found within the Montreal River and its tributaries in Iron County based on 1975 records from the Wisconsin Mussel Monitoring Database (NSPW, 2020).

2.5 Project Nexus

The operations of the Project could influence freshwater mussel species located within the Project boundary.

2.6 Study Area

The study area consists of two 1,000-foot-long river reaches. One is located downstream of the dam and one is located in a riverine portion of the reservoir near the upstream Project boundary. The study areas are depicted in Appendix 1.

2.7 Methodology

2.7.1 Mussel Survey

The 2015 Wisconsin Department of Natural Resources Guidelines for Sampling Freshwater Mussels in Wadable Streams (Guidelines) and other standard survey methodologies were reviewed and used to develop the mussel survey for the Projects (Piette, 2015). The Guidelines provide information on minimum survey efforts for wadable conditions and have been modified for non-wadable conditions. Normal to low water conditions and good visibility must be present to conduct the field work; project activities will be planned accordingly.

Two riverine reaches will be surveyed at the Project. Reach 1 is a 1,000-meter reach in a riverine portion of the Gile Flowage reservoir beginning near the Sucker Hole Boat Launch and extending approximately 1,000 meters upstream. Reach 2 begins at the Project tailrace and extends approximately 1,000 meters downstream.

Both reaches are 1,000 meters in length. In each reach, surveys will consist of transects extending bank to bank that will be spaced every 100 meters 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.

In both reaches, searches along each transect will be done in 10-meter-long segments and searching 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 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 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. River 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 including the reservoir and tailrace area will be completed. Normal to low water conditions and good visibility must be present to conduct the field work; project activities will be planned accordingly.

2.7.2 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 time searches. Mussel taxonomy will follow the names presented by Williams et al., 2017.

If any living or dead federally listed or state-listed species are encountered, a Licensee representative will be notified immediately. WDNR and the U.S. Fish and Wildlife Service (USFWS) will be notified per surveyor collection permit requirements. No live mussels will be harmed or taken during this project. Any specimens of federally listed or state-listed species that are encountered will be individually hand placed into their places of origin.

2.7.3 Personnel Qualifications

All surveys will be conducted by individuals with prior mussel identification training and experience with aquatic and mussel surveys.[1]

2.8 Consistency with Generally Accepted Scientific Practice

This Mussel Study follows generally accepted scientific practice regarding field data collection and reporting. Similar protocols, developed in coordination with WDNR, have been used by the Applicant in relicensing studies at several of their other hydroelectric projects.

2.9 Project Schedule and Deliverables

Results of this study will be summarized in a Mussel Study Report. The report will 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 will also describe mussel density and diversity within the vicinity of the Project.

[1] Consultant(s) selected to complete the work will be responsible for obtaining any scientific collectors permits required.

A general description of mussel habitat within the Project boundary, including the Project reservoir and tailwater area, will also be provided. GIS-based mapping will provide further visual presentations of the findings of the survey. Completed survey sheets will be included in the report as well.

NSPW anticipates that field work will be completed between June 15, 2022 and September 1, 2022 to ensure that all mussel surveys and the mussel study report can be completed prior to the September 28, 2022 filing deadline for the Initial Study Report.

2.10 Level of Effort and/or Cost

NSPW estimates that this study will cost approximately $30,000 to complete.

2.11 Discussion of Alternative Approaches

NSPW has generally incorporated WDNR comments on their request for mussel surveys. The overall approach has been used by NSPW in their other relicensing proceedings in Wisconsin. Modifications from WDNR's study request are detailed in Section 3.0 of the Proposed Study Plan. The proposed methods for this study are consistent with FERC's study requirements under the ILP. No alternative approaches to this study are warranted.

3. References

Northern States Power Company – Wisconsin, dba Xcel Energy. 2020. Pre-Application Document-Gile Flowage Storage Reservoir Project. Prepared by Mead & Hunt. October 27, 2020.

Pierre, R.R. 2015. Guidelines for sampling freshwater mussels in wadable streams. Wisconsin Department of Natural Resources. 50 pp.

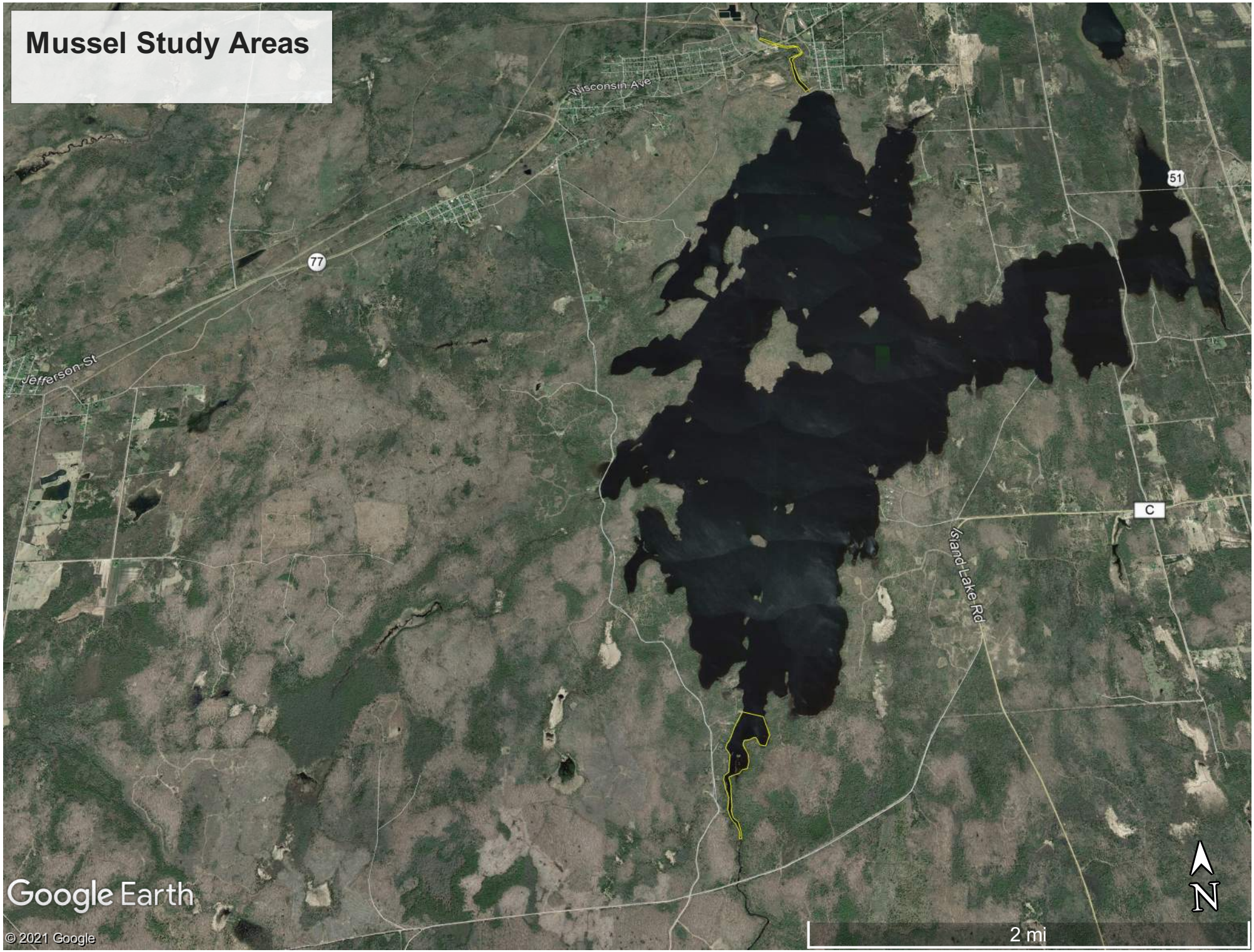
River Alliance of Wisconsin. 2021. Notice of Intent to File License Application, Filing of Pre-Application Document (PAD), Commencement of Pre-Filing Scoping, Request for Comments on the PAD and Scoping Document and Identification of Issues on the PAD and Scoping Document and identification of Issues Associated with Study Requests. March 17, 2021.

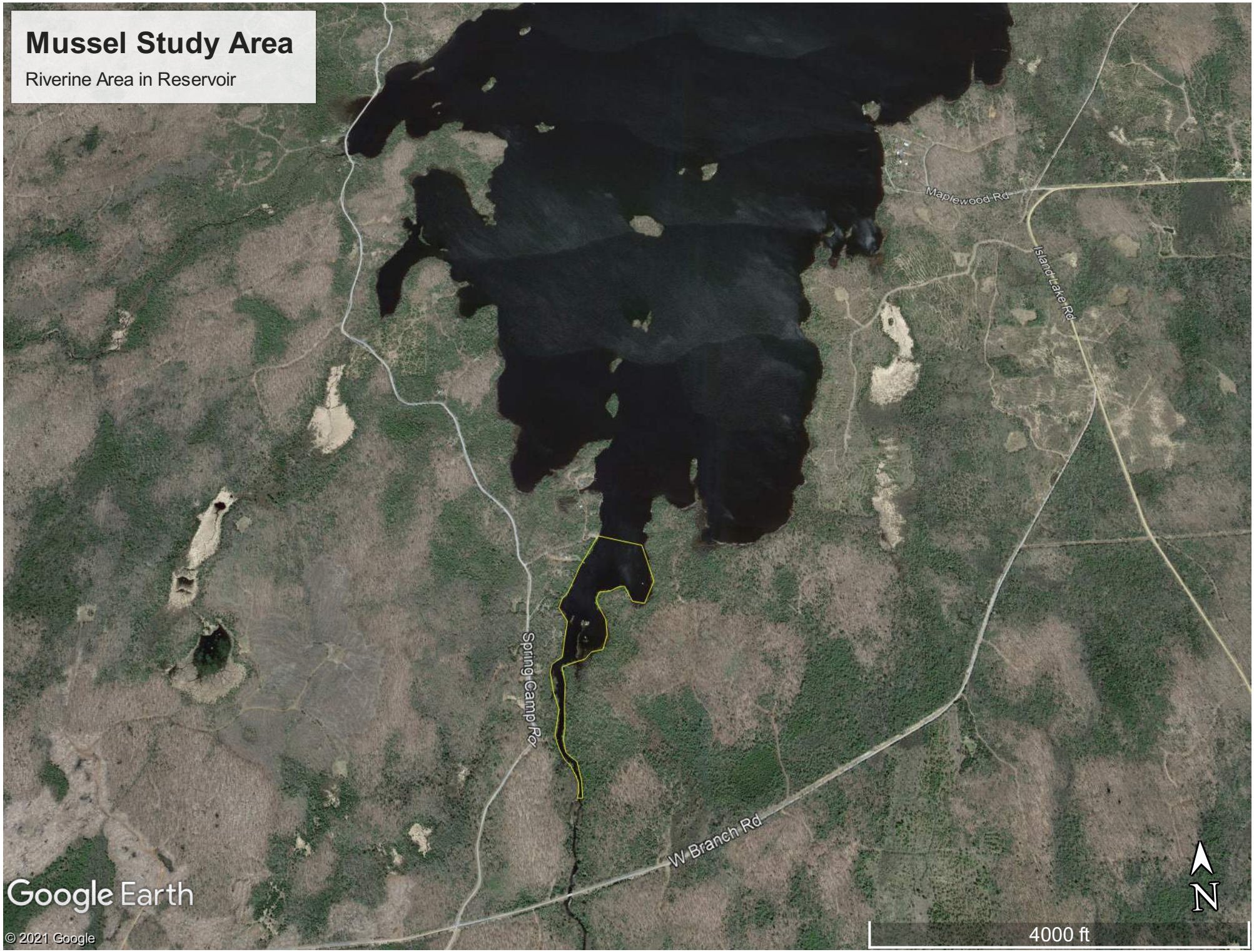
Smith, D.R. 2006. Survey design for detecting rare freshwater mussel species. Journal of the North American Benthological Society, 25:701-711.

Williams, J.D et. al. 2017. A revised list of the freshwater mussels (Mullusca: Bibalvia Unionida) of the United States and Canada. Freshwater Mollusk Biology and Conservation, 20(2), 33-58.

Wisconsin Department of Natural Resources. 2021. Comments on Notice of Intent, Scoping Document 1, Preliminary Application Document, and Studies Request for the Gile Flowage Storage Reservoir Project (P-15055-000) Licensing. March 5, 2021.

Appendix 1 – Mussel Study Area


Mussel Study Areas
Wisconsin Ave
77
51
Jefferson St
C
Island Lake Rd
N
2 mi
Google Earth
© 2021 Google


Mussel Study Area
Riverine Area in Reservoir
Maplewood Rd
Island Lake Rd
Spring Camp Rd
W Branch Rd
Google Earth
© 2021 Google
N
4000 ft


Mussel Study Area
Downstream Area
Kokogan St
Nimikon Ave
Oshkosh Ave
Isabel St
Park St
Park Rd
Google Earth
© 2021 Google
N
1000 ft

Appendix 2 – Mussel 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								

PROJECT: Gile Flowage

Mussels Observed within West Fork Montreal River, 2022

Species		Reach 1							Reach 2							Overall (All Reaches Together)	
Common Name	Scientific Name	T1	T2	T3	T4	T5	Total Number Reach 1	Relative Abundance (% of total- Reach 1)	T1	T2	T3	T4	T5	Total Number Reach 2	Relative Abundance (% of total- Reach 2)	Total Number	Relative Abundance (% of total)
Abundance (total number of mussels)																	
Number of Species (Live)																	
Effort (size of transect m^2)																	
Surface Density (# per m^2)																	

Appendix G – Recreation Study

Gile Flowage Storage Project
FERC No. 15055

Study Plan

Recreation Study

Prepared for

Prepared by

Mead & Hunt

meadhunt.com

August 2021

1. Introduction

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is in the process of applying for an original license from the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Gile Flowage Storage Project (Gile Flowage or Project). The Project is owned, operated, and maintained by NSPW. To obtain a License, NSPW must submit a Final License Application (FLA) to FERC no later than August 18, 2023. The FLA, in part, must include an evaluation of the existing recreational facilities associated with the Project along with any potential recreation enhancements.

On January 19, 2021, FERC issued Scoping Document 1 and requested that stakeholders provide comments on the Pre-Licensing Application (PAD) and study requests within 60 days. During the 60-day comment period, the Licensee received comments and study requests from several entities. The Friends of the Gile Flowage (FOG), the National Park Service (NPS), the River Alliance of Wisconsin (RAW), and Wisconsin Department of Natural Resources (WDNR) requested the Applicant to complete a recreation study as part of the licensing process.

The FERC requested that the Applicant complete a recreation study to gather existing information on recreation facilities, recreation use, and potential project effects in order to determine existing and future recreation use and capacity at the Project.

The FOG requested that the Applicant complete a recreation study to evaluate motorized and non-motorized recreational issues, needs, opportunities, aesthetics, and accessibility. They also requested that recreation use on the islands and water level fluctuation impacts on recreation be evaluated.

The NPS requested that the Applicant complete a comprehensive recreation study that involves a detailed condition assessment and inventory of recreation facilities and dispersed recreation use in the Project area to evaluate whether recreation needs are being met within the proposed Project boundary.

The RAW requested that the Applicant complete a recreation study to evaluate the existing condition of recreational facilities, document needed upgrades, and update or create a new recreational brochure to serve as a guide for the public.

The WDNR requested that the Applicant complete a recreation study to evaluate current recreational use, including opportunities during low flow and high flow events, public access, aesthetics, trails, water sports, and fishing with consideration for the different seasonal uses.

2. Study Plan Elements

2.1 Study Goals and Objectives

The purpose of this study is to obtain a subjective assessment of recreation facility conditions and needed enhancements; determine capacity of existing facilities to address current and future user demand; and provide sufficient information for making recreation enhancement recommendations. The evaluation of whitewater boating flows is a separate effort independent of this study plan.

2.2 Resource Management Goals

Recognize the full potential for meeting present and future public outdoor recreation demands, while maintaining and enhancing a quality environmental setting and provide direction to give equal consideration to other non-power resources such as recreation.

2.3 Public Interest

FERC, FOG, NPS, RAW, and WDNR expressed interest in this study.

2.4 Background and Existing Information

Recreation in the vicinity of the Project is dominated by activity near the Project facilities. There are several recreational use areas, both under and outside the control of the Licensee, that will be evaluated for recreational use and improvements.

2.5 Project Nexus

A nexus exists between the Project recreation opportunities and the proposed study. This study will help to describe existing conditions and enhancement opportunities.

2.6 Study Area

The study area is depicted in Appendix 1. The recreation inventory, facility condition assessment, recreation use survey, and spot counts will incorporate the recreation sites listed below in Table 2.6-1.

Table 2.6-1. Recreation Sites to be Inventoried and Surveyed for Existing Use

Gile Park
Gile Dam Canoe Portage
Sucker Hole Landing
Town of Pence Landing
County Hwy C Landing

2.7 Methodology

2.7.1 Recreation Inventory

Each of the recreation sites listed in Table 2.6-1 will be inventoried during one of the recreational use surveys using the forms attached as Appendix 2 to collect information on recreation amenities and capacity. The following types of information will be recorded:

1) The entity responsible for operation and maintenance of the recreation facility.
2) Identification of whether the facility is a proposed project or non-project recreation facility.
3) The seasons/hours of operation.
4) The primary type(s) of recreation provided at the site.
5) Existing sanitation facilities (if any).
6) Type of vehicle access and parking capacity (if any).
7) The presence and type (if any) of barrier-free facilities.
8) The GPS location of the facility.
9) The type and number of amenities at each site and their location in respect to the proposed Project boundary.
10) Photographs of the recreation site, each amenity, each sign, the entryways to primary recreation sites from the main road(s), and any adverse impacts from the site on the resources, including shoreline erosion.
11) The minimum water elevation adequate recreation use is observed for existing recreation features including boat landings, docks, piers, etc.

2.7.2 Facility Condition Assessment

During at least one site visit to each of the recreation sites listed in Table 2.6-1, the condition of each component (including recreational wayfinding signs and interpretive signs) and its immediate vicinity will be assessed. A rating for the 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 awarded where additional attention is required, the specific item that needs additional attention will be noted on the form.

2.7.3 Recreation Use Survey

Recreation use surveys will be conducted during visits to each of the recreation sites listed in Table 2.6-1. The surveys will last at least two hours 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 the day which will account for time-of-day use patterns. The

recreation use survey included in Appendix 3 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 with regard to the amount and types of recreation opportunities offered within the proposed Project boundary. The recreation use surveys will be conducted according to the following schedule in Table 2.7.3-1.

Table 2.7.3-1. Recreation Use Survey Schedule

Survey Month/Season	Recurrence Interval
May	Two randomly selected weekend days. Two randomly selected non-holiday weekend days. One day during Memorial Day weekend.
June	Two randomly selected weekdays. Two randomly selected weekend days.
July	Two randomly selected weekdays. Two randomly selected non-holiday weekend days. One day during July 4th weekend.
August	Two randomly selected weekdays. Two randomly selected weekend days.
September	Two randomly selected weekdays. Two randomly selected non-holiday weekend days. One day during Labor Day weekend.
October	Two randomly selected weekdays. Two randomly selected weekend days.
January	Two randomly selected weekdays. Two randomly selected weekend days.

2.7.4 Recreation Spot Counts

When first arriving at each recreation site where recreation use surveys will be collected, a spot count will be conducted using the form enclosed in Appendix 4. This information will be statistically analyzed to develop recreational use figures for the Project. This information will be summarized by season and activity for each type of use in the study report.

2.7.5 Evaluation of Existing Recreation on Undeveloped Islands

There are 43 undeveloped islands within the proposed Project boundary. Recreation activities occurring on privately owned islands will not be evaluated as part of this study. Islands owned by either the Applicant or public will be evaluated for existing recreational use during one holiday weekend (Memorial Day, July 4th, or Labor Day) when use would be expected to be the greatest. During the assessment, the surveyor will examine each island for evidence of recreational use including the beaching or mooring of boats, shore fishing, picnicking, and camping. The location of any erosion caused by recreation access and any recreational user-developed facilities present (i.e., fire pits, campsites, signs) will also be documented. The type of recreation access, existing user-developed facilities, and recreation-caused erosion sites will be summarized in the recreation report. Recreation spot counts and recreation surveys will also be conducted on each island that has recreationists present at the time of the survey.

2.8 Consistency with Generally Accepted Scientific Practice

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

2.9 Project Schedule and Deliverables

Results of this study will be summarized in a Recreation Study Report. The report will include a facility inventory that includes the following items:

- The location of facilities in relation to the proposed Project boundary, including facilities or amenities that may straddle the proposed boundary;
- The number and types of amenities provided at each facility;
- The condition of the facility/amenities;
- Identification of any erosion at each recreation site;
- Identification of all proposed project and non-project recreation facilities;
- Entities responsible for operation and maintenance of the facilities;
- Hours/seasons of operation;
- Photographs;
- Use figures for each recreation site, overall recreational use figures, and projected use figures;
- Compilation of responses to the recreation use survey;
- Discussion of whether proposed project operation would lower the reservoir level below the minimum water elevation at which existing public boat ramps, piers, docks or landing points within the project reservoir and its islands would be accessible and operable, and if so, how often and how long these features or sites would be inaccessible or inoperable;
- A discussion on whether proposed project operation would lower the reservoir level below the minimum water elevation at which in-water recreation such as boating, swimming, and recreation would be affected, and if so, how often and for how long these activities would be affected;
- All field sheets, completed forms, completed surveys, and photographs collected during the study.

NSPW anticipates that field work will begin in October 2021 to ensure that all recreation surveys and the recreation study report can be completed prior to the September 28, 2022, filing deadline for the Initial Study Report.

2.10 Level of Effort and/or Cost

NSPW estimates that this study will cost approximately $60,000 to complete.

2.11 Discussion of Alternative Approaches

NSPW has generally incorporated FERC, FOG, NPS, RAW, and WDNR comments regarding their request for recreation surveys. The overall approach has been used in other relicensing proceedings and is consistent with generally accepted methods used by federal and state agencies. In addition, the proposed methods for this study are consistent with FERC's study requirements under the ILP. No alternative approaches to this study are warranted.

3. References

Federal Energy Regulatory Commission. 2021. Comments on Preliminary Study Plans, Request for Studies, and Additional Information. March 17, 2021.

Friends of the Gile Flowage. 2021. Comments on Notice of Intent, Scoping Document 1, Preliminary Application Document, and Studies Request for the Gile Flowage Storage Reservoir Project, P-15055-000. March 16, 2021.

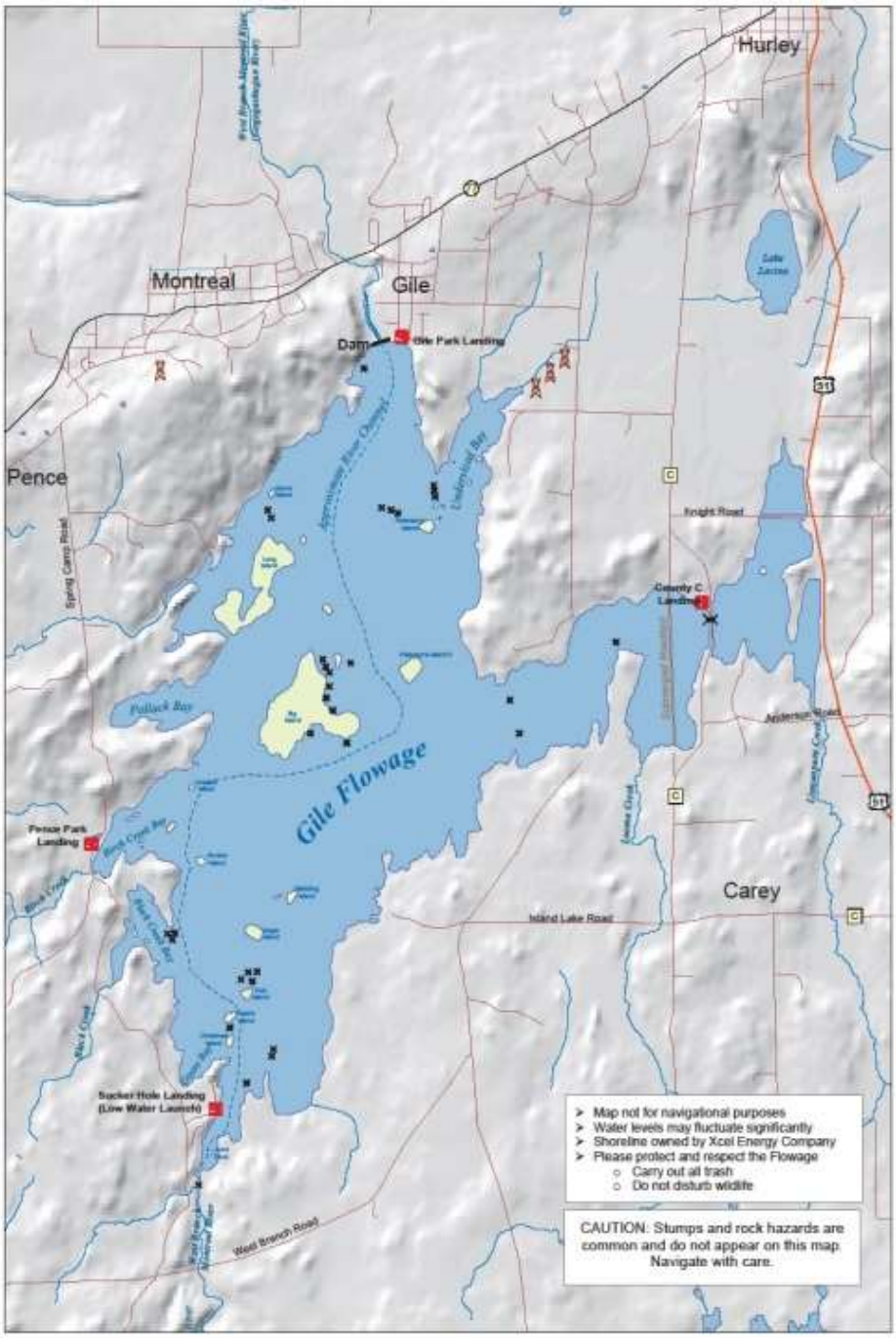
National Park Service. 2021. Comments on the Pre-application Document and Study Request for the Gile Flowage (P-15055) Hydroelectric Project. March 16, 2021.

Northern States Power Company – Wisconsin, dba Xcel Energy. 2020. Pre-Application Document-Gile Flowage Storage Reservoir Project. Prepared by Mead & Hunt, October 27, 2020.

River Alliance of Wisconsin. 2021. Notice of Intent to File License Application, Filing of Pre-Application Document (PAD), Commencement of Pre-Filing Scoping, Request for Comments on the PAD and Scoping Document and Identification of Issues on the PAD and Scoping Document and identification of Issues Associated with Study Requests. March 17, 2021.

Wisconsin Department of Natural Resources. 2021. Comments on Notice of Intent, Scoping Document 1, Preliminary Application Document, and Studies Request for the Gile Flowage Storage Reservoir Project (P-15055-000) Licensing. March 5, 2021.

Appendix 1 – Recreation Study Area



Boat Landing

Rock Bar

Towers

Culverts

Streams

River Channel

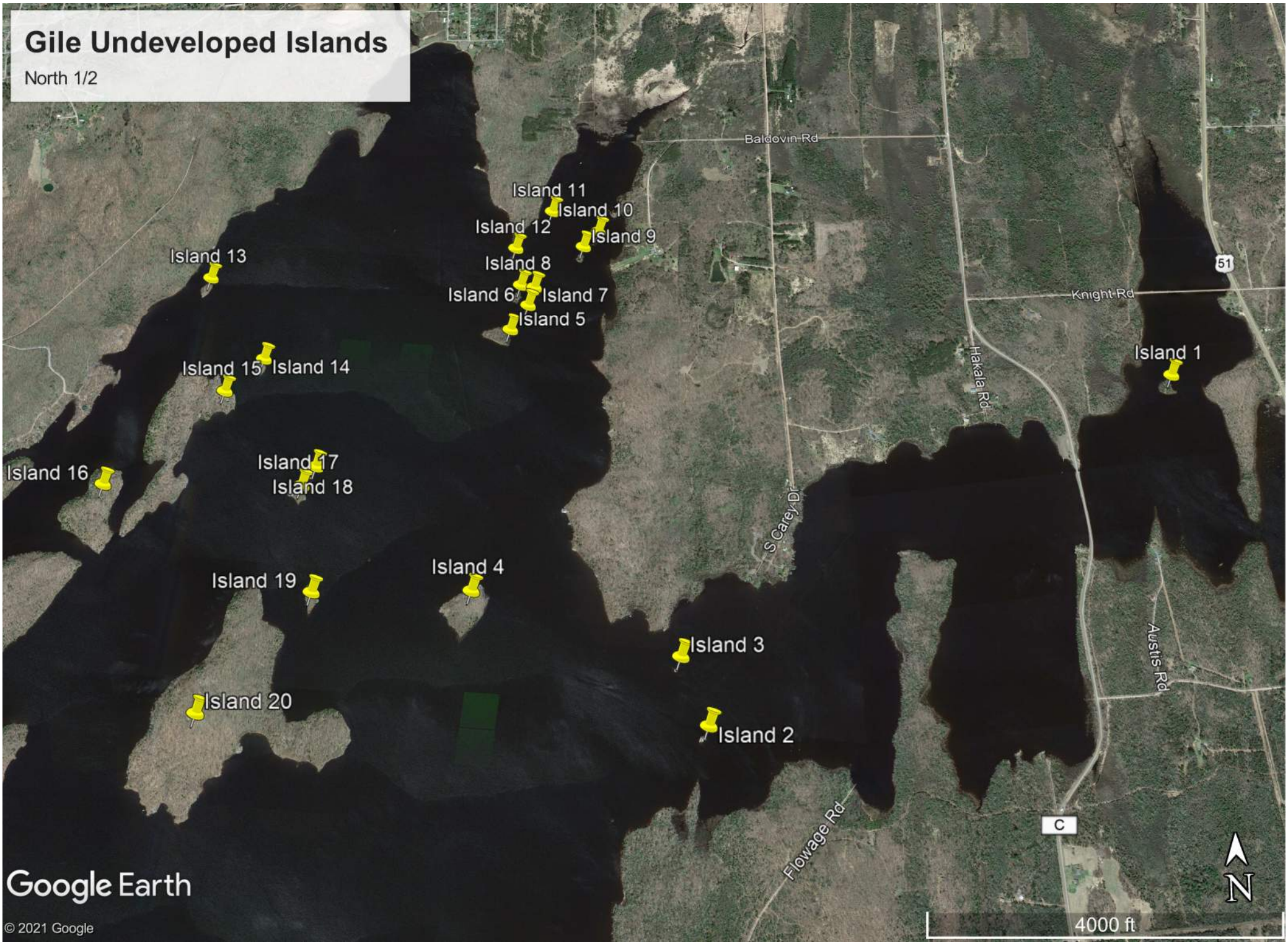
Gile Flowage

Iron County Wisconsin

Be A Friend...
Help Stop the Spread of Invasive Species

FRIENDS OF THE GILE FLOWAGE

N


Gile Undeveloped Islands
North 1/2
Baldovin Rd
Island 11
Island 10
Island 12
Island 9
Island 13
Island 8
Island 6
Island 7
Island 5
Knight Rd
51
Island 15
Island 14
Island 1
Hakala Rd
Island 16
Island 17
Island 18
S Carey Dr
Island 4
Island 19
Island 3
Austis Rd
Island 20
Island 2
Flowage Rd
C
Google Earth
© 2021 Google
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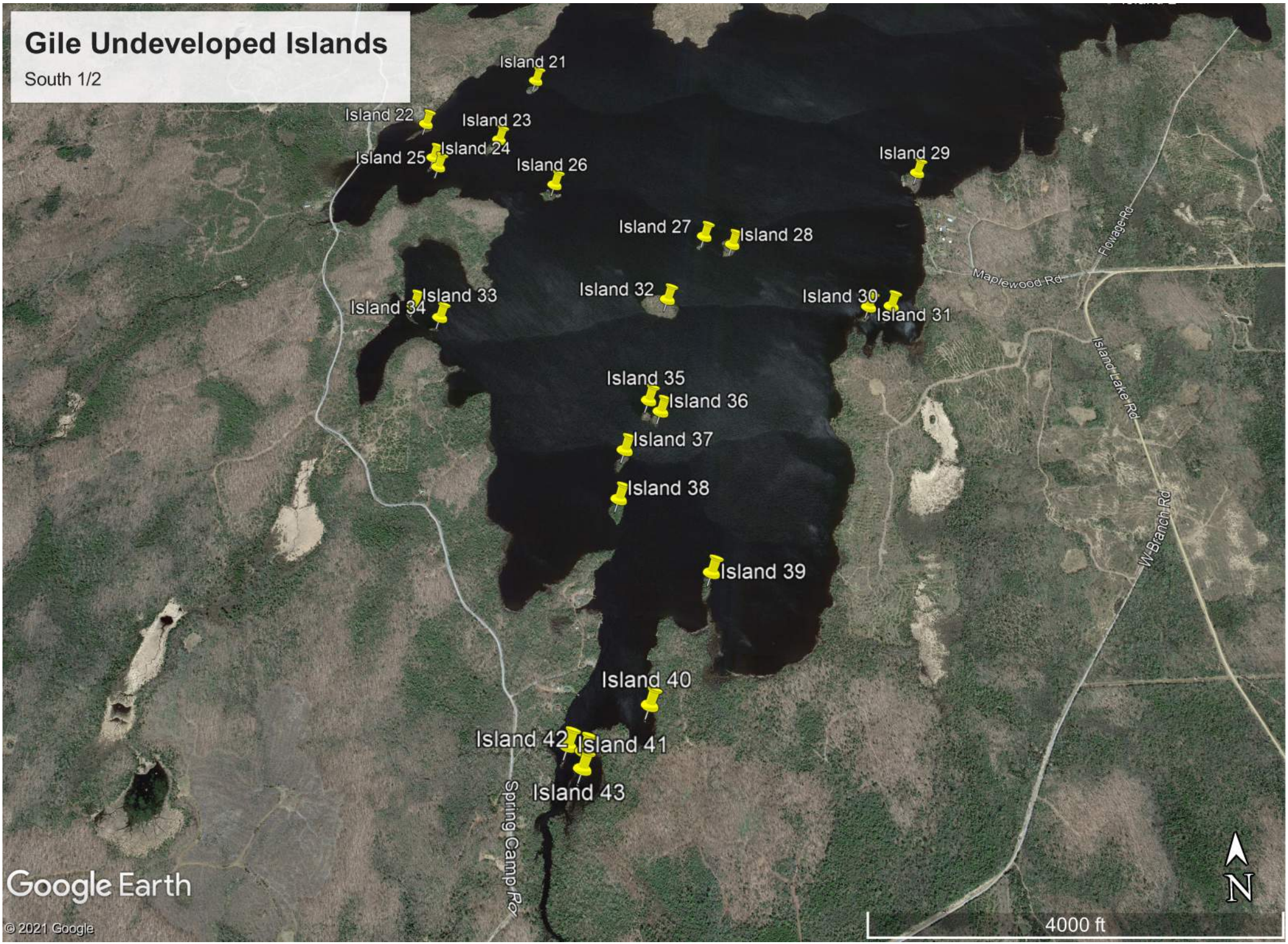
4000 ft


Gile Undeveloped Islands
South 1/2
Island 21
Island 22
Island 23
Island 24
Island 25
Island 26
Island 27
Island 28
Island 29
Island 30
Island 31
Island 32
Island 33
Island 34
Island 35
Island 36
Island 37
Island 38
Island 39
Island 40
Island 41
Island 42
Island 43
Flowage Rd
Maplewood Rd
Island Lake Rd
W Branch Rd
Spring Camp Rd
Google Earth
© 2021 Google
N
4000 ft

Appendix 2 – Recreation Facility Inventory Forms

Recreation Inventory and Condition Assessment					
Location:				Date:	
Gile Flowage Storage Project P-15055-000					
Owned By:					
Operated / Managed By:					
Hours / Seasons of Operation:					
Survey Person:					
GPS Location:					
Amenity Photo Numbers:					
Shoreline Photo Numbers:					
Entryway Photo Number:					

Type of Amenity:	**Quanitity of Amenities:**	**Condition of Amenity:** -Not Usable (N) -Needs Repair (R) -Needs Maintenance (M) -Good Working Condition (G)	**Notes:**	**Barrier Free?** (Y or N)
Boat Launch	Lanes: Launches:	N R M G		
Skid Pier		N R M G		
Fishing Pier		N R M G		
Picnic Tables		N R M G		
Restroom		N R M G		
Trash Receptacles		N R M G		
Trail		N R M G		
Other		N R M G		

Mimimum Reservoir Elevation Needed to Operate Amenities		Feet NGVD

Parking	**Total Spaces:**	**Number of Spaces (each type):**		**Notes:**	**Condition:**
		Standard:			N
		Barrier-Free:			R
		Trailer:			M
		Other:			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, erosion, or anything observed that is not already documented above.

Appendix 3 – Recreation Use Survey

ON-SITE/IN-PERSON RECREATION INTERVIEW

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is in the process of applying for an original license from the Federal Energy Regulatory Commission (FERC) to operate and maintain the existing Gile Flowage Storage Project (Gile Flowage or Project). The Project is owned, operated, and maintained by NSPW. The purpose of the Project is to provide water for downstream power generation at NSPW's Saxon Falls (FERC No. 2610) and Superior Falls (FERC No. 2587) hydroelectric projects. To obtain a license for the Gile Flowage, NSPW must submit a final license application to FERC no later than August 18, 2023. As part of the licensing 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 Gile Flowage.

Interview Location
☐ **Gile Park**
☐ **Town of Pence Landing**
☐ **Sucker Hole Landing**
☐ County **Highway C Landing**
☐ **Island**

Total Number in Group:	
Home Zip Code:	
Interviewer:	
Date:	
Time:	

RECREATION INTERVIEW QUESTIONS

1. Regarding the Gile Flowage area, do you consider yourself: (Please select only one)

- ☐ Regular visitor *(3 or more times per year)*
- ☐ Occasional visitor *(1-2 times per year)*
- ☐ Infrequent visitor *(Less than 1 time per year)*
- ☐ This is my first visit

2. When did you arrive on this trip to the Gile Flowage area?

Arrive Date: _____

Arrive Time: _____ am/pm

3. When do you expect to leave the Gile Flowage area?

Departure Date: _____

Departure Time: _____ am/pm

4. About how many miles did you travel to get to the Gile Flowage area?

_____ miles

5. During the last 12 months (including this trip), which month(s) did you visit the Gile Flowage area? (Check all that apply)

Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐

6. Which of the following recreation areas did you visit for recreation during the past 12 months? (Check all that apply)

☐ Gile Park
☐ Town of Pence Landing
☐ Sucker Hole Landing
☐ County Highway C Landing
☐ Reservoir Island (identify island location on map)
☐ Other (please list below)
☐ None of the above

_____

7. Are you staying overnight in the Gile Flowage area (not including your own home) on this trip?

☐ Yes ☐ No

8. If you answered yes to 7, at what type of accommodations will you be staying? (Please select only one)

☐ RV/Auto/Tent Campground
☐ Motel/Hotel
☐ Bed and Breakfast
☐ Vacation or Rental Home
☐ Other (please list below)

_____

_____

9. Which of the following best describes your group during this trip? (Please select only one)

☐ Individual
☐ Adult group (over 21)
☐ Youth group (under 21)
☐ Family (with children)
☐ Mixed Group (various groups and ages)

10. On this trip to the Gile Flowage area, what activities have you or do you expect to participate in? (Please select all that apply)

☐ Bank fishing	☐ Picnicking	☐ Rafting/Tubing
☐ Boat fishing	☐ Swimming	☐ Wildlife viewing
☐ Pleasure boating	☐ Sight-seeing	☐ Other (please describe below)
☐ Personal watercraft	☐ Hunting	

On any trip to the Gile Flowage in the last year, which of the following activities have you participated? (Please select all that apply)

☐ Bank fishing	☐ Picnicking	☐ Rafting/Tubing
☐ Boat fishing	☐ Swimming	☐ Wildlife viewing
☐ Pleasure boating	☐ Sight-seeing	☐ Other (please describe below)
☐ Personal watercraft	☐ Hunting	

11. Of the activities you selected in 10 above, what is the primary activity you participated in or expect to participate in on *this* visit? (Please write answer below)

Primary activity _____

12. For the primary activity you participated in, please rate the following categories:

Category	Totally Acceptable	Acceptable	Neutral	Unacceptable	Totally Unacceptable
Safety	**5**	**4**	**3**	**2**	**1**
Enjoyment	**5**	**4**	**3**	**2**	**1**
Crowding	**5**	**4**	**3**	**2**	**1**
Overall Experience	**5**	**4**	**3**	**2**	**1**
Amenity Condition	**5**	**4**	**3**	**2**	**1**

If you rated one of the categories above as "unacceptable" or "totally unacceptable", please indicate what could be done to improve the category to "acceptable." (Please write answer below)

_____

13. Please rate all Gile Flowage area recreational activities you participated in today or in the past.

Rating scale is the same as used in 12 above:
5 - Totally Acceptable
4 - Acceptable
3 - Neutral
2 - Unacceptable
1 - Totally Unacceptable

Recreation Activity	Gile Park	Town of Pence Landing	Sucker Hole Landing	Highway C Landing	Reservoir Islands
Bank fishing					
Boat fishing					
Pleasure boating					

Personal watercraft					
Picnicking					
Swimming					
Sight-seeing					
Hunting					
Rafting/Tubing					
Wildlife viewing					
Other					

14. Please indicate if low water levels were a problem for any of the following activities at the recreation area(s) you are visiting today:

Circle one number for each:

Ability to:	No Problem	Small Problem	Neutral	Moderate Problem	Large Problem	No Opinion or N/A
Swim safely	5	4	3	2	1	☐
Launch/take out boat	5	4	3	2	1	☐
Boat safely	5	4	3	2	1	☐
Use docks	5	4	3	2	1	☐
Shoreline fish	5	4	3	2	1	☐
Access shoreline	5	4	3	2	1	☐
Shoreline scenic quality	5	4	3	2	1	☐
Other (specify below)	5	4	3	2	1	☐

Other: _____

15. Please share any additional thoughts or comments you have regarding recreation on the Gile Flowage:

_____

_____

_____

_____

_____

Thank you for completing the Recreation Survey!

Appendix 4 – Recreation Use Spot Count Form

Recreation Observation Form																	
Date:							Time:										
Gile Flowage Storage Project P-15055-000																	
Survey Person:																	
Temperature:		Weather:				Wind Speed:											
Reservoir Elevation:																	
Any amenities not usable due to low/high reservoir elevations?																	

Note: Please list primary activity by placing a "P" in the box. Use and "S" for secondary activities.

Recreation Site	Number of Vehicles	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	Other (specify)	
Gile Dam															
Gile Park															
County C Landing															
Sucker Hole Landing															
Town of Pence Landing															
Island Number____															

Additional Comments:

Appendix H – Shoreline Stability Study

Gile Flowage Storage Project
FERC No. 15055

Study Plan

Shoreline Stability Study

Prepared for

Prepared by

Mead & Hunt

meadhunt.com

August 2021

1. Introduction

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is in the process of applying for an original license from the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Gile Flowage Storage Project (Gile Flowage or Project). The Project is owned, operated, and maintained by NSPW.

On January 19, 2021, FERC issued Scoping Document 1 and requested that stakeholders provide comments on the Pre-Licensing Application Document (PAD) and study requests within 60 days. During the 60-day comment period, the Applicant received comments and study requests from several entities. The FERC requested the Applicant complete a shoreline stability study as part of licensing process. More specifically, the FERC requested that the Applicant complete a shoreline stability study to identify areas of erosion, mass soil movement, or other forms of instability along the reservoir shoreline and the West Fork of the Montreal River (West Fork) downstream of the Gile Dam.

While the Friends of the Gile Flowage (FOG) did not specifically request a shoreline stability study, they did request that erosion due to reservoir fluctuations be monitored as part of their request for a water level study.

The Applicant has proposed this Shoreline Stability Study to collect information on the stability of all shorelines within the Project's area of potential effect (APE) including the Project reservoir and the West Fork downstream of the Gile Dam.

2. Study Plan Elements

2.1 Study Goals and Objectives

The objective of this study is to identify areas of erosion, mass soil movement, slumping, or other forms of instability along the reservoir shoreline and the West Fork downstream of the Project.

2.2 Resource Management Goals

Provide equal consideration to non-power resources such as aquatic resources that could potentially be impacted by Project operations.

2.3 Public Interest

FERC expressed interest in this study.

2.4 Background and Existing Information

A shoreline littoral zone survey was conducted on the Gile Flowage in 2005. The study is located on the Friends of the Gile Flowage (FOG) website at http://www.friendsofthegile.org/home/flowage-publications. The report's author is not listed. The study analyzed the substrates in the littoral zone in areas up to six feet below the full pool elevation of 1,490 feet. The report indicated that substrates within the upper6 feet consisted of 20.3% bedrock, boulder, or cobble; 26.9% gravel, gravel with cobble, or gravel with boulders;

39.8% consisted of sand, muck or detritus; 13% consisted of sand with gravel, cobble, and/or boulders (FOG, 2005).

2.5 Project Nexus

Project operation affects water level and flow patterns in both the Project reservoir and the West Fork of the Montreal River (West Fork) downstream of the Gile Dam. The water fluctuation and flow patterns may cause shoreline erosion or instability, which may in turn influence environmental resources. Understanding the Project's influence on shoreline erosion is necessary in understanding the effects continued operation of the Project may have on environmental resources.

2.6 Study Area

The study area includes the reservoir shoreline, including islands, and the shoreline downstream of the Gile Dam that is within the proposed Area of Potential Effects (APE). The APE is depicted in Appendix 1.

2.7 Methodology

2.7.1 Survey Methods

The Applicant will inspect the Project shoreline by boat (or by foot in areas not accessible by boat) for evidence of erosion, such as lack of stabilizing vegetation, mass soil movement, slumping or sliding, or other forms of instability. During the survey, NSPW will record reservoir elevation and flow.

2.7.2 Assessment of Instability at Identified Erosion Sites

When erosion is identified, the length of the impacted shoreline will be recorded with the use of a handheld GPS unit for mapping purposes. Representative photographs will be taken at each erosion site. For each erosion area identified on the reservoir, the erosion intensity score worksheet contained in NR 328.08 of the Wisconsin Administrative Code will be completed and a total score will be provided.

For each site featuring 150 feet or less of continuous erosion along the shoreline downstream of the dam (i.e. less than 150 feet complete one form, for continuous areas greater than 300 feet, complete one form each 150 foot interval), the bank erosion potential score worksheet contained in NR 328.08 of the Wisconsin Administrative Code, located at https://docs.legis.wisconsin.gov/code/admin_code/nr/300/328, will be completed and a total score will be provided.

In addition to the completed forms, information collected during the survey will be used to create detailed maps showing all areas of unstable/eroding soils within the Project APE. Results will be analyzed and presented in a final study report as described in Section 2.9 below.

2.8 Consistency with Generally Accepted Scientific Practice

The overall approach to the shoreline stability study is consistent with generally accepted methods for this type of inventory.

2.9 Project Schedule and Deliverables

Results of this study will be summarized in a Shoreline Stability Study Report. The report will include the following items:

- Description of Study Area
- Methods
- Results
- Discussion and Analysis of Results and Erosion Site Total Scores
- Conclusions
- Estimate of River Flow
- Detailed Maps of Erosion Areas
- All field sheets, completed data collection forms, and photographs collected during the study.

NSPW anticipates that field work will be completed by late August 2022 with the study report to be filed with FERC in the Initial Study Report.

2.10 Level of Effort and/or Cost

NSPW estimates that this study will cost approximately $35,000 to complete.

2.11 Discussion of Alternative Approaches

NSPW has generally incorporated FERC's comments regarding their request for a shoreline stability study. The overall approach is consistent with generally accepted methods used by federal and state agencies. In addition, the proposed methods for this study are consistent with FERC's study requirements under the ILP. No alternative approaches or additional information is required to meet the objectives of this study.

3. References

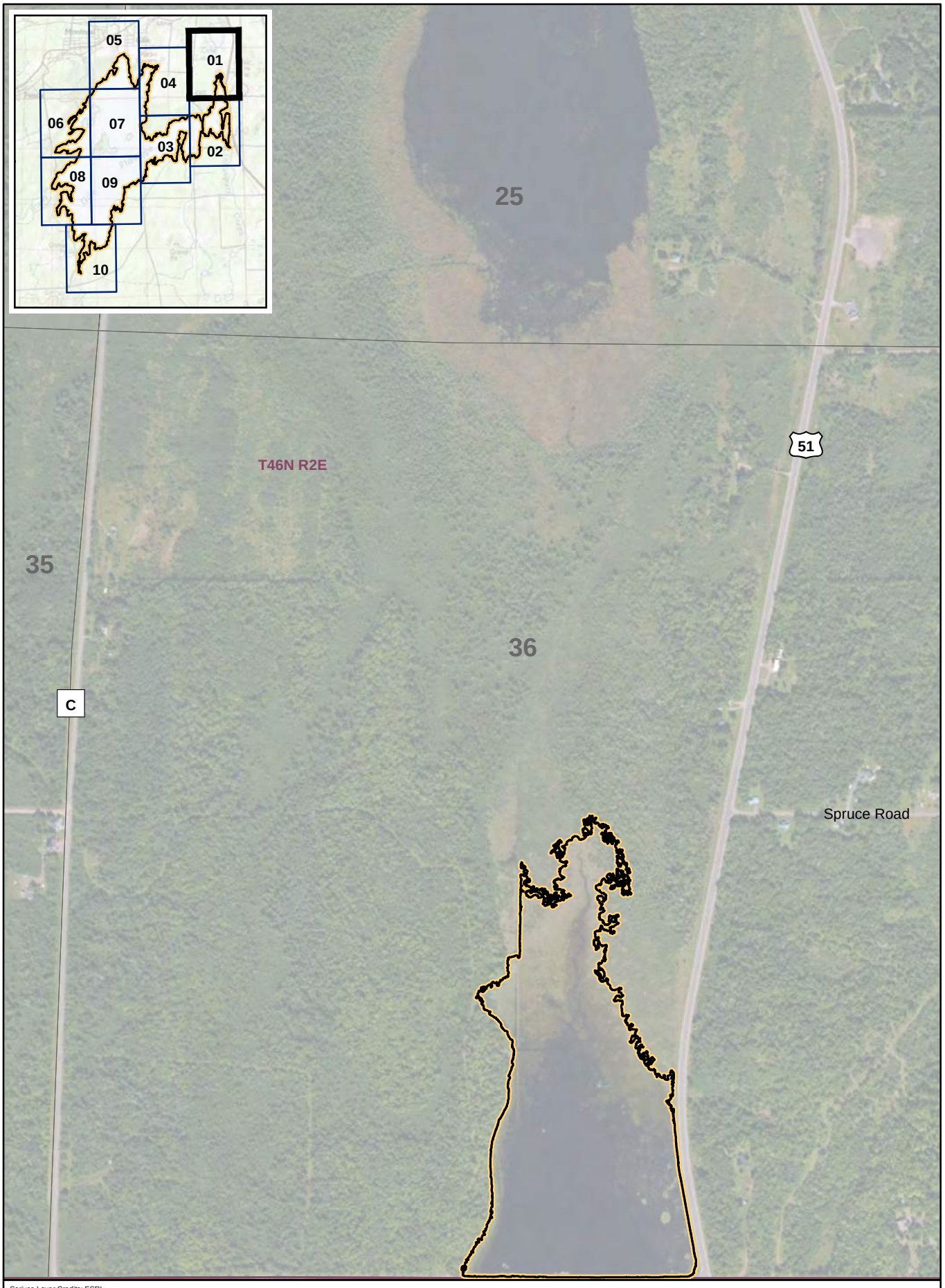
Federal Energy Regulatory Commission. 2021. Comments on Preliminary Study Plans, Request for Studies, and Additional Information. March 17, 2021.

Friends of the Gile Flowage. 2021. Comments on Notice of Intent, Scoping Document 1, Preliminary Application Document, and Studies Request for the Gile Flowage Storage Reservoir Project, P-15055-000. March 16, 2021.

Friends of the Gile Flowage. 2005. Gile Flowage Littoral Zone Survey, 2005. https://docs.google.com/file/d/0B75MzL2b1_KCaWtGN0UxSFhKbTQ/edit. Accessed October 6, 2020.

Wisconsin Administrative Code Chapter NR 328 Shore Erosion Control Structures in Navigable Waterways. February 2014.

Appendix 1 – Project APE



Serivce Layer Credits: ESRI

Xcel Energy

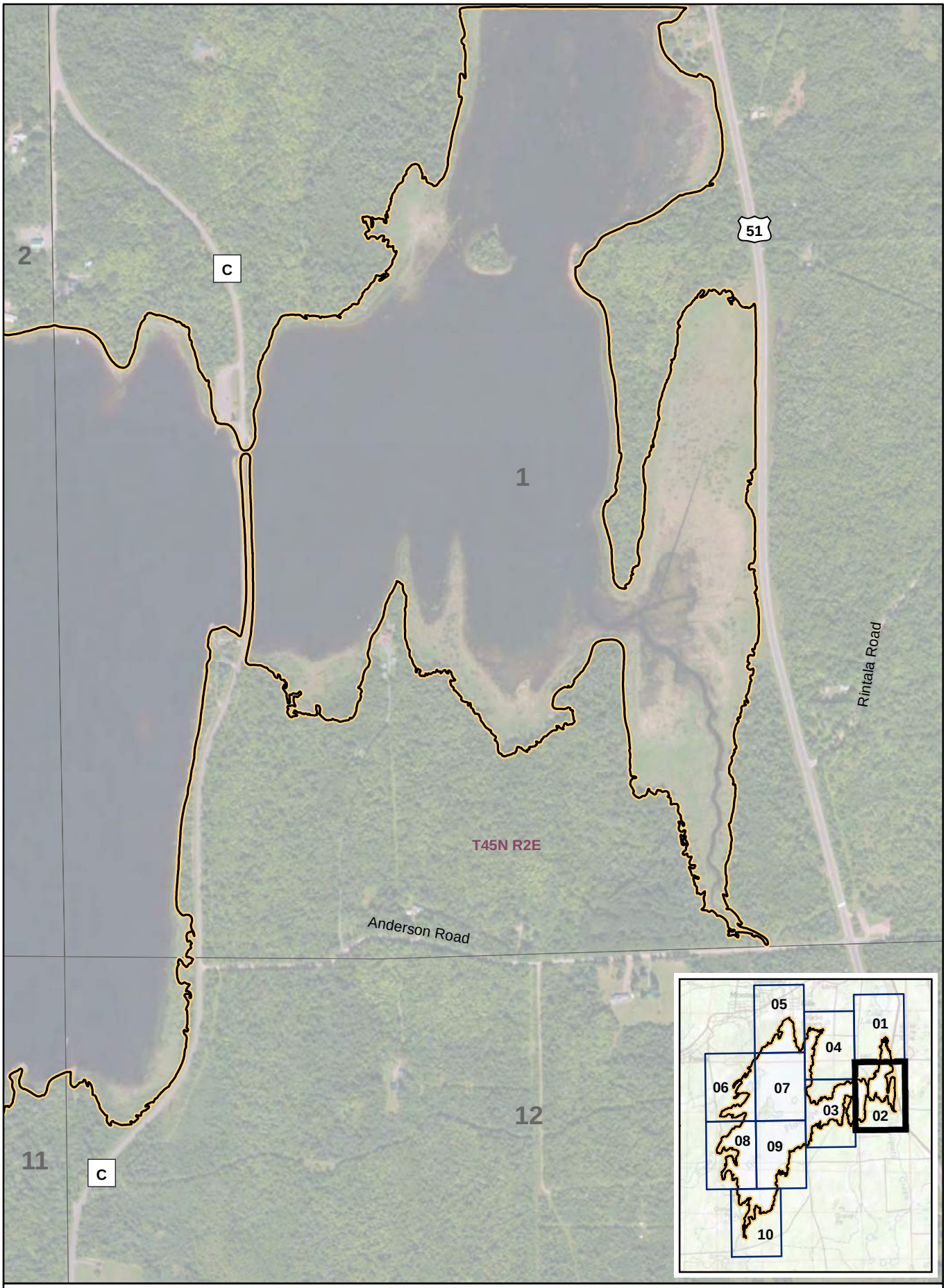
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 01 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

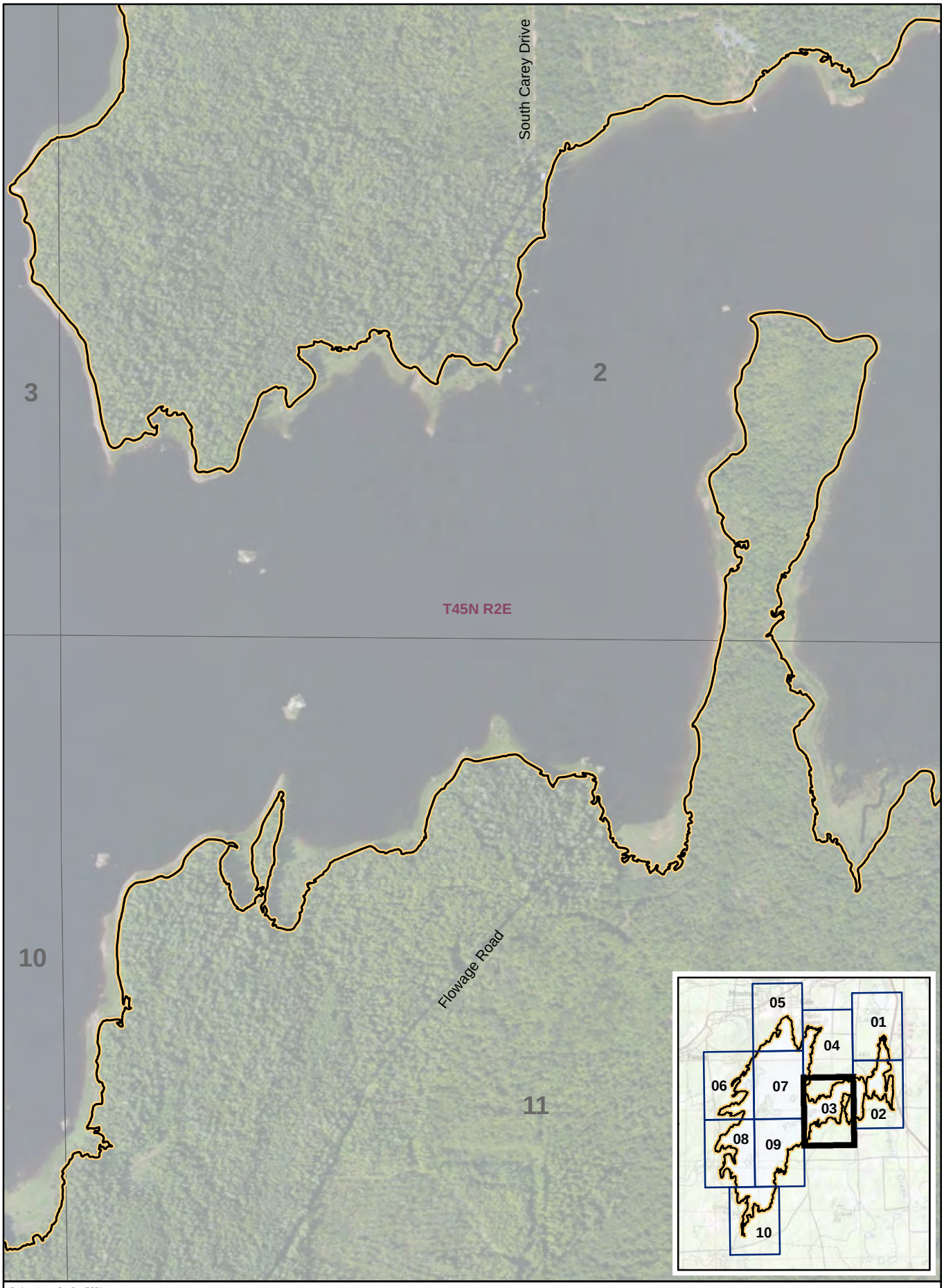
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 02 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

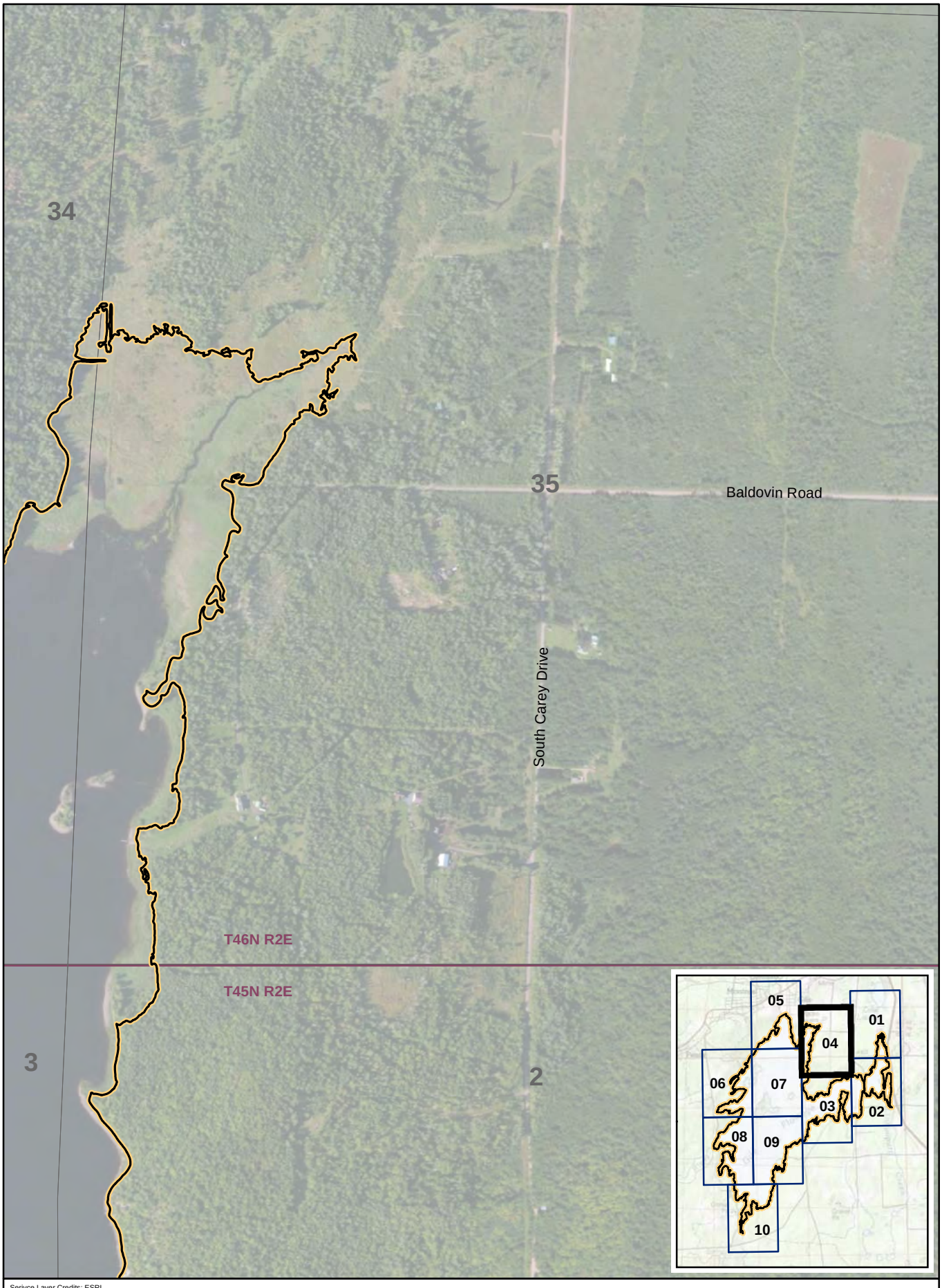
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 03 of 10
FERC No. 15055



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Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 04 of 10
FERC No. 15055

Serivce Layer Credits: ESRI

Xcel Energy

Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

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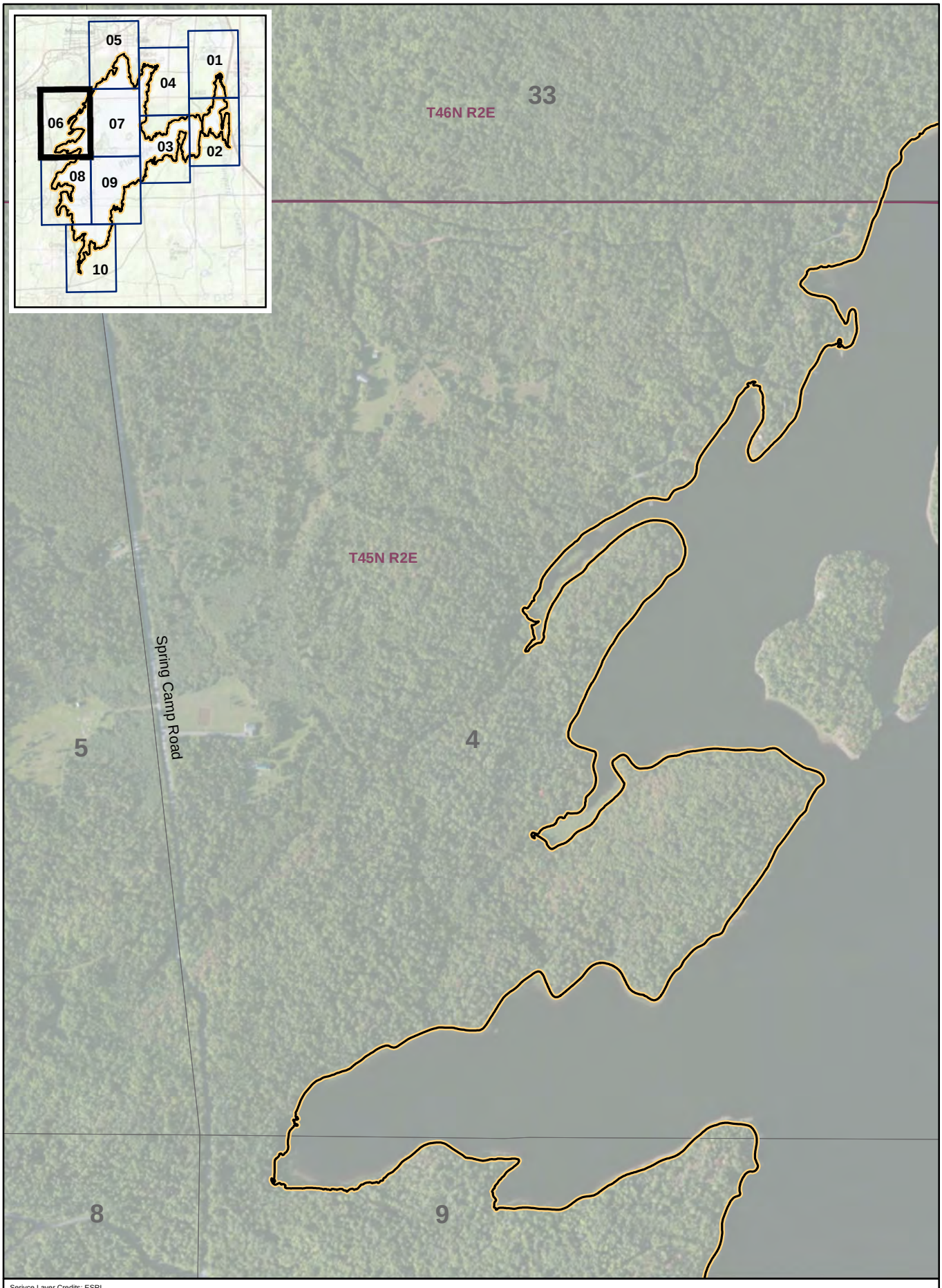
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 05 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

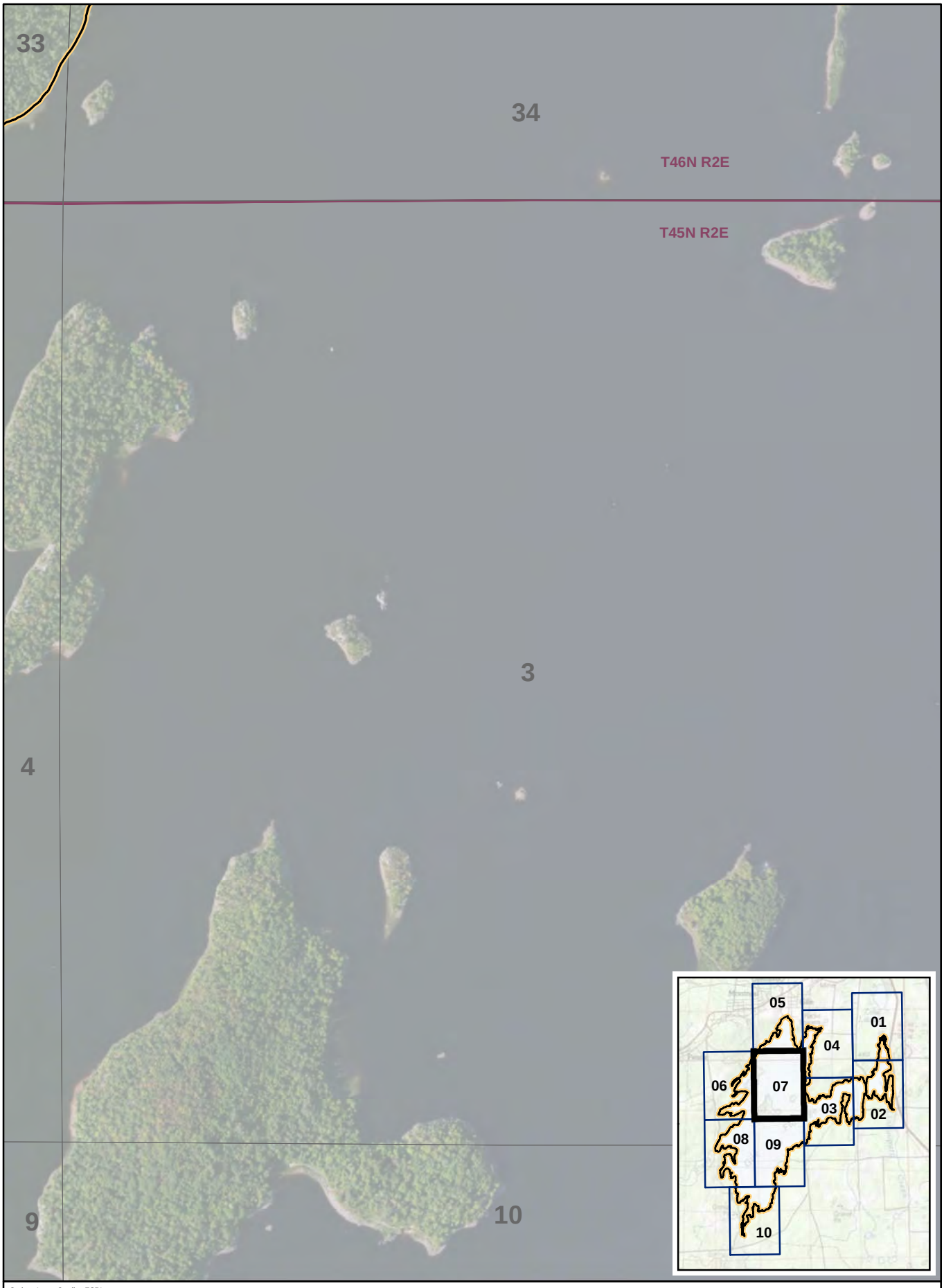
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 06 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

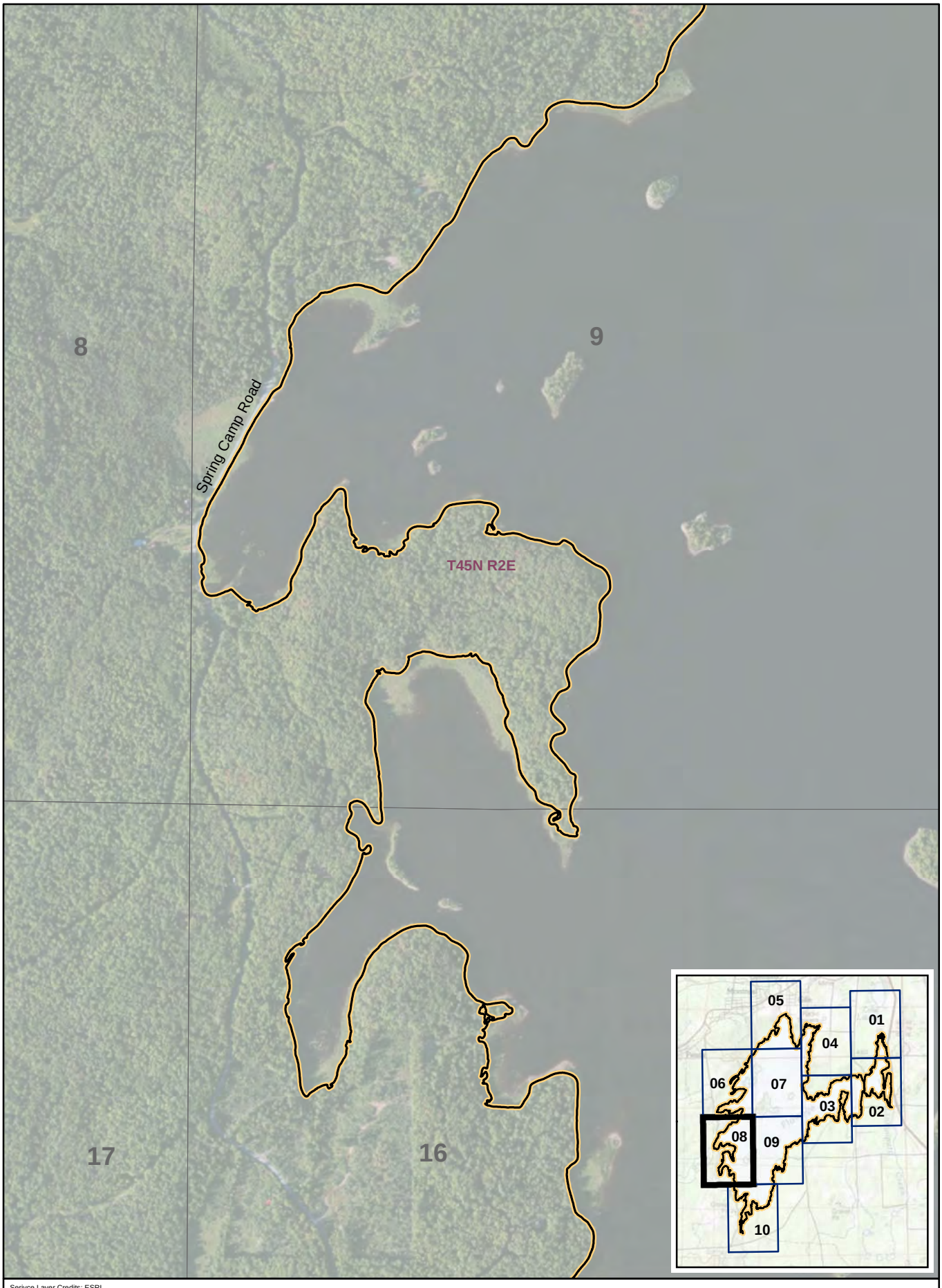
Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 07 of 10
FERC No. 15055



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Xcel Energy®

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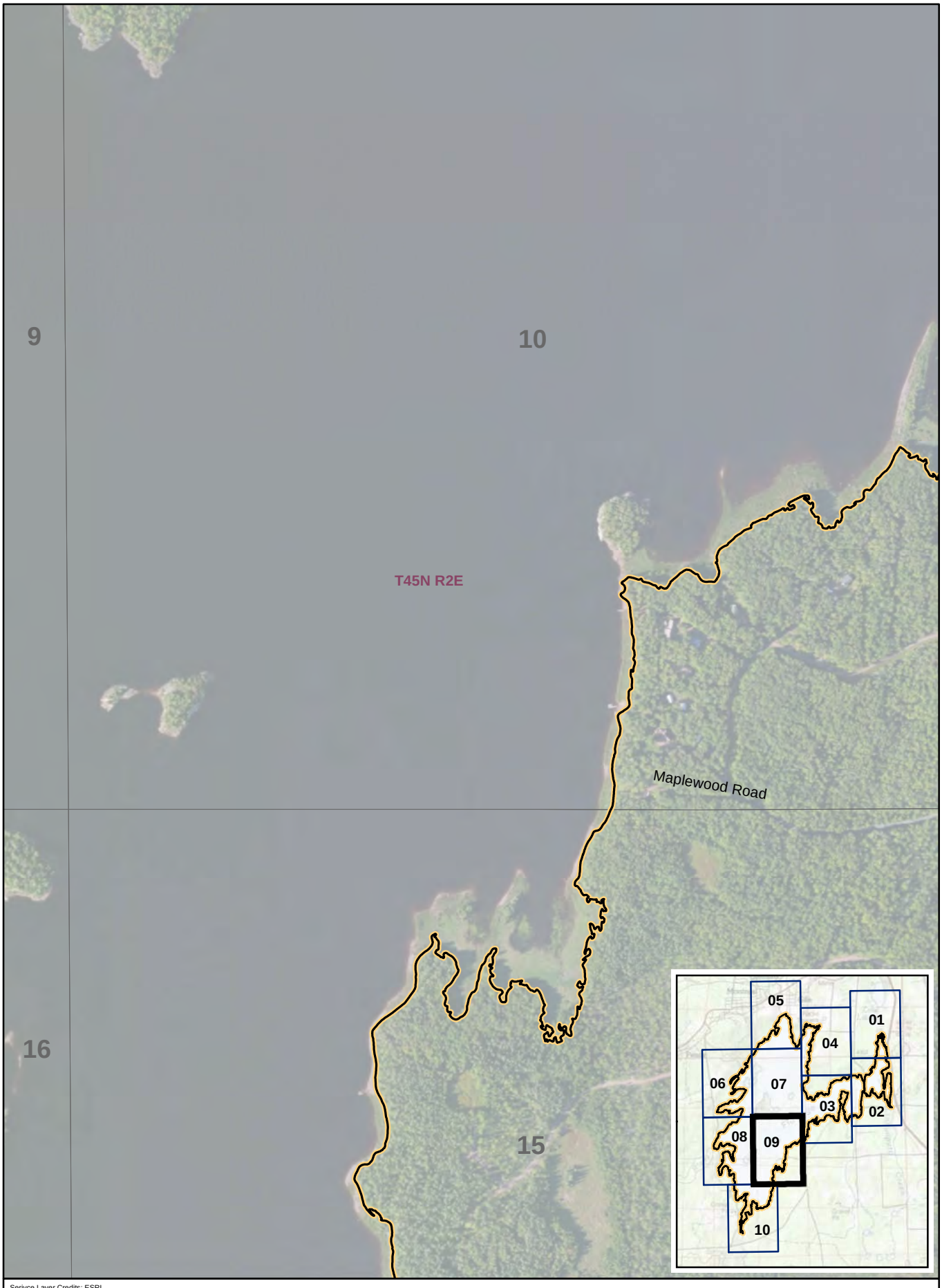
Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 08 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy®

Mead & Hunt

Proposed Project Boundary

Proposed Project APE

Township Range Line

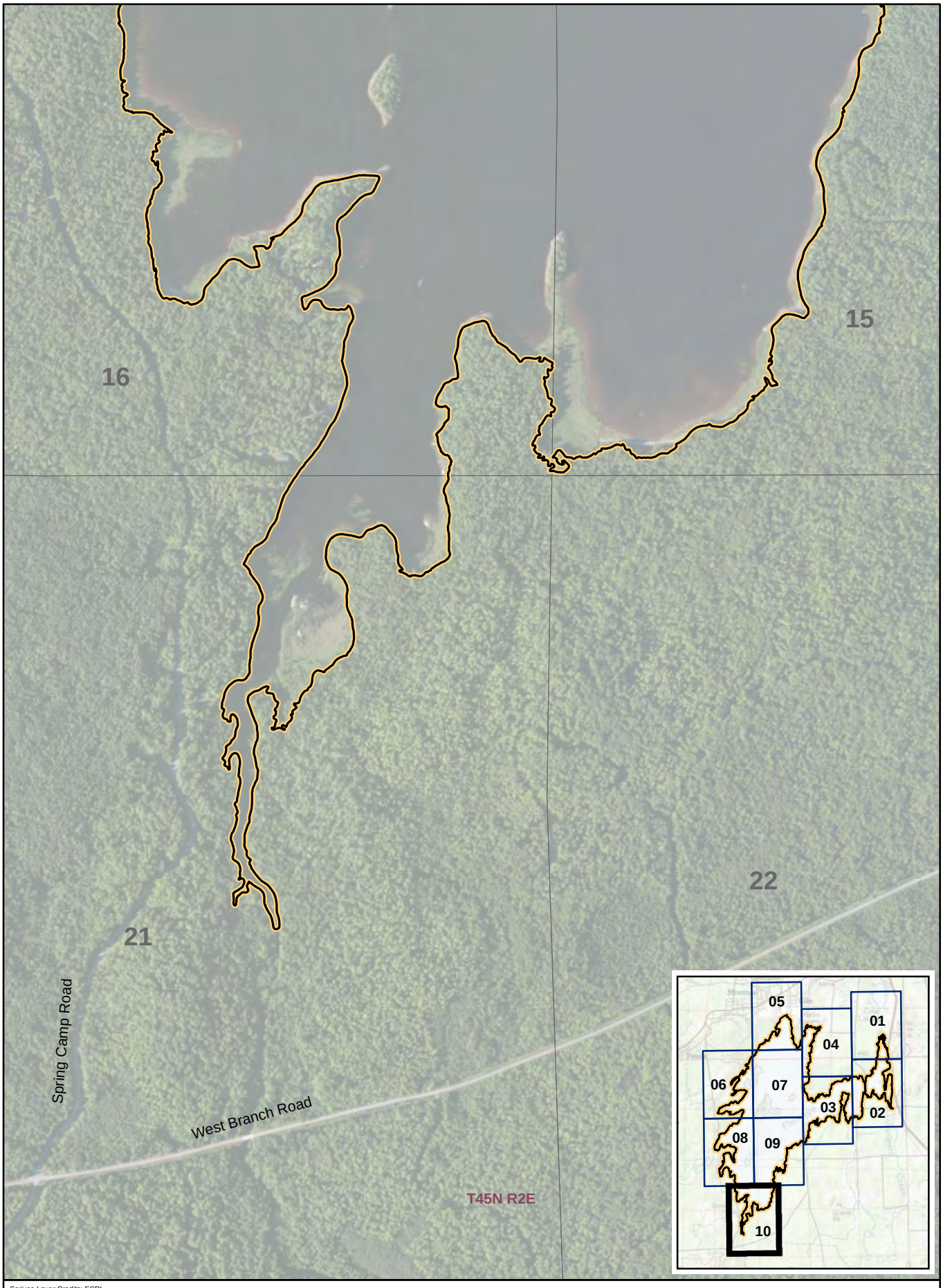
Section Line

N

0 375 750

Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 09 of 10
FERC No. 15055



Serivce Layer Credits: ESRI

Xcel Energy

Mead & Hunt

Proposed Project Boundary
Proposed Project APE
Township Range Line
Section Line

N

0 375 750
Feet

Gile Flowage Storage Reservoir Project
Proposed Project Area of Potential Effects
Map Sheet 10 of 10
FERC No. 15055

Appendix I – Water Quality Monitoring Study

Gile Flowage Storage Project
FERC No. 15055

Study Plan

Water Quality Monitoring Study

Prepared for

Prepared by

Mead & Hunt

meadhunt.com

August 2021

1. Introduction

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is currently seeking to obtain an original license from the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Gile Flowage Storage Project (Gile Flowage or Project) under FERC Docket Number P-15055-000. The Project is owned, operated, and maintained by the Applicant. To obtain an original license, the Applicant must submit a Final License Application (FLA) to FERC no later than August 18, 2023. The FLA, in part, must include an evaluation of the existing water quality associated with the Project.

On January 19, 2021, FERC issued Scoping Document 1 and requested that stakeholders provide comments on the Pre-Licensing Application (PAD) and study requests within 60 days. During the 60-day comment period, the Applicant received comments and study requests from several entities. Only the Wisconsin Department of Natural Resources (WDNR) requested that the Applicant complete a water quality monitoring study as part of relicensing.

The WDNR requested that a water quality study be conducted to further understand current water quality conditions of the flowage and riverine resources to ensure state water quality standards are being met. WDNR requested that data be collected or analyzed using the WDNR WISCALM Guidance and Surface Water Grab Sampling Protocols. They requested that a total of 23 water quality parameters be monitored.

The applicant is proposing to conduct a Water Quality Monitoring Study to determine if waters within the proposed Project boundary meet current state water quality standards.

2. Study Plan Elements

2.1 Study Goals and Objectives

The objective of this water quality monitoring study is to evaluate the existing water quality at the Project to determine if the Project meets current state water quality standards.

2.2 Resource Management Goals

The resource management goal is compliance with Wisconsin Administrative Code NR 102 Water Quality Standards for Wisconsin Surface Waters (NR 102).

2.3 Public Interest

WDNR expressed interest in this study.

2.4 Background and Existing Information

One permitted point-source municipal discharge from the City of Montreal sewer treatment plan is located 0.8 miles downstream of the Project dam. Satellite water clarity has been measured annually from 2010 through 2017. Metals were measured in 2010. Water quality parameters were collected in 2012 and 2017-2019. Fish contaminant monitoring was conducted in 2013 (WDNR, 2021).

2.5 Project Nexus

The operations of the dam may affect the water quality of the impoundment and downstream resources.

2.6 Study Area

The study will include water quality monitoring at four locations at the Project, one location downstream of the tailrace, downstream of the mixing zone, one location approximately 250 feet upstream of the Project dam, one location in the deep hole (at the station where citizen lake monitoring takes place), and one location in a riverine area upstream of the main impoundment. The monitoring locations are depicted in Appendix 1.

2.7 Methodology

2.7.1 Water Quality Monitoring

The parameters to be monitored, type of sampling and sampling frequency are detailed in Table 2.7.1-1 below. Each sampling event should occur near the middle of the sampling month with the exception of September, which can be sampled earlier in the month to allow time for the study report to be completed prior to the filing of the Initial Study Report (ISR) with FERC at the end of September 2022.

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. Nutrient samples should be collected using WDNR's Grab Sampling Protocol, which is located in Appendix 2.

Table 2.7.1-1 Water Quality Monitoring Study

Parameter	Samples	Type of Sampling	Sampling Frequency			
			May	July	Aug.	Sept.
Ammonia	1 total	Lab		X		
Bacteria	3 total	Lab		X	X	X
Chloride	1 total	Lab	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	3 total	Lab		X	X	X
Iron	3 total	Lab		X	X	X
Manganese	3 total	Lab		X	X	X
Sulfide	3 total	Lab		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

Parameter	Samples	Type of Sampling	Sampling Frequency			
			May	July	Aug.	Sept.
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

For the parameters that are labeled as field profiles, for the three sampling locations within the Project reservoir, 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. For the one sampling location downstream of the tailrace, only a surface grab sample is required since the river downstream of the tailrace should be fully mixed and stratification is unlikely.

2.7.2 Personnel Qualifications

All surveys will be conducted by individuals with prior water quality monitoring training and experience.

2.8 Consistency with Generally Accepted Scientific Practice

This Water Quality Monitoring Study follows generally accepted scientific practice regarding field data collection and reporting. Similar protocols have been used in other relicensing studies.

2.9 Project Schedule and Deliverables

Results of this 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/or Consultation
- Literature Cited

NSPW anticipates that field work will be completed by early September 2022. The study report will be included in the ISR when it is filed with FERC, no later than September 28, 2022.

2.10 Level of Effort and/or Cost

NSPW estimates that this study will cost approximately $30,000 to complete.

2.11 Discussion of Alternative Approaches

NSPW has generally incorporated WDNRs request for water quality monitoring. NSPW has provided reasoning in Section 3.0 of the Proposed Study Plan as to why the WDNR request to monitor three parameters, methyl mercury, cyanobacteria, and sediment accumulation were not included in the parameters to be monitored in the Study. The proposed methods for this study are consistent with accepted professional practices. The overall approach has been used in other relicensing proceedings and is consistent with generally accepted methods used by federal and state agencies. In addition, the proposed methods for this study are consistent with FERC's study requirements under the ILP. No alternative approaches to this study are warranted.

3. References

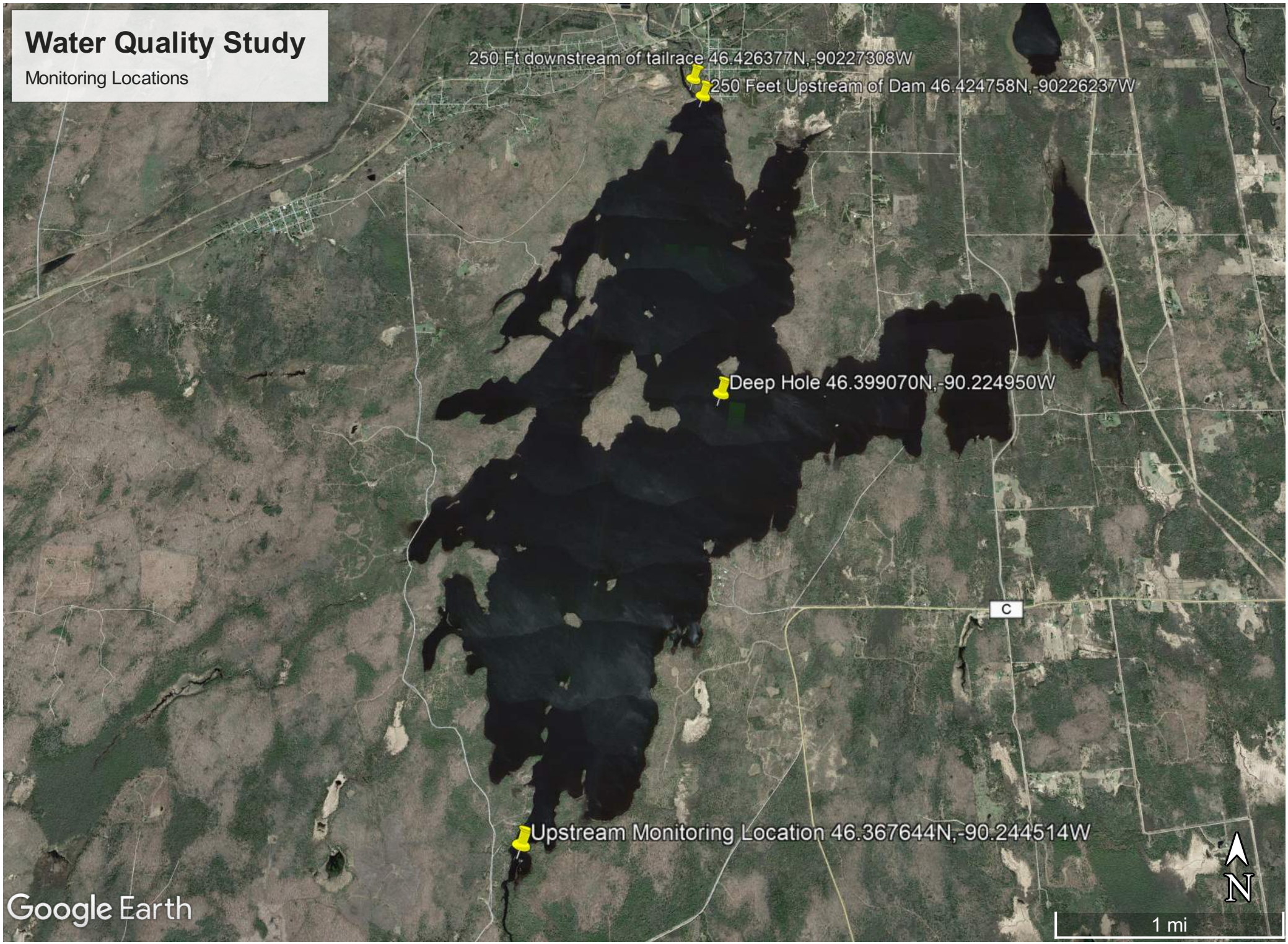
Northern States Power Company – Wisconsin, dba Xcel Energy. 2020. Pre-Application Document-Gile Flowage Storage Reservoir Project. Prepared by Mead & Hunt. October 27, 2020.

Wisconsin Department of Natural Resources. 2021. American Whitewater. 2021. Comments on Notice of Intent, Scoping Document 1, Preliminary Application Document, and Studies Request for the Gile Flowage Storage Reservoir Project (P-15055-000) Licensing. March 5, 2021.

Wisconsin Department of Natural Resources. 2015. Nutrient Chemistry Grab Sampling (V3.3). WDNR - PUB-WY-019-2015. February 26, 2015.

Wisconsin Department of Natural Resources. 2022. Wisconsin Consolidated Assessment and Listing Methodology (WisCALM) 2022. Guidance # 3200-2021-01. January 14, 2021.

Appendix 1 – Water Quality Monitoring Study Area


Water Quality Study
Monitoring Locations
250 Ft downstream of tailrace 46.426377N,-90227308W
250 Feet Upstream of Dam 46.424758N,-90226237W
Deep Hole 46.399070N,-90.224950W
C
Upstream Monitoring Location 46.367644N,-90.244514W
Google Earth
N
1 mi

Appendix 2 – WDNR Grab Sampling Protocol

A. Scope

This method pertains to the collection of surface water chemistry grabs for the determination of the concentration of nutrients (forms of nitrogen and phosphorus). While nutrients are generally grouped as nitrogen or phosphorus for field sampling protocols it is more important to consider if the sample should be preserved on non-preserved. This SOP will also cover the rare circumstance where field staff may be asked to filter samples in the field (Section F). However, for nearly all DNR sampling protocols samples that need to be filtered before analysis will be filtered at the Wisconsin State Lab of Hygiene. There is a video available on sample preservation for DNR monitoring: http://intranet.dnr.state.wi.us/int/es/science/ls/videos/Sample_Preservation.wmv

1. Preserved Samples

Preserved samples have a known quantity of acid added to the sample immediately after collection. Holding time for samples between sample collection and analysis is **28 days**. Acid preservative for samples is provided in vials by the Wisconsin State Lab of Hygiene (WSLH). Constituents that are preserved before analysis include:

a. Total Phosphorus
b. Total Dissolved Phosphorus
c. Total Nitrogen
d. Total Dissolved Nitrogen
e. Kjeldhal Nitrogen (organic nitrogen plus ammonia)
f. Nitrate + Nitrate (most common together, can be ordered individual)
g. Ammonia (NH3 and NH4)

2. Non-Preserved Samples

Non-Preserved samples do not have acid added to the sample which dramatically reduces the holding time. Non-preserved samples have a holding time of only **48 hours**. Constituents that are not preserved before analysis include:

a. Total Dissolved Phosphorus
b. Dissolved Ortho-Phosphorus

B. Summary of method:

Prior to sample collection all sampling equipment and sample containers must be thoroughly cleaned. Sample bottles for nutrients from the WSLH will be pre-cleaned and ready for use. In general, the possibility for contamination for non-filtered and lab filtered nutrients are low if simple sampling techniques are used. However, contamination is a major concern with field filtered nutrient samples due to the extra equipment used that has the chance to contaminate the sample. Generally, DNR field staff will be sampling for non-filtered or lab filtered nutrients for baseline monitoring programs.

In stream systems the sampler should wade into the water moving upstream and sample near the thalweg making sure that the area is free of recently disturbed sediments. Samples should be collected 3-6 inches below the surface of the water to avoid any surface scums or particles. Samples that require a preservative must be preserved with 1mL H_2SO_4 per 250 mL sample bottle and stored on ice before analysis. Samples that are not preserved have a **48 hour** holding time. Preparations must be made to send these samples to the WSLH before the holding time expires.

i. **Exception:** Samples for Total Dissolved Phosphorus require a different preservative than the other preserved nutrient samples. Total Dissolved Phosphorus requires a preservative of 0.48 mL H_2SO_4 12.5% and is collected in a 60 mL sample bottle and still has a holding time of **28 days**. Contact the WSLH for needed sampling equipment for Total Dissolved Phosphorus

1. Standard QA/QC practices

In general, one field blank and one duplicate sample for nutrients is recommended for every ten nutrient samples (i.e. 10% rule). For a field blank de-ionized (DI) water is transported into the field in a separate container. While in the field, a crew member fills a nutrient bottle with DI water and transports it on ice with the other samples. A field duplicate is taken in the field in the same location as the single sample. For each QA/QC sample the appropriate preservative should be added to the sample in the same many as any other grab sample. In general, a field blank is used to determine if there is any cross contamination or interference in the sample collection. A duplicate is used to determine how interferences in laboratory analysis or inherent variability in the concentration of the waterbody.

C. Safety:

Safety precautions of a general nature should be recognized. Life jackets should be worn if sampling from a boat or in areas of swift current. Collecting samples in cold weather, especially around cold waterbodies, carries the risk of hypothermia, and collecting samples in extremely hot and humid weather carries the risk of dehydration and heat stroke. Preserving nutrient samples requires the use of small amounts of acid. Caution should be used to avoid contact with skin or eyes when acidifying the sample. A first aid kit should always be carried with the field crew for general safety considerations.

D. Equipment:

- 250 mL polyethylene bottle(s) (Preserved samples)
- 60 mL polyethylene bottle (Non-Preserved samples and Total Dissolved Phosphorus)
- 1.0 mL vial H_2SO_4 (Preserved samples)
- 0.48 mL vial H_2SO_4 (Total Dissolved Phosphorus only)
- Waterproof pen or marker
- Lab slip
- Ice
- Cooler
- Instruments to measure flow, temperature, dissolved oxygen, pH and specific conductivity

E. General Collection procedures

1. Label the bottle with the appropriate field number and sampling location and, if appropriate, check the box on the label indicating that H_2SO_4 has been added as a preservative. Circle "Nutrients" indicating the bottle has been sampled for nutrients.

2. Locate a sampling location that is at least 10 to 20 feet upstream from a bridge crossing, in the middle of the stream channel, and is at least knee deep. In cases where stream depth is shallow it is more important to collect the sample in the area of strongest flow (thalweg) than the deepest location. Walk upstream to the sampling location.This ensures the sample is not contaminated by sediment that has been dislodged from the substrate.

    a. If sampling using collection equipment (i.e. from a bridge) be sure to triple rinse equipment with DI and stream water. After first rinse, be sure to manually inspect equipment and wipe of any adhered dirt or debris.

3. Facing upstream, rinse a polyethylene nutrients bottle three times with the water to be sampled. Rinse with water 3 to 6 inches below the water surface.

4. Avoid touching the inside of the bottle or inside of the cap.

5. Fill the bottle completely, 3 to 6 inches below the surface.

F. Collection Procedures Preserved Nutrients:

1. See Section E 1-5 for General Collection Procedures

2. Use a **250 mL** polyethylene nutrients bottle for sample collection

3. Add **one 1.0 mL vial of H_2SO_4**, cap, and invert the bottle several times.

a. For Total Dissolved Phosphorus use a 60 mL sample bottle add 0.48 mL 12.5% vial of H_2SO_4

4. Holding time before analysis is **28 days** if sample is stored refrigerated.

G. Collection Procedures Non-Preserved Nutrients:

a. In general, DNR staff will collect samples for Non-Preserved nutrients that will be filtered in the lab by the WSLH. This greatly reduces the chances of contamination but substantially decreases the holding time of the sample.

b. See Section E 1-5 for General Collection Procedures.

c. Use a **60 mL** polyethylene nutrients bottle for sample collection

d. Note, holding time for Non-Preserved nutrients is **48 hours**, much shorter than preserved samples.

3) Sampling at Depth

When sampling at depth is performed it is very easy to compromise the cleanliness of a sample as more hardware is involved in obtaining a sample (lake, nonwadeable river, etc.). One way to do this is to rigorously clean any equipment (i.e. Kemmerer sampler) used to obtain the sample. Secondly, be sure to thoroughly triple rinse collection equipment with ambient water.

E. Documentation:

Standard documentation procedures should be followed for the collection of samples for nutrient analysis. However, it must be very clear whether the samples were acid preserved in the field or not. Be certain samples are received by the lab well in advance of the holding time as multiple days will be required due to shipping and time needed for organization and sample analysis at the WSLH. As of 2017 the WSLH requires that yellow batch label on each vial of preservative is attached to the lab slip. This ensures that expired acid is not being used to preserve samples.

F. Field Filtered nutrients

For certain projects it may be required for DNR staff to filter nutrient samples in the field using field filtering equipment. This type of sampling is inherently more susceptible to cross contamination and approved Quality Assurance Project Plans (QAPPs) must be approved before the project begins. It may be required for employees to pass a certification of competence test for field filtered nutrients. In general, this would require a crew member processing two field blanks on site that must come

back from the lab as non-detect. In this case the crew member has shown the ability to perform the task.

I. Equipment:

- 60 mL polyethylene bottle
- Transfer bottle
- Waterproof pen or marker
- 50 mL plastic syringe, peristaltic pump or other filter apparatus
- Filter housing
- Membrane filter 0.45 µm pore size
- Lab slip
- Ice
- Cooler
- Instruments to measure flow and temperature (optional)

II. Field Filtering QA/QC

Cross contamination is much more likely for field filtered nutrients and as such a more extensive QA/QC plan is required. All duplicates and field blanks should be taken in accordance with standard nutrient QAQC collection procedures above. In addition, for every 10 samples taken one sample blank should be taken. For filtered nutrients a sample blank is taken by filtering DI water in the same manner as the original sample using the same cleaned filtering equipment.

III. Collection Procedures for Field Filtered Nutrients

a. See Section E 1-4 for General Collection Procedures.

b. Use a 60 mL polyethylene nutrients bottle for sample collection

c. Remove the plunger from the 50 mL plastic syringe. Attach a filter by pushing or screwing it onto the syringe tip. Note that it will only fit one correct way.

d. Pour non-preserved sample from the transfer bottle into the syringe and fill to the top of the barrel.

e. It is important to filter a known amount so it can be properly acidified, 50 ml is recommended.

f. Re-insert the plunger, place the filter over a 60-ml polyethylene bottle opening, and slowly push the plunger down until you reach the 50ml mark.

g. Use this excess filtrate to rinse the 60-ml bottle, and discard. The filtered nutrients bottle may only be rinsed with pre-filtered water, never with ambient stream water.

h. Place the plunger over the bottle opening and push the plunger down to filter the remaining sample (50ml). It may seem difficult, but most samples will only require 10-30 seconds to filter. The filter may rupture if too much pressure is applied. Inspect the filter and if it is ruptured discard the filter and syringe and start over. Ideally a second filtered sample bottle would be used to collect the new sample. However, if there are not extra bottles handy be sure to thoroughly, triple rinse the container with Filtered stream water.
    i. This is very time consuming, it is advised that an extra few seconds of patience filtering the sample can avoid a rupture filter and save these steps.

i. Add **one 1.0 mL vial of H_2SO_4**, cap, and invert the bottle several times.

j. Check the box on the bottle label that indicates the sample has been preserved and label with the appropriate field number.

k. Write on the lab slip that the 60 mL bottle has been field filtered and preserved with H_2SO_4.

l. Store bottles on ice during transport to a refrigerator or the WSLH.

G. Updates and Tracking

Version Number	Date	Sections	Name	Approval
3.2	05/15/2014	All	Shupryt/Turcotte/ Arneson/LTT Workgroup	Shupryt 5/26/2015
3.3	04/02/2019	All, minor editorial changes	Shupryt	Shupryt 04/02/2019

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608-266-2621

WDNR-PUB-WY-019-2015

Appendix J – Whitewater Recreation Flow Study

Gile Flowage Storage Project
FERC No. 15055

Study Plan

Whitewater Recreation Flow Study

Prepared for

Prepared by

Mead & Hunt

meadhunt.com

August 2021

1. Introduction

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is currently seeking an original license from the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Gile Flowage Storage Project (Gile Flowage or Project). The Project is owned, operated, and maintained by the Applicant.

On January 19, 2021, FERC issued Scoping Document 1 and requested that stakeholders provide comments on the Pre-Licensing Application (PAD) and study requests within 60 days. During the 60-day comment period, the Applicant received comments and study requests from several entities. American Whitewater (AW), Friends of the Gile Flowage (FOG), and the National Park Service (NPS) requested the Applicant to complete a whitewater recreation flow study as part of the licensing process.

AW requested that a controlled flow study be conducted by evaluating at least three different river flows between 400 cfs and 1,000 cfs on the West Fork of the Montreal River (West Fork) from the Gile Dam downstream to the US Highway 2 Bridge.

FOG requested that silent sport recreation, including whitewater kayaking, be one of the recreation activities included in their request for a recreation study.

NPS requested that a recreation flow study be conducted on the West Fork from below the Gile Falls to US Highway 2 to determine which flows are acceptable to boaters.

The Applicant is proposing to conduct a Whitewater Recreation Flow Study (Study) to determine optimal flows for whitewater recreation downstream of the Gile Dam on the West Fork.

2. Study Plan Elements

2.1 Study Goals and Objectives

The objective of this Whitewater Recreation Flow Study is to evaluate the effects of incremental flow releases from the Gile Flowage on the availability of whitewater boating opportunities on the West Fork, beginning below the Gile Dam and extending downstream for approximately 5.7 miles to Kimball Falls Town Park. The study objectives are as follows:

- Evaluate the incremental flow releases to determine optimal whitewater boating opportunities for different skill sets.
- Based upon updated flow duration curves, determine the number of days per year when river flows equal or exceed optimal whitewater flows and assess the feasibility of potential recreational flow releases.
- Quantify the effect on downstream generation and the impact on Gile Flowage water levels for any four-hour period of proposed flow releases, adjusted for the month in which it could occur.
- Develop an estimate of potential whitewater boating use if scheduled releases are provided.

- Identify any competing recreational needs or environmental concerns associated with scheduled releases up to four hours in length.
- Verify the difficulty rating for each reach at varying flows as listed on the American Whitewater website.

2.2 Resource Management Goals

Recognize the full potential for meeting present and future public outdoor recreation demands, while maintaining and enhancing a quality environmental setting. FERC guidelines and the Federal Power Act also provide direction to give equal consideration to other non-power resources such as recreation.

2.3 Public Interest

AW, FOG, and NPS expressed interest in this study.

2.4 Background and Existing Information

American Whitewater provided information on recommended flow ranges for the West Fork in their study request. They completed a survey-based flow study (i.e., where users self-report flows and respond to an online survey) in 2007 which concluded that 400 - 1,000 cfs was the optimal range for whitewater boating (AW, 2021).

2.5 Project Nexus

An analysis of several flows downstream of Gile Flowage Dam relative to whitewater boating opportunities will provide baseline information to make decisions on how to balance multiple uses of the river by members of the public.

2.6 Study Area

Initially, the study area was to include a stretch of the West Fork of the Montreal River from the Gile Dam downstream to US Highway 2. However, a review of property ownership at the US Highway 2 crossing revealed that this area is privately owned and public access to the site would be dependent upon landowner permission. Therefore, the study area was modified to extend from the Gile Dam to Kimball Falls Town Park, which features public access to the river. The park is located approximately 0.8 miles upstream of US Highway 2.

The above-referenced river section will be divided into three river reaches for study purposes. Reach 1 will extend approximately 2.0 miles from the Gile Flowage Dam to the South Street Bridge. Reach 2 will extend approximately 2.6 miles from South Street Bridge to the Center Street Bridge. Reach 3 will extend approximately 1.1 miles from Center Street Bridge to Kimball Falls Town Park. The study area is shown in Appendix 1.

2.7 Methodology

2.7.1 Participants

NSPW will coordinate with Jake Ring, a local boating enthusiast who routinely boats this reach, in selecting a minimum of 5 individuals to participate in the Study. Emphasis will be placed on selecting volunteers who have either boated this stretch of river before or are found to be experienced whitewater boaters or whitewater paddling instructors. NSPW will also inform AW and NPS at least two weeks prior to the scheduled event so they can publicize the event, if desired, and request additional volunteers to participate. NSPW will not limit the number of participants, however, it will request that all participants RSVP prior to the event for logistical reasons (i.e., to ensure that there is sufficient parking and enough survey materials available). Participants will provide their own transportation from the put-in and take-out.

NSPW will coordinate flow releases as well as provide pens, clipboards, and evaluation forms for each boater. It is assumed that existing access and parking associated with the put-in and take-out are adequate to accommodate the study participants.

The study will be conducted in late June after spring runoff has concluded. NSPW will notify AW and NPS at least two weeks prior to the event so they may observe the study if they choose to do so. Due to rapidly changing weather and river flow conditions during the spring, NSPW believes a two-week notice is the longest it is able to provide.

NSPW is proposing to test up to three separate flows between 600 cfs and 1,000 cfs[1]. The actual flows to be released will be determined after consultation with study participants. After any given release, subsequent releases may be adjusted according to boaters' recommendations following their evaluation of the previous flow.

At the conclusion of the last run, discharge from the Gile Dam will be ramped down over a period of three hours.

2.7.2 Evaluations

After each run, boaters will be asked to fill out the Boater Evaluation Form included in Appendix 2. After all runs have been completed, boaters will be asked to fill out the Summary Boater Evaluation Form included in Appendix 3. The information obtained from the Summary Boater Evaluation Forms will be used to guide a discussion with all boaters regarding the optimal range of flows (lowest and highest flow deemed usable for their watercraft).

[1] This range of flow was selected based upon existing information provided by the 2007 AW internet flow study. Since the accuracy of the flows provided in an internet flow study can be inaccurate, the flows will begin at 600 cfs instead of the minimum 400 cfs provided because it is believed the 400 cfs flow level is likely the minimum flow to facilitate whitewater boating in this river reach.

2.7.3 Photos at Each Surveyed Flow

Photographs at four easily accessible locations along the river will be collected for each flow. Those locations include the State Highway 77 Bridge, the South Drive Bridge, the Center Street Bridge, and the Kimball Falls Park Bridge. Photographs looking upstream and downstream from each bridge will be taken at each tested flow and will be included in the final report.

2.8 Consistency with Generally Accepted Scientific Practice

This Whitewater Recreation Flow Study follows generally accepted scientific practice. Similar protocols have been used in other relicensing studies.

2.9 Project Schedule and Deliverables

Results from this study will be summarized in the final study report. The study report will include, at a minimum, the following elements:

- Whitewater boating attributes for the range of flows examined. This will include a difficulty rating and length of trip.
- Minimum optimal flow.
- Preferred flow.
- Maximum safe flow.
- The frequency of the availability and expected timing of the identified flows under the current operating regime.
- The feasibility and cost of providing scheduled releases by month, for up to four hours in length, with an emphasis on weekends (during April to November period).
- An estimate of potential whitewater boating use if scheduled releases (up to four hours in duration) are provided at the optimal flow.
- A discussion of the natural resource impacts associated with controlled releases, and options to minimize or avoid adverse impacts to the aquatic community.
- Data forms from the study including boater evaluation forms, photos, and flow information.
- List of participants.
- Discussion of access considerations.
- Summary of boater group discussion.

NSPW anticipates that the field work will be completed by the end of June 2022. The study report will be included in the Initial Study Report.

2.10 Level of Effort and/or Cost

NSPW estimates that this study will cost approximately $25,000 to complete.

2.11 Discussion of Alternative Approaches

NSPW has generally incorporated AW and NPS comments regarding their requests for a whitewater recreation flow study. However, NSPW has decided to forgo the NPS's recommended Phases 1 and 2 and instead conduct only the Phase 3 controlled flow study. NSPW's rationale for this decision is included in Section 3.0 of the Proposed Study Plan.

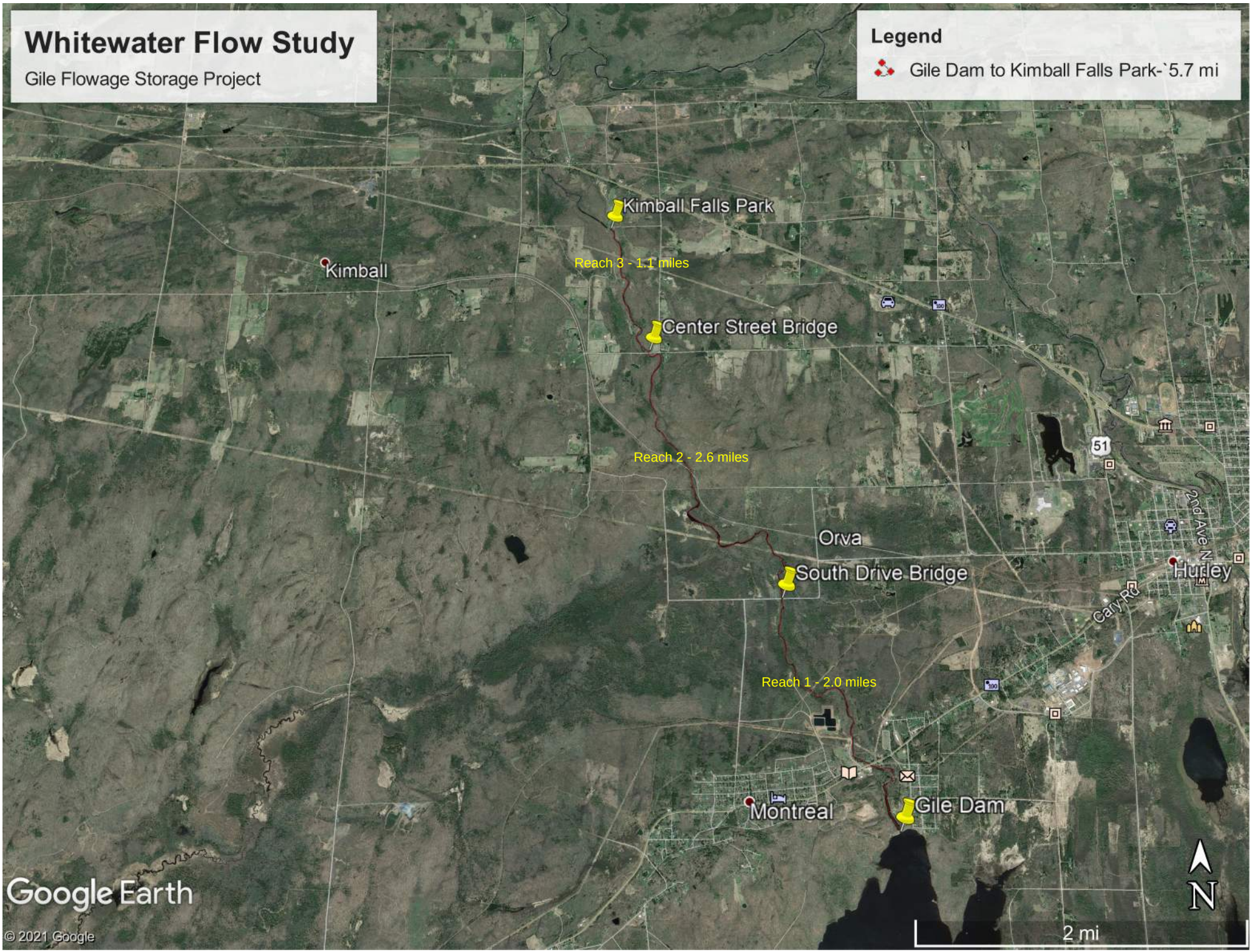
The proposed methods for this study are consistent with accepted professional practices. The overall approach has been used in other relicensing proceedings and is consistent with generally accepted methods used by federal and state agencies. In addition, the proposed methods for this study are consistent with FERC's study requirements under the ILP. No alternative approaches to this study are warranted.

3. References

Northern States Power Company – Wisconsin, dba Xcel Energy. 2020. Pre-Application Document-Gile Flowage Storage Reservoir Project. Prepared by Mead & Hunt. October 27, 2020.

American Whitewater. 2021. Comments of American Whitewater on the Pre-Application Document and Study Request. March 17, 2021.

APPENDIX 1 Study Area


Whitewater Flow Study
Gile Flowage Storage Project
Legend
Gile Dam to Kimball Falls Park-`5.7 mi
Kimball Falls Park
Kimball
Reach 3 - 1.1 miles
Center Street Bridge
Reach 2 - 2.6 miles
Orva
South Drive Bridge
Reach 1 - 2.0 miles
Montreal
Gile Dam
Hurley
51
2nd Ave N
Cary Rd
N
2 mi
Google Earth
© 2021 Google

APPENDIX 2 Boater Evaluation Form

Boater Evaluation Form
For the Gile Dam to Kimball Falls Reach
of the West Fork of Montreal River

(To Be Completed After Each Run)

Boater Information: (boater information other than name only needs to be completed once)

Name:	Email Address:	Zip Code:
Skill Level (check one): ☐-Advanced ☐-Expert ☐-Elite		
How many years have you boated at your current skill level? _____ years		
In the past three years, how many days a month do you boat? _____ days		
How many times have you boated this run before today? _____ times		
If you boated this run before: What were the flows? _____cfs What type of watercraft did you use? _____		
How far is this river stretch from you home? _____ miles		

Timing:

Date of the Run _____

What was the flow during the run?___cfs

Watercraft:

What type of watercraft did you use for this run? (check one)

☐-Hardshell kayak ☐-Inflatable kayak ☐-Canoe ☐-Other

Locations and Times:

Put-in Location: Gile Dam Time:_____

Take-out Location: Kimball Falls Park Time:_____

Difficulty:

How would you rate the difficulty (Class I, Class II, etc.) of the reach?

_____

(please see next page)

Enjoyment:

Are you likely to return for future boating if today's flow was to be provided? (check one)

☐-Definitely No ☐-Possibly ☐-Probably ☐-Definitely Yes

Relative to this specific flow release, would you prefer a flow that was higher, lower, or was this optimal? (check one)

☐-Much Lower ☐-Lower ☐-Higher ☐-Much Higher ☐-Optimal

Satisfaction:

Please respond to each of the following statements about the characteristics at this flow level (please circle one opinion)

Statement	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Reach 1 is boatable at this flow level.	1	2	3	4	5
Reach 1 is safe at this flow level.	1	2	3	4	5
Reach 2 is boatable at this flow level.	1	2	3	4	5
Reach 2 is safe at this flow level.	1	2	3	4	5
Reach 3 is boatable at this flow level.	1	2	3	4	5
Reach 3 is safe at this flow level	1	2	3	4	5
Overall, this is an aesthetically pleasing run.	1	2	3	4	5

Challenges:

Please identify any particularly challenging rapids or section of river and rate its difficulty at this flow. Please use the International Whitewater Scale and note if you portaged.

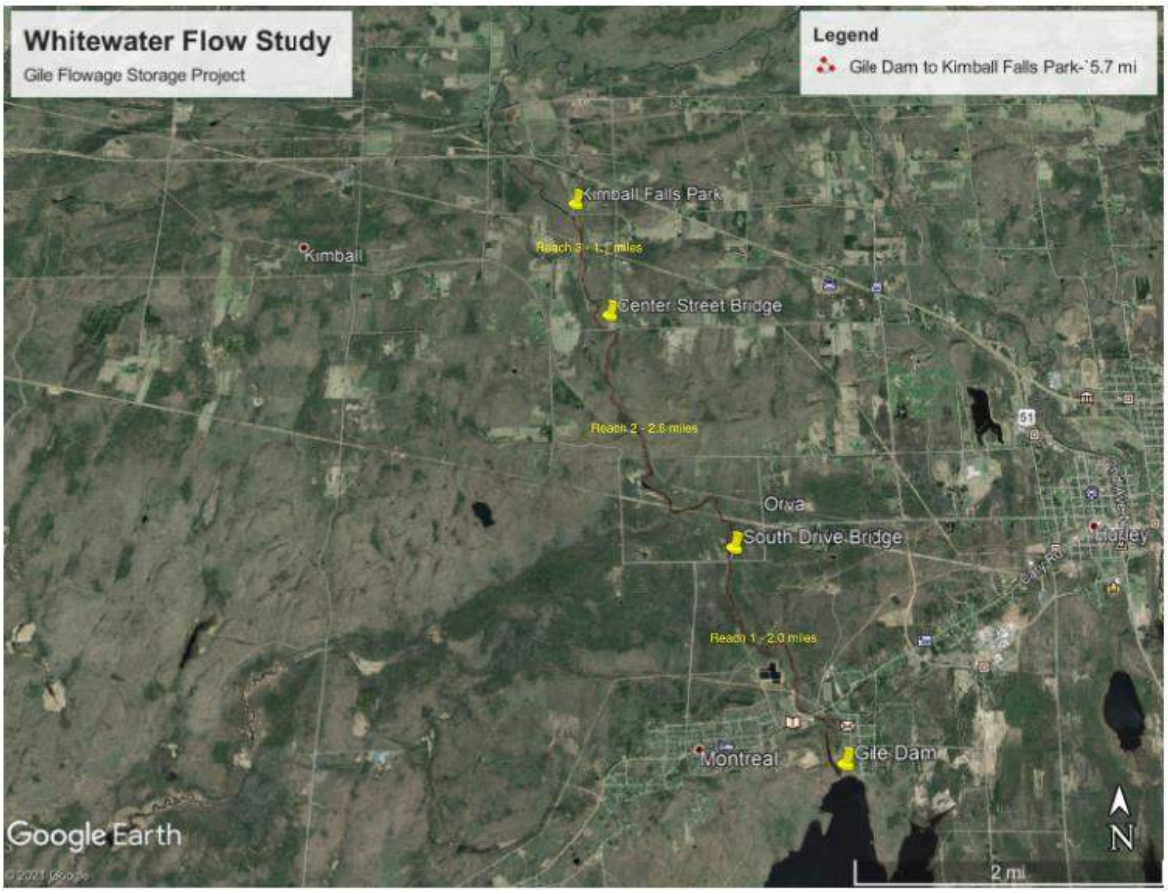
Rapid Location (name of Reach)	Whitewater Class	Portage? (yes or no)

Portages:

If you used a portage as indicated in the question above, please rate the difficulty at this flow level.

Portage Location (name of site)	Easy	Slightly Difficult	Moderately Difficult	Extremely Difficult
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4

Thank You for your Time and Consideration



APPENDIX 3 Summary Boater Evaluation Form

Summary Boater Evaluation Form
For the Gile Dam to Kimball Falls Reach

(To Be Completed After All Runs)

Boater Information:

Name:	Email Address:	Zip Code:
Skill Level (check one): ☐-Advanced ☐-Expert ☐-Elite		

Flow Levels:

Based upon all of your boating trips today at the various flow levels, please answer the following:

What is the optimal range that provides the best whitewater boating for this reach?_____cfs

What do you feel the highest safe flow is for your craft and skill level?____ cfs

What do you consider is the optimal flow for this run?____cfs

What is the best or optimal flow for a "standard" trip?_____cfs

What is the best or optimal flow for a "technical" trip? _____cfs

What is the best or optimal flow for a "high challenge" trip? _____cfs

If only one flow could be released for boating, what flow would you prefer?_____cfs

Run Specifics:

Please respond to each of the following statements regarding the characteristics at this flow (please circle one opinion).

Statement	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
This run is a good length.	1	2	3	4	5
The portages (if any) on this run are not a problem.	1	2	3	4	5

Use of the Run:
Are you likely to return for future boating if the optimal flow would be provided? (check one)

☐-Definitely No ☐-Possibly ☐-Probably ☐-Definitely Yes

What months would you return to boat? (check one)

☐-Apr ☐-May ☐-Jun ☐-Jul ☐-Aug ☐-Sep ☐-Oct ☐-Nov

How would you like to receive flow information? (check one)

☐-Telephone Number with Recording ☐-Website Information ☐-Email Notification

Do you believe any of the flows provided today would be suitable for beginning boaters? (check one)

☐-Definitely No ☐-Possibly ☐-Probably ☐-Definitely Yes

If so, which flow(s)? _____

Do you believe any of the flows provided today would be suitable for play boating? (check one)

☐-Definitely No ☐-Possibly ☐-Probably ☐-Definitely Yes

If so, which flow(s)? _____

Thank You for your Time and Consideration

Appendix K – Wood Turtle Study

Gile Flowage Storage Project
FERC No. 15055

Study Plan

Wood Turtle Study

Prepared for

Prepared by

Mead & Hunt

meadhunt.com

August 2021

1. Introduction

Northern States Power Company – Wisconsin (NSPW or Applicant), d/b/a Xcel Energy, is currently seeking to obtain an original license from the Federal Energy Regulatory Commission (FERC or Commission) to operate and maintain the existing Gile Flowage Storage Project (Gile Flowage or Project) under FERC Docket Number P-15055-000. The Project is owned, operated, and maintained by the Applicant.

On January 19, 2021, FERC issued Scoping Document 1 and requested that stakeholders provide comments on the Pre-Licensing Application (PAD) and study requests within 60 days. During the 60-day comment period, the Applicant received comments and study requests from several entities. Only the Wisconsin Department of Natural Resources (WDNR) requested that the Applicant complete a wood turtle study as part of relicensing.

The WDNR requested that a wood turtle study be conducted to better understand the abundance and distribution of the species. Through previous survey efforts, the species is known to occur within the Montreal River, however, it is unknown whether surveys for this species have occurred within the Gile Flowage. The two main objectives of the study are to determine if wood turtles are present within the Project boundaries of the flowage and to determine whether any wood turtle nest sites occur within the Project boundary.

The applicant is proposing to conduct a Wood Turtle Study to determine if wood turtles, nesting habitat, or evidence of wood turtle nesting are present in the specific areas identified by WDNR as having suitable habitat for the species in Endangered Resources Review (ERR) Log # 19-734.

2. Study Plan Elements

2.1 Study Goals and Objectives

The objective of this Wood Turtle Study is to determine if there are wood turtles, nesting habitat, or evidence of wood turtle nesting present in three specific areas identified by WDNR as having suitable habitat for wood turtles.

2.2 Resource Management Goals

The resource management goal is 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 study request that through previous survey efforts, this species is known to occur within the Montreal River, however it is unknown whether surveys for, or casual observations of, this species have occurred within the Gile Flowage.

The WDNR provided ER Review Log # 19-734 (ER Review) of the Gile Project vicinity to NSPW on February 2, 2021. The ER Review ERR Log # 19-734 indicated that there was suitable habitat for state-threatened wood turtles in the Project vicinity within three specific areas and includes uplands and wetlands within 300 feet of the stream.

2.5 Project Nexus

The operations of the dam may affect nesting or overwintering wood turtles in areas with suitable habitat. Identifying whether wood turtles are present within the Project boundary will help determine whether any mitigation measures are necessary as part of licensing.

2.6 Study Area

The study will include three specific area identified as having suitable wood turtle habitat in consultation with the WDNR. The specific locations are shown in Appendix 1 and have been filed as privileged information to avoid revealing specific endangered resources location information.

2.7 Methodology

2.7.1 Presence/Absence Surveys

Presence /absence surveys for wood turtles in the specific areas identified in consultation with WDNR and shown in Appendix 1 will be conducted in the spring of 2022. Surveys can begin after ice-out on sunny days when the air temperature is 50-80 degrees Fahrenheit. This is typically between April and early June.

The survey consists of visual searches within approximately 50 feet of the river's edge, where wood turtles can be found basking on days that meet the weather criteria. Surveys should be conducted 2 days (preferably non-consecutive) per week for a period of 4 weeks and should focus on free-flowing stretches.

2.7.2 Nesting Habitat Surveys

When conducting presence/absence surveys, the surveyor will also assess nest site suitability within the study area. Suitable nesting habitat includes sand or gravel substrate that is either unvegetated or sparsely vegetated, receives sun exposure for most of the day during late spring to early summer and is within approximately 200 feet of a suitable stream. This can include gravel parking areas, roads, or shoulders of paved roads (WDNR, 2021). If suitable nesting habitat is identified, the remaining presence absence surveys will be delayed and completed in conjunction with nesting site surveys occurring between the first week in June and the first week in July, Surveys will be conducted two days per week (preferably non-consecutive) during this timeframe.

GIS locations of all suitable nesting sites will be collected in order to provide a map of suitable nesting sites within the study area for the final study report. Any wood turtle nesting activity identified during the surveys will also be noted.

2.7.3 Personnel Qualifications

All surveys will be conducted by individuals qualified and approved by WDNR to identify wood turtles and wood turtle nesting habitat.

2.8 Consistency with Generally Accepted Scientific Practice

This Wood Turtle 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 final 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 by early summer 2022. The study report will be included in the ISR when it is filed with FERC, no later than September 28, 2022. Any information identifying the specific locations of wood turtles or other threatened or endangered species will be filed as privileged, non-public information per WDNR guidelines.

2.10 Level of Effort and/or Cost

NSPW estimates that this study will cost approximately $40,000 to complete.

2.11 Discussion of Alternative Approaches

NSPW has generally incorporated WDNRs request to conduct presence absence surveys and nesting habitat assessments. NSPW has provided reasoning in Section 3.0 of the Proposed Study Plan as to why the WDNR's requested monitoring locations and nesting site survey frequencies were adjusted in this study plan. The proposed methods for this study are consistent with accepted professional practices. In addition, the proposed methods for this study are consistent with FERC's study requirements under the ILP. No alternative approaches to this study are warranted.

3. References

Northern States Power Company – Wisconsin, dba Xcel Energy. 2020. Pre-Application Document-Gile Flowage Storage Reservoir Project. Prepared by Mead & Hunt. October 27, 2020.

Wisconsin Department of Natural Resources. 2021. Comments on Notice of Intent, Scoping Document 1, Preliminary Application Document, and Studies Request for the Gile Flowage Storage Reservoir Project (P-15055-000) Licensing. March 5, 2021.

Wisconsin Department of Natural Resources. 2021. Endangered Resources Review (ERR Log # 19-734) Proposed Gile Flowage Licensing, Iron County, WI. February 2, 2021.

Appendix 1 – Wood Turtle Survey Area

This Appendix has been filed separately with FERC as privileged information.

Appendix L Gile Flowage ER Review-Public

The ER Review has been filed separately with FERC as privileged information.

Appendix M - 2005 Gile Flowage Littoral Zone Survey

GILE FLOWAGE LITTORAL ZONE SURVEY, 2005

INTRODUCTION

The Gile Flowage is a 3,384 acre reservoir located in Iron Co., WI. The flowage is used as a water retention reservoir for downstream hydroelectric facilities at Saxon Falls and Superior Falls on the Montreal River. Full pool level is 1490 feet above mean sea level and a maximum drawdown of 15 feet is allowed. The flowage is usually drawn down twice a year, during both summer and winter. A typical annual water level regime includes a gradual summer drawdown beginning in May and averaging 6 feet by October. Refilling generally occurs in late fall. Winter drawdown begins in early December and typically averages 7 – 8 feet by early March. Refilling is usually achieved by early May.

The drawdowns have a number of negative effects on the flowage. The aquatic plant community is minimal since the entire littoral zone is regularly subjected to drying and freezing. A 1994 aquatic macrophyte survey showed the maximum depth of plant growth was 6.1 feet below the full pool level of 1490 ft. Eighty-five percent of the littoral area contained no aquatic plants.

Wave scour that occurs during drawdown probably further limits aquatic plant growth by removing and transporting fine sediment to deeper water. Seeds from aquatic plants are probably also flushed from the littoral zone in this manner.

The minimal presence of aquatic plants results in a lack of plant-related fish habitat. Panfish, especially bluegill and pumpkinseed need aquatic plant beds as nursery habitat. Also, the loss of a significant volume of water twice annually concentrates young panfish into a much reduced pool, increasing their vulnerability to predation. As a result, few survive and panfish populations are low in comparison to other waters. Over-winter drawdowns may be at least partially responsible for poor survival of young walleyes, due either to entrainment (passage downstream through the dam) or increased predation by adult walleyes (cannibalism) facilitated by the 58% reduction in winter pool area.

Spiny water fleas were discovered in the Gile Flowage in 1993. It is the first inland lake in Wisconsin to be invaded by this exotic species. Panfish predation on spiny water fleas may offer an effective control mechanism. That was the conclusion at Fish Lake, a Minnesota reservoir very similar to the Gile Flowage. Production of large year classes of bluegill and black crappie there coincided with the disappearance of spiny water fleas. The currently limited panfish population in the Gile Flowage prevents the development of this control mechanism.

Lack of a significant littoral zone aquatic plant community also limits a potential food source for waterfowl and aquatic mammals.

Recreational Impacts? –boat launching difficulty, riparian piers and access difficulty, reduced fishing potential, others?

SURVEY METHODS

A physical survey of the Gile Flowage littoral zone was conducted in May of 2005. A total of 108 transect stations were established around the flowage perimeter (figure 1). Stations were placed every 1,270 feet along the 26.0 mile shoreline. Coordinates for stations were entered into a GPS unit to allow their location in the field. At each station a transect perpendicular to the shore was evaluated. Bottom locations at elevations of 1,488 ft, 1,486 ft, and 1,484 ft were determined (2 ft, 4 ft, and 6 ft below full pool elevation). At each bottom location, the distance to the ordinary high water mark (1,490 ft; full pool level) was measured using a laser range finder, and the substrate type was determined by probing.

SURVEY RESULTS

Complete survey data is given in appendix 1. The mean widths and areas of the three contour intervals are listed in table 1, below:

Table 1. Widths and Areas of Gile Flowage Littoral Zone Contour Intervals

Contour Interval	Mean Width (yds)(+/- 90% C.I.)	Total Area of Interval* (acres)	% of Total Flowage Area
0 – 2 ft	7.3 (+/-1.4)	87.3	2.6
2 – 4 ft	23.3 (+/-7.6)	278.8	8.2
4 – 6 ft	27.9 (+/-7.2)	333.8	9.9

*Assumes a countour interval length of 32.9 miles. This includes the perimeter shoreline length of 26 miles and island shoreline length of 6.9 miles.

The area of the contour intervals increases with increasing depth. A substantial area of littoral zone (333.8 acres) exists within the 4 – 6 ft contour interval.

Substrate data is summarized in table 2, below:

Table 2. Summarized Substrate Data for the Gile Flowage Littoral Zone

Substrate Type Groupings	% of Substrate Type Groupings at Each Depth 2 ft	4 ft	6 ft
1 - Bedrock, Boulder, Cobble	27.7	25.9	20.3
2 - Gravel, Gravel with cobble, Gravel with boulders	6.5	13.0	26.9
3 - Sand, Muck, Detritus	58.3	55.6	39.8
4 - Sand with Gravel, cobble, And/or boulders	7.4	5.6	13.0
2-4 – Substrates with Gravel and finer Material present	72.3	74.1	79.7

A substantial portion of the littoral zone has very coarse substrates present (bedrock, boulders, or cobble; 20.3 to 27.7%). However, the majority of the littoral zone has substrates present that could support the growth of aquatic plants. Areas of substrates with gravel and finer material present account for 72.3 to 79.7% of the littoral zone. Reductions in flowage drawdowns would be expected to enhance the suitability of littoral zone substrates for aquatic plant growth. Reducing the scouring action of drawdowns would result in enhanced deposition of fine sediment materials that are generally beneficial for most aquatic plants.

It was noted during the survey that some semi-aquatic vegetation is present around much of the shoreline. Reed canary grass and willow shrubs were observed at the majority of transect sites. Densities of reed canary grass were variable with higher densities occurring in bays. Willow shrub density was generally low. Reed canary grass grew to a maximum depth of 4 ft. below full pool level. Willow shrubs grew to a maximum depth of about 2 1/2 ft. below full pool level.

Both of these species are "semi-aquatic". They cannot survive continuous submersion for multiple years, but are able to survive when regular drawdowns occur. They supply

useful aquatic habitat in the flowage when pool levels are high. During the survey numerous fish and ducks were observed at sites with more extensive beds of these plants.

A large stand of cattails was present in the vicinity of transect site 102. It grew to a maximum depth of 3.1 ft. below full pool level. Significant stands of other aquatic emergent vegetation were not observed.

CONCLUSIONS

Reducing the extent of drawdowns in the Gile Flowage has the potential to greatly enhance the quality of the littoral zone. There are substantial areas with suitable substrates to allow the establishment of a significant aquatic plant community. This would benefit the flowage's fish and wildlife, enhance recreational opportunities, and potentially provide a control mechanism for spiny water fleas.

APPENDIX 1. GILE FLOWAGE LITTORAL ZONE PHYSICAL SURVEY DATA

TRANSECT POINT	DISTANCE TO OHWM (YDS) AT 2' BELOW 1490'	SUBSTRATE*	DISTANCE TO OHWM (YDS) AT 4' BELOW 1490'	SUBSTRATE*	DISTANCE TO OHWM (YDS) AT 6' BELOW 1490'	SUBSTRATE*	DISTANCE BETWEEN DEPTH POINTS 2' - 4' (YDS)	DISTANCE BETWEEN DEPTH POINTS 4' - 6' (YDS)
1	10	S	18	S	46	S	8	28
2	3	G,C	5	C	8	G,C	2	3
3	5	S	22	S	38	G	17	16
4	6	S	28	S	42	S,C	22	14
5	0.5	BR	1	BR	2.5	G,C	0.5	1.5
6	3.5	S	8	S	25	G	4.5	17
7	.6	S	12	G	22	G	6	10
8	1.5	S	3.5	G	5.5	G	2	2
9	2	M,G	7	M,G	12	C	5	5
10	3	M	26	G	27.5	G	23	1.5
11	1	B	3	C	7	S,G	2	4
12	2	G	3	G	8	S	1	5
13	3	M	17	M,G	70	G	14	53
14	0.5	BR	1	BR	2.5	S	0.5	1.5
15	6	S	2	C	17	C	-4	15
16	3	S	10	S	22	G	7	12
17	3	S	6	S	14	G	3	8
18	22	M	32	S	64	S	10	32
19	5	S	12	S	21	S	7	9
20	3	C	5	C	9	G	2	4
21	3	C	5	C	8	G	2	3
22	2	BR	2.5	BR	3	BR	0.5	0.5
23	3.5	C	10	S	24	G	6.5	14
24	5	S	18	M,S	43	S	13	25
25	3	M	7	S	26	S	4	19
26	2	S	6	S	16	S	4	10
27	0.5	BR	2	BR	4	S	1.5	2
28	1	B	2.5	B	3.5	B	1.5	1
29	3	C	7.5	C	11	C	4.5	3.5

	30	2.5	S	19	M,S	53	S	16.5	34
	31	33	S	54	S	126	S	21	72
	32	3	S	20	S	80	G,B	17	60
	33	6	S	9	S	52	S	3	43
	34	0.5	B	3.5	B	7	S	3	3.5
	35	5	S	22	S	52	S	17	30
	36	5	G	11	G	25	C	6	14
	37	4	S	12	G	43	C	8	31
	38	4.5	S	18	S	29	S	13.5	11
	39	3	S	8	S	21	S	5	13
	40	3	C	8.5	C	15	S	5.5	6.5
	41	2	C	4	C	6	C	2	2
	42	0.5	M	2.5	C	6	C	2	3.5
	43	4	S	10	S	22	S	6	12
	44	4	S	9	S	21	S	5	12
	45	22	S	34	S	62	S	12	28
	46	7	S	22	S	48	S	15	26
	47	11	S	34	S	95	S	23	61
	48	11	C	27	G	40	G	16	13
	49	9	S	21	G	40	C	12	19
	50	5	G,C	10	G,C	20	G,C	5	10
	51	7	G,C	22	G,C	25	G,C	15	3
	52	66	D	110	S	196	G	44	86
	53	3	BR	5	BR	30	BR	2	25
	54	0.5	BR	2	BR	3	BR	1.5	1
	55	8	S,C	24	S	46	C	16	22
	56	6	S,B	28	S	44	S,B	22	16
	57	36	D	78	S	156	S	42	78
	58	24	D	40	S,C	75	S,C	16	35
	59	10	S,C,B	34	S,C,B	44	S,C	24	10
	60	6	G,C	20	S	26	S	14	6
	61	10	S,B	24	S,B	35	S,B	14	11
	62	9	S	27	S	39	S,C	18	12
	63	12	S,C	21	S	51	S,B	9	30
	64	6	S,C	17	C	28	S,C,B	11	11
	65	5	C,B	22	B	30	B	17	8

	66	2	B	4	B	6	B	2	2
	67	5	S	20	S	40	S,G	15	20
	68	10	S	26	S	66	M,S	16	40
	69	0.5	BR	4	S	5	S	3.5	1
	70	13	D	59	M,S	81	S,B	46	22
	71	2	S,G,B	8	S	22	S,B	6	14
	72	0.2	BR	0.5	BR	1	BR	0.3	0.5
	73	5	S	11	S	30	G	6	19
	74	24	S	44	S	128	S	20	84
	75	4	S	11	G	20	S	7	9
	76	10	S	211	M,S	228	S	201	17
	77	10	S	211	M,S	228	S	201	17
	78	10	S	112	M,S	241	S	102	129
	79	10	S	350	M,S	606	S	340	256
	80	8	S	216	M,S	434	S	208	218
	81	7	S	20	S	38	G	13	18
	82	3.5	S	10	S	28	C	6.5	18
	83	6	S	24	S	290	S	18	266
	84	2	S	21	M,S	194	M	19	173
	85	6	S	26	S	82	S	20	56
	86	31	S	114	S	146	S,C	83	32
	87	5	S	13	S	25	G	8	12
	88	5	C	22	S,G	82	G,C	17	60
	89	3	S,G,C,B	8	S,G,C	20	S,G,C,B	5	12
	90	20	S	46	S	66	G	26	20
	91	3	S	26	S	42	S	23	16
	92	15	S	34	G	53	M	19	19
	93	3	C	9	C	20	G	6	11
	94	6	C	16	C,B	26	C	10	10
	95	0.2	BR	0.5	BR	1	BR	0.3	0.5
	96	6	C,B	16	B	20	B	10	4
	97	6	S	20	S	30	S	14	10
	98	4	C	26	C	52	C	22	26
	99	4	C	8	G	16	G	4	8
	100	4	S	90	S	136	M,S	86	46
	101	10	D	96	S	110	S	86	14

	102	10	D	132	S	164	S	122	32
	104	28	S	69	S	140	S	41	71
	105	6	M	23	S	56	G	17	33
	106	9	G	18	G	26	G	9	8
	106	5	C	9	C	11	G	4	2
	107	3	C,B	6	S,C	15	G	3	9
	108	1.5	B	3.5	C	6	C	2	2.5
		7.3	0-2' MEAN WIDTH				MEAN WIDTH =	23.3	27.9
		9.0	STD. DEVIATION				STD. DEVIATION =	48.3	45.6
		1.4	90% CONF. INTERVAL				90% CONF. INT. =	7.6	7.2
	*B = BOULDER								
	BR = BEDROCK								
	C = COBBLE								
	D = DETRITUS								
	G = GRAVEL								
	M = MUCK								
	S = SAND								

Appendix N - West Branch Montreal River Internet Flow Study

AMERICAN WHITEWATER
PO BOX 1540
CULLOWHEE, NC 28723

WEST BRANCH MONTREAL RIVER INTERNET FLOW STUDY OCTOBER 2007

EVAN STANFORD and THOMAS O'KEEFE

AMERICAN WHITEWATER
www.americanwhitewater.org

ABSTRACT

The West Branch of the Montreal is a low-volume, popular class IV-whitewater river located on the south shore of Lake Superior in northern Wisconsin, USA. Those seeking whitewater recreation can generally only find adequate flows during a week or two in early spring when the reservoir upstream spills. In this study researchers have utilized the structural norm approach and impact acceptability curves to examine instream flows for recreation on the West Branch of the Montreal. The range of acceptable flows, as determined by the impact acceptability curve was from 400-1,000 cfs. All average evaluations for flows between these levels were above the neutral line. 600 cfs received the highest average evaluation and is therefore considered to be the optimal flow. According to these data, a release of 600 cfs would appeal to the greatest variety of river users. Dam operations upstream of Gile Falls could allow for scheduled whitewater releases into the West Branch extending the recreation season for paddling in the Lake Superior area.

KEY WORDS

instream flows, flow management, recreation flows, flow study

INTRODUCTION

The West Branch of the Montreal is a low-volume river located on the south shore of Lake Superior in northern Wisconsin, USA. On the stretch of the West Branch between Gile Falls and Highway 2 a popular class IV- whitewater run exists. Although this stretch hosted the National Wildwater Championships in 1992 and the Pan Am races in the early 1980's, paddlers can generally only find adequate flows for whitewater runs during a week or two in early spring when the reservoir upstream spills.

Researchers have utilized the structural norm approach and impact acceptability curves to examine instream flows for recreation on a variety of river stretches across the United States including the Grand Canyon of the Colorado River in Arizona (Whittaker & Shelby, 2002). River managers can manipulate instream flows through controlled dam releases. On river stretches where manipulation is possible, flow management has become a central issue in recreation management. Dam operations upstream of Gile Falls could allow for scheduled whitewater releases into the West Branch extending the recreation season for paddling in the Lake Superior area. To explore this possibility an internet flow survey was conducted between the spring of 2006 and 2007.

Whitewater paddlers who responded to the internet survey were enthusiastic about the possibility of scheduled releases. Many expressed difficulty in predicting runnable flows for the West Branch and some respondents had never done the run due to the extremely short season when adequate flows spilled from the dam. Respondents articulated a need for whitewater opportunities in the warm weather summer months in the upper Midwest and many were willing to travel long distances for scheduled releases on the weekend. Results from the impact acceptability curve suggest that instream flow releases of 600-1,000 cfs would be acceptable to a majority of river users. A Saturday release was favored by 56% of respondents and the average preferred time and duration for instream releases were 10am and 6 hours respectively.

METHODS

The structural norm approach is a technique used to represent social norms graphically. Structural characteristics of norms are displayed visually through a device referred to as an impact acceptability curve. This visual representation has proven useful to the process of communicating normative concepts to resource managers. The potential for conflict index (PCI) developed by Manfredo, Vaske, and Teel (2003) advanced the graphic representation of social norms by visually displaying information about their central tendency, dispersion and form simultaneously (Vaske, Needham, Newman, Manfredo, & Petchenik, in press).

Instream flow is the amount of water in a river at a given time. Understanding the relationship between instream flows and resource values can aid in the creation of standards for recreation use (Whittaker & Shelby, 2002). Using the structural norm approach, impact acceptability curves and the PCI (Figures 1 & 2) researchers have described optimum flows, ranges of tolerable flows, intensity and crystallization (i.e., respondent agreement) for numerous specific river settings (Shelby, Vaske, & Donnelly, 1996; Whittaker, Shelby, & Abrams, in press). The impact acceptability curve takes norms related to the acceptability of specific instream flows, measured at the individual level and then aggregates them to describe social norms by plotting the averages of individual's response evaluations (Shelby et al., 1996). The set of specific instream flows measured are displayed on the horizontal axis. Average evaluations are displayed on the

vertical axis, with negative evaluations on the bottom, a neutral line in the middle, and positive evaluations on top (Whittaker & Shelby, 2002).

The highest point or peak of the curve represents the optimum flow. The range of flows with average evaluations above the neutral line represents the range of tolerable flows. The points where the curve intersects with the neutral line define the standards to be associated with too high and too low a flow. The relative distance of the curve in relationship to the neutral line defines the intensity of a norm. The variation among evaluations at each flow level constitutes the crystallization of the norm but is typically not visually displayed on a impact acceptability curve. In this study we use the PCI bubbles (Figure 2) to describe crystallization graphically on the curve, where the larger the PCI bubble, the less agreement between respondents and the smaller the bubble, the greater the agreement.

An internet specific instream flow survey was conducted between the spring of 2006 and 2007. The survey was advertised on the American Whitewater website through a number of articles. The Wisconsin Hoofers Outing Club also played a role in attracting respondents to the internet based survey. Individuals interested in the possibility of scheduled whitewater releases on the West Branch were invited to take part in the survey regardless of their skill level, whitewater experience, craft used or familiarity with the stretch.

A wide range of variables were measured for this study. Respondents evaluated the acceptability of 13 specific flows from the West Branch dam. The flows ranged from 100 cfs to 1,000 cfs (see Table 1 for a complete listing of flow levels measured). Each flow was evaluated on a 7-point scale: totally unacceptable (-3), moderately unacceptable (-2), slightly unacceptable (-1), neutral (0), slightly acceptable (1), marginally acceptable (2) and totally acceptable (3). Acceptable flows, optimal flows, and norm crystallization were determined for all respondents. Three release preference variables were measured including preferred release time of day (i.e. 9am, 10am etc.), preferred release duration (i.e. 1 hour, 2hours, etc.) and preferred day of release (Saturday, Sunday., or either). A set of open ended flow related variables were also measured including optimum, standard, increased challenge, and preferred release flow.

TABLE 1

Mean acceptability rating, Standard Deviation and Potential for Conflict Index value for measured specific cfs flows on the West Branch Montreal, Wisconsin, USA

Specific Flow CFS	Mean Acceptability	Standard Deviation	PCI
100	-2.82	0.40	0
150	-2.60	0.84	0
200	-2.10	1.45	0.06
250	-1.88	1.54	0.07
300	-0.90	2.13	0.40
350	-0.70	2.45	0.53
400	0	2.49	0.74
450	0.54	2.34	0.49
500	1.33	1.92	0.27
600	1.5	1.83	0.12
700	1.33	1.72	0.22
800	1.27	1.74	0.17
1000	0.83	1.80	0.28

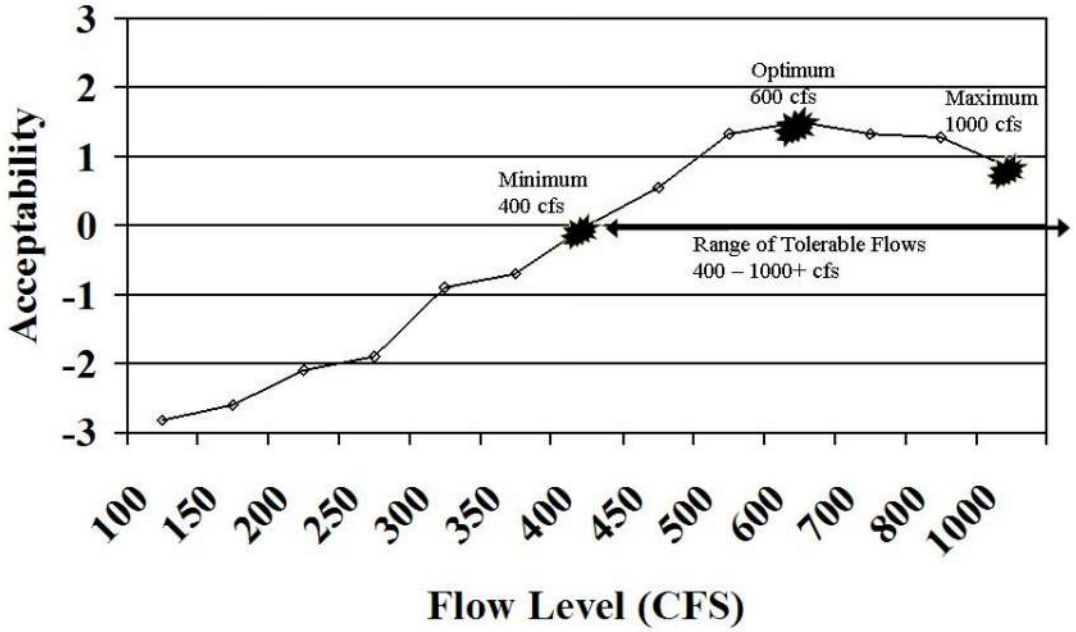
RESULTS

Under the structural norm approach, flows between 100 cfs and 350 cfs were, on average, unacceptable (Figure 1). Flows of 450 cfs and greater were within the range of acceptable flow conditions. Flows of 600, 700 and 800 cfs were considered optimal. Flows of 1,000 cfs were, on average, considered acceptable. Flows greater than 1,000 cfs were not measured. While some individuals have run the river at these higher flows these opportunities are limited and unlikely to be provided for during a controlled release.

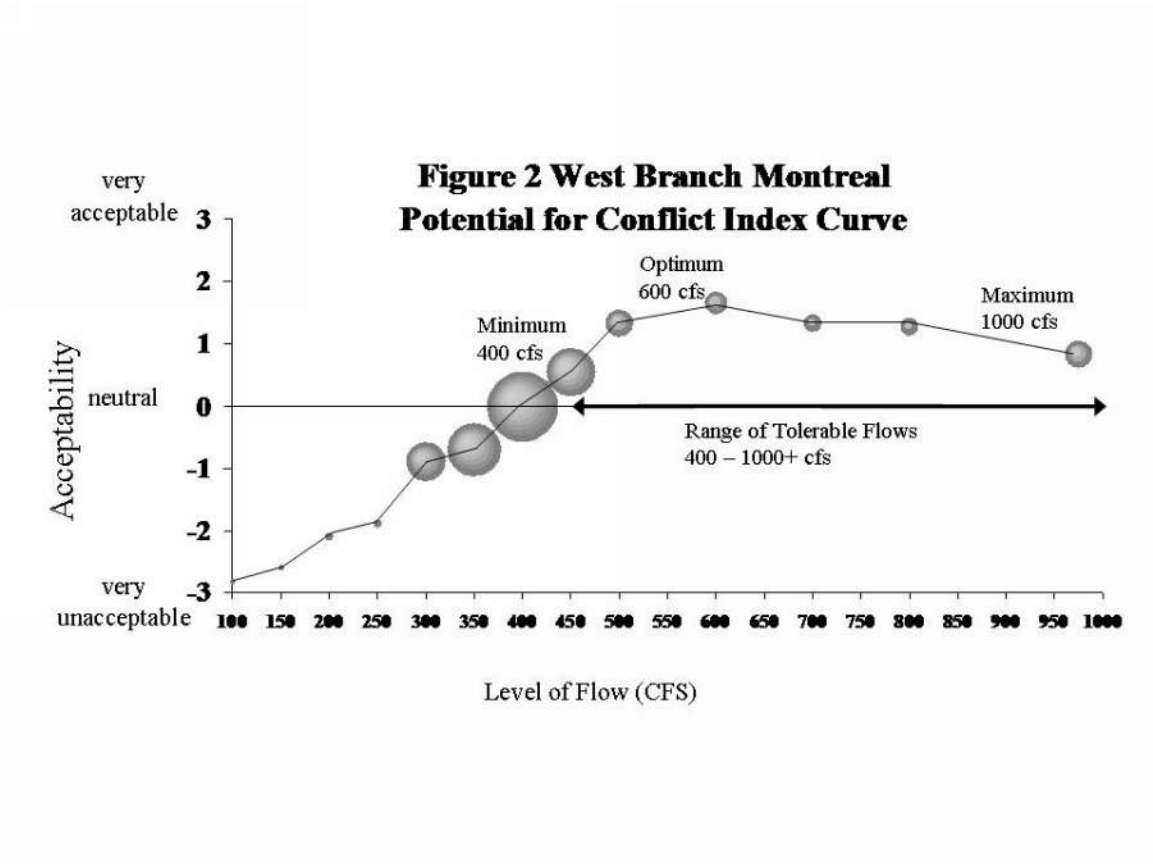
Under the set of open ended flow response questions 905 cfs was considered, on average, to be the optimum flow, with responses ranging from 400-2,500 cfs. The average standard flow was 730 cfs on average, with a response range of 400-2,000 cfs. A flow of 1,310 cfs was the average flow for an increased challenge trip, with a range of 600-5,000 cfs. The average preferred release flow was 875 cfs, with a range of 400-2,500 cfs. The average preferred duration or length of a release was on average 6 hours, with a range from 4 hours to 1 week in length. The average preferred time of day for a release was 10 am, with a range from 9 am – 1 pm. When asked what their preferred day for a release would be, 56% of respondents chose Saturday, 3% preferred a Sunday release and 41% responded that either day of the weekend was acceptable.

The Potential for Conflict Index ranges from 0 (no conflict, high consensus) to 1 (high conflict, low consensus). PCI scores for the acceptability of specific flows ranged from .00 (100 and 150 cfs), to .73 (400 cfs). Using the traditional norm acceptability curve (Figure 1), the average flow evaluation for 400 cfs was at the neutral line, suggesting that

Figure 1 Impact Acceptability Curve
West Branch Montreal



a flow of 400 cfs was within the acceptable range of flows. When the curve is displayed with PCI bubbles (Figure 2), it is apparent that some boaters evaluated a flow of 400 as unacceptable. The bubble straddles the neutral line and the PCI value is the largest measured for any of the specific flow evaluations (.73). PCI scores at the optimal flows of 600, 700, and 800 cfs were .22, .17 and .17 respectively, the lowest for any of the flows measured with average ratings above the neutral line. These relatively low PCI values (small bubbles, Figure 2) suggest that across all boaters there was considerable consensus regarding the acceptability of these optimum flow levels. PCI values, as well as mean evaluations and standard deviations, for the flows evaluated under the impact acceptability curve are displayed in Table 1.



DISCUSSION

Understanding the impact acceptability curves for river stretches where instream flow manipulation is possible is fundamental to the proper recreation management of these stretches. Instream flow releases can provide unique recreation opportunities for multiple user groups and can help flow diversion and storage operations meet their protection, mitigation and enhancement measures necessary to re-license their operations under the Federal Energy Regulatory Commission (FERC) (Whittaker & Shelby, 2002). Xcel Energy manages Gile Flowage which provides water to their Saxon Falls Hydroelectric Project and Montreal Hydroelectric Project downstream. Gile Flowage is a storage impoundment and not a licensed project, but paddlers are still interested in determining the potential for a scheduled flow release or releases.

This study was implemented to help determine the instream flow-recreation relationship and to help determine at which flow level a scheduled release would be most appropriate.

The range of acceptable flows, as determined by the impact acceptability curve (Figure 1), is from 400-1,000 cfs. All average evaluations for flows between these levels were above the neutral line. 600 cfs received the highest average evaluation (1.5) and is therefore considered to be the optimal flow. According to these data, a release of 600 cfs would appeal to the greatest variety of river users.

Where respondents were able to identify flow characteristics in an open ended response format, average flow evaluations were slightly higher. This combined with the above neutral acceptability evaluation on the impact acceptable curve for 1,000 cfs, suggests that there is a significant population of river users who would prefer higher flow releases. When asked directly what flow level would be their preferred release, the range of responses was from 400-2,500 cfs, with a mean of 875 cfs. Respondents interested in release flows over 1,000 cfs were most likely looking for an increased challenge whitewater experience. Evidence of this phenomenon comes from the mean response to an open ended, preferred flow question for an increased challenge trip of 1,310 cfs. Users who are not as experienced river runners, or who preferred a more moderate whitewater challenge, are more likely to be comfortable with flows closer to the minimum acceptable flow of 400 cfs. All river users are likely to find these lower flows to be acceptable, but more experienced and daring river users may not find the level of whitewater challenge that they are looking for.

The Potential for Conflict Index (PCI) helps to identify the agreement between respondents at each individual flow level. Table 1 and Figure 2 reveal a PCI score trend that is similar to previous studies (Vaske, Stafford, Shelby & Whittaker, in review). Users are in the most agreement at flow levels which are highly unacceptable and highly acceptable. Users are in the least agreement when average response evaluations are near the neutral line. At the instream flow of 400 cfs, users are highly divided over the acceptability of this flow for whitewater recreation. Some respondents felt that this flow was too low for a meaningful whitewater experience, while other users found this to be an acceptable flow. It is possible that the acceptability of flows on the lower end of the flow spectrum have been influenced by the limited availability of days during the year when this stretch is runnable. Some users may find lower flows acceptable because these are the only flows they have been able to catch on this stretch.

PCI scores on the higher end of the flow spectrum show strong agreement between users. Flows of 600, 700, and 800 cfs had PCI scores of .22, .17, and .17 respectively. For whitewater river running a certain amount of flow is necessary just to navigate a stretch. In general, once that minimum flow level is passed, the stretch becomes runnable up to a certain much higher level of flow, which can be dictated by a number of variables, including skill level, experience and craft type. For the West Branch Montreal the majority of river users were in agreement that flows up to and beyond 1000 cfs are acceptable and are not out of their range of acceptable flows.

This study has a number of limitations. Internet studies are by nature a biased and hard to control medium for conducting research. For instream flow related research they may prove to be acceptable because instream flow research normally does not look to sample the general population. For most studies only experienced river users are surveyed because prior research suggests that experienced boaters are more knowledgeable about how flows affect recreation attributes and are most capable of evaluating specific flows (Shelby, Brown, & Baumgartner, 1992). Reaching out to experienced users through internet surveys is a very real possibility. There is also the chance that less experienced users who are not truly capable of estimating and determining the difference between specific flow levels will respond and should therefore be considered a limitation of this

study. 63% of respondents estimated flow levels for their previous runs and 95% of respondents recalled their level of flow from memory. Flow level estimations can be a reliable source for actual levels from experienced river users, but in this study there is no way to determine the experience level of different respondents.

Another limitation to this study was the amount of respondents who had not run this stretch prior to responding to the survey. 38% of respondents had not completed the West Branch Montreal and an average of 31 respondents skipped the questions referring to specific flow levels. This can be attributed to the extremely short season for whitewater recreation on this stretch, but this also shows that there is strong interest in scheduled releases for this run. Respondents who have not completed this run were very likely the same respondents who skipped flow related questions and therefore would have little, if any affect on the variables used to determine the acceptability of instream flows.

This survey provides most, if not all of the necessary components to determine an acceptable instream flow level, a time of day, duration and day of the week for scheduled whitewater releases on the West Branch Montreal. The data strongly suggest that a minimum release level should be 600 cfs, as this flow level was found to be acceptable to the greatest variety of river users. The data also suggest that varying the flow levels released over multiple release days or a release weekend may provide for an even more varied group of river runners. An optimum release schedule for a weekend of two releases, according to this study, would begin with a release of 600 cfs on Saturday morning at 10 am and would last until 4 pm, and would have a second release day of 800-1,000 cfs on Sunday, which would begin at 10 am and would last until 4 pm. If the release schedule had to be limited to one day then a flow of 600-800 cfs should be released between 10 am and 4 pm on a Saturday. Considering this studies limitations, a follow up survey of participants is recommended subsequent to an initial whitewater release in order to obtain a more accurate instream flow – recreation relationship for the West Branch.

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