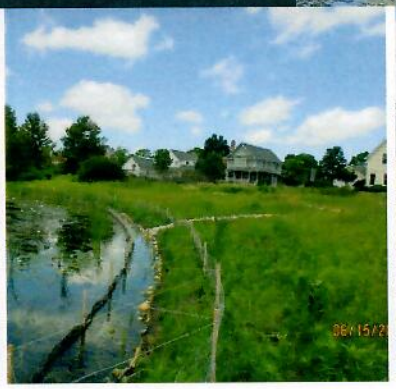
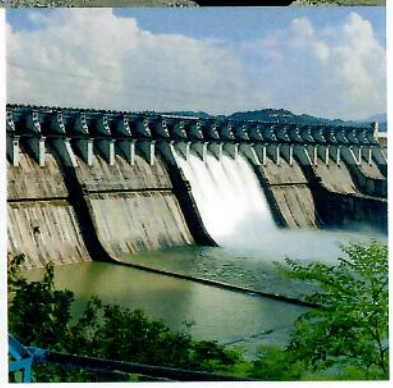
Lake Sinissippi Improvement District
Lake Management Plan



Submitted to:

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Portions of this project were funded by a Surface Water Grant provided through the Wisconsin Department of Natural Resources (WDNR)

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Section I.1: Introduction

Lake Sinissippi, centrally located in Dodge County, Wisconsin, has a long history of sediment related management issues which can impact navigation, algal and nuisance aquatic plant growth, and recreational use. The sediment accumulation also has the potential to create water quality impacts affecting dissolved oxygen availability, further influencing the fishery and ecology of the waterway. The State of Wisconsin has listed Lake Sinissippi as impaired for degraded habitat due to sediment/total suspended solids (TSS) and excess algal growth, eutrophication due to total phosphorus.

The Lake Sinissippi Improvement District (LSID) has advocated for assistance in the appropriate management of the sediment and through the assistance of the Wisconsin Department of Natural Resources (WDNR) is developing this lake management plan (LMP) to document a viable pathway to sustainable sediment management that can better guide the LSID and its stakeholders in completing in-water projects while proactively working to minimize input from the watershed landscape. The LSID was awarded a Surface Water Grant (SWG) in March 2022 to develop this LMP focused on sediment management grounded in the following key areas:

- Lake Working Group Development and Communication: Develop a consistent and unified group of individuals to serve as an impartial advisory group to LSID and their diverse stakeholders when it comes to planning and project execution. This group would not supplant any existing groups but rather help focus on meeting expectations and objections, and ultimately staying on course towards meeting goals.
- Lake Sediment Management (focused in-lake with watershed components): Briefly review and revisit the existing repository of documents that dictate directives to the management of sediment impacts to Lake Sinissippi. This will help stakeholders realize work to date and help inform this group of the alternatives that have been recommended both from the LSID and regulatory community. This information will be coupled with ongoing sediment monitoring information to help inform LSID in establishing the project or projects with the highest return on investment both in the lake and on the land and lay out a process to execute it.
- Develop Shoreline Improvement and Protection Plan: LSID understands that management and protection of the shoreline will help facilitate multiple objectives including the anchoring of shoreline sediments, enhancing habitat, protecting lakefront property values, and improving natural communities. While this seems intuitive, developing a process and documenting the procedures are important to enable this issue to be integrated into future funding initiatives and appropriate management of resources.
- Lake level management: As a large shallow impoundment, Lake Sinissippi has considerable littoral area for which can be greatly impacted due to water elevation fluctuation. Impacts from water elevation change are not just from the static change, but

the readjustment of waves and wakes to that change. Since several of the in-lake projects suggest the need to manipulate water levels to facilitate construction, developing a guide to document the approach to enable the LSID to effectively engage with regulatory staff needed to make these changes will greatly streamline schedules and expectations when undertaking such projects.

It is anticipated that these four areas will be complimentary to each other and better assist LSID in directing resources appropriately to more efficiently coordinate both internally and externally with land users and regulatory staff when necessary. LSID has invested in numerous studies with partners to investigate the primary causes of sedimentation issues and how the sediment may be addressed from various management perspectives. To properly manage from a project execution standpoint, LSID must understand all the moving parts that are integral in gaining support both socially and financially. This plan is meant to help facilitate that process.

Like with all plans, the plan should be adaptable to change as information, individuals, and regulatory requirements change. Once approved by WDNR, this plan will serve as the guidance resource to initiate projects or directly identify the additional documents and resources that will be valuable in progressing projects to the betterment of the Lake Sinissippi.

Figure i: 4 Modules of LSID Lake Management Plan (LMP)

Section I.2: Problem Statement

Lake Sinissippi is situated in the Upper Rock River sub basin (Figure A) and has a watershed of 22,540 acres (35.2mi^2) and is predominantly of agricultural land use (63%). The calculated annual sediment and phosphorus loads to Lake Sinissippi are 9,806 tons and 53,173 lbs., respectively (Dodge Co., 2019). This has led to sediment laden areas of the lake impacting navigation, fishing, recreation, water clarity and quality, and is generally undesirable to lake users and local property owners. The focus of this lake management plan (LMP) is to build an overall process and understanding around this issue and identify the appropriate pathway to obtain progress to managing in-lake and watershed sediment sources while managing the expectations of the diverse cross section of stakeholders that visit and live in the watershed and on the lake. Lake Sinissippi is a valuable natural resource to the area, particularly Hustisford, neighboring communities, Dodge County, and an extension of the Horicon Marsh. The need to maintain, improve, and preserve the lake and surrounding support ecosystems is imperative to the region and the State of Wisconsin.

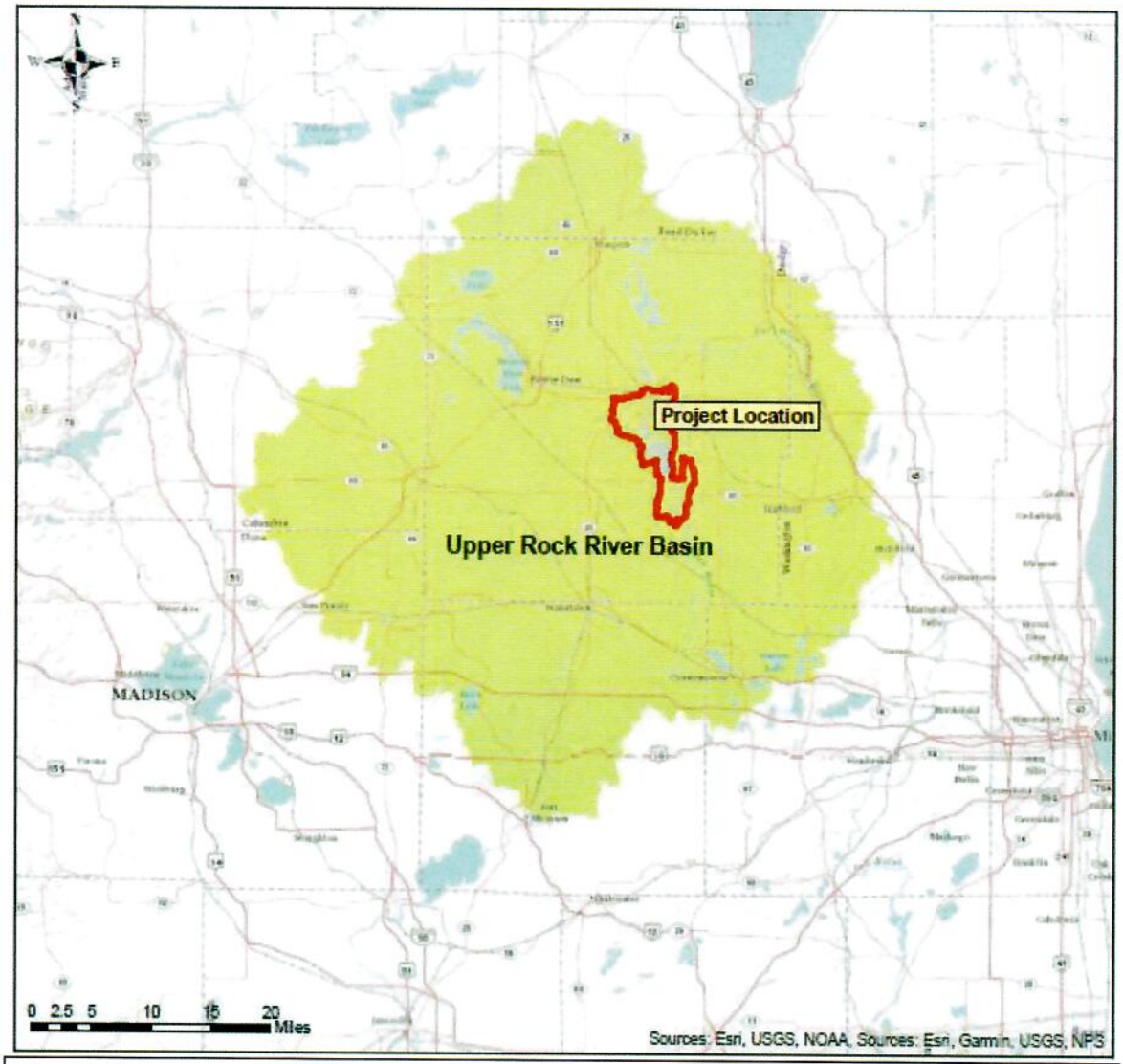


Figure ii: Lake Sinissippi Watershed location within the Upper Rock Watershed (Exhibit courtesy of Dodge County (Dodge Co., 2019))

Section A.1: Background

Lake Sinissippi does not have an overabundance of lakeshore property owners, large taxing base, or local development for a 2,850-acre lake located less than one hour from downtown Milwaukee, WI. It is therefore imperative that the LSID continues to work and collaborate with available watershed partners nearby, capitalizing on local assets to develop and grow a strategic Lake Management Working Group (LMWG). The focus of such a working group would realize the value that Lake Sinissippi brings to both lakefront property owners and watershed residents alike, serving as a multipurpose resource for all. It will be key to be able to consistently communicate with this working group in a way that is efficient, clear, and consistent. A map depicting the boundaries of the LSID is located in Appendix A1.

The LSID further recognizes that the lake and watershed consist of a geographically large, diverse, and at times segregated stakeholder group. This group will be essential in achieving any degree of success in Lake Sinissippi both in the water and on the land. To realize the benefits of in water projects while improving conditions within the greater watershed, appropriate actions will be needed to consolidate the communications to all stakeholders to pull in a common direction. While not meant to be disassociate the stakeholder group, for the purpose of further discussion the following groups and sub-groups have been identified (Figure A1).

Figure A1: Lake Sinissippi Lake Management Plan Stakeholders

Section A.2: Watershed Stakeholders

This group represents individuals and entities which reside within the greater watershed area but may not have a direct connection or even access to the lake. These stakeholders occupy property within the watershed and their use of the land has an impact on the runoff received by Lake Sinissippi. Detailed assessment of the runoff prior to reaching the lake may be better addressed in a watershed planning effort which focuses on the specific elements and nature of the inputs while attempting to identify the specific upland practices necessary to abate the runoff constituents. Unfortunately, stakeholder groups were not specifically identified within the Lake Sinissippi-Rock River Nonpoint Source Watershed Implementation Plan, completed by Dodge County Land and Water Conservation Department (LWCD) 2019, however further discussion is provided within this chapter.

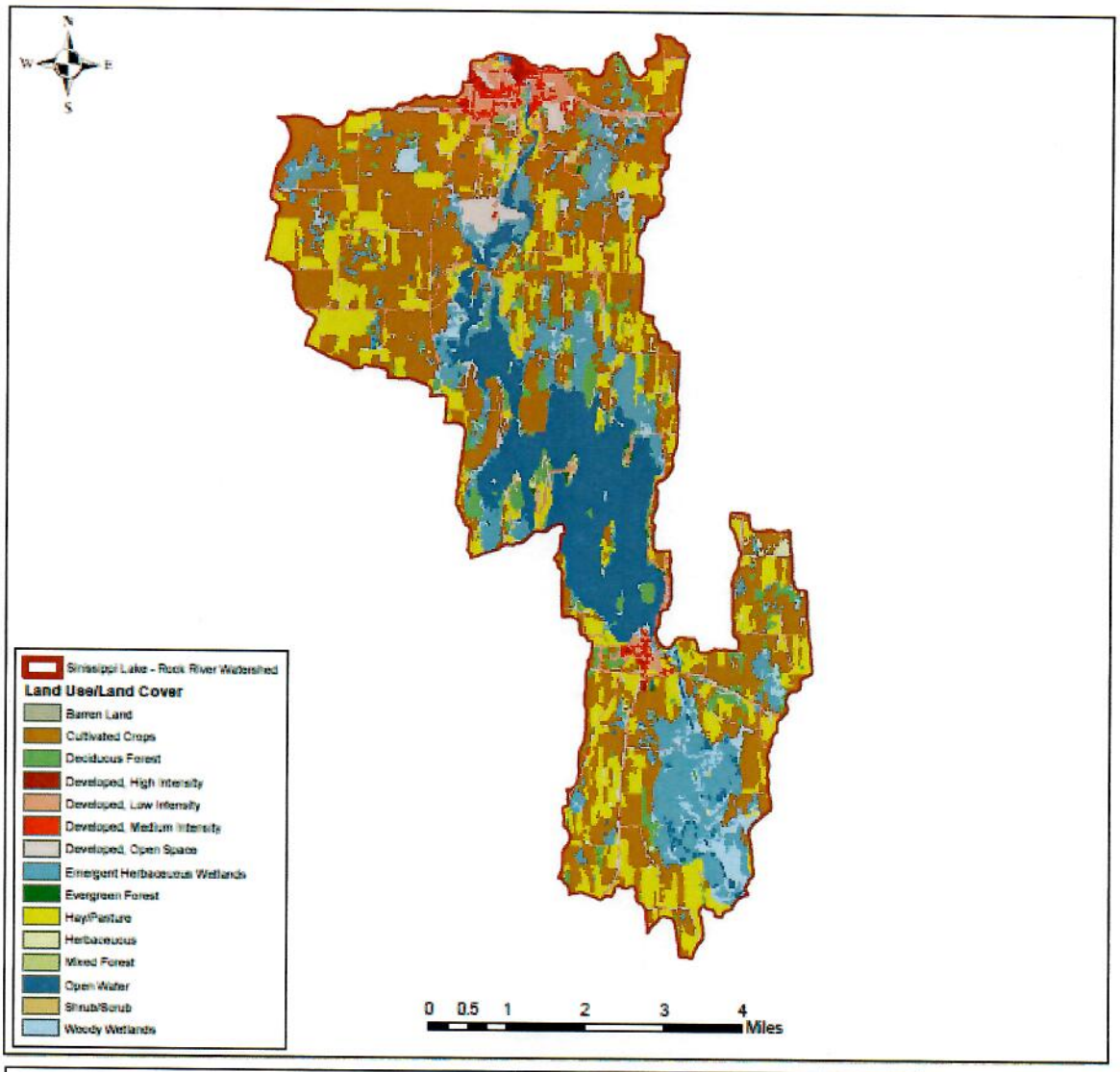


Figure A2: Land use map of the Sinissippi Lake – Rock River Watershed (Exhibit courtesy of Dodge County

Dodge County reviewed the land use within the watershed in their 2019 Watershed Implementation Plan. Figure C provides a map of the watershed for reference that was included in the Dodge County Watershed Plan. The watershed reflected within the 2019 plan represents a logical categorical separation of the watershed as determined by EPA. This representation of the watershed does not, however represent the entire tributary area to Lake Sinissippi. Therefore, stakeholders and identified beneficial projects can very well extend beyond the mapped area to include landowners further upstream and management actions at the Horicon Marsh, including tributary waters extending into Fond du Lac County.

The benefit of reviewing these stakeholders also helps identify the potential each contributes to excess sediment and nutrients to the lake. Further breakdown and description of these users is provided below:

Section A.2.a: Watershed Stakeholders - Agricultural

- Agricultural land holders: This group of landowners represents by far the largest stakeholder group based on land area alone and due to the nature for which the land is managed and generates the highest cumulative amount of sediment and phosphorus, which are key constituents to be addressed by in-lake projects as part of this LMP. Within the Lake Sinissippi watershed, agriculture presents 63% of the watershed land use (Figure D). The LSID has made great strides to meet and work with this group proactively, however this group will need to continue to require individual management and messaging to effectively communicate their impact and the value of partnering.

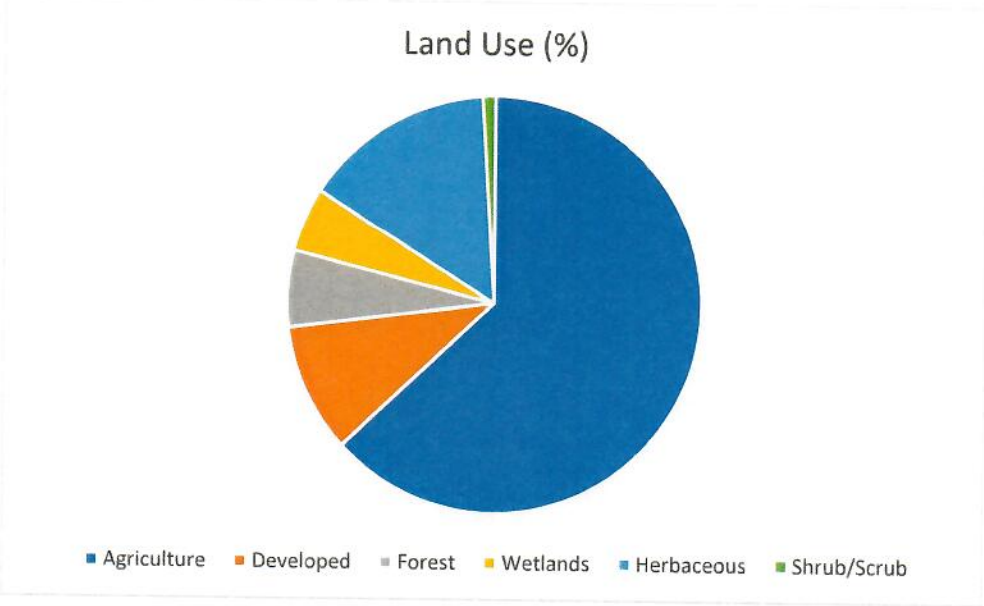


Figure A3: Representative Percent Land Use breakdown. Derived from Dodge County (2019).

Communication Plan: The LSID is currently working to build stakeholder capacity with this group through a number of avenues including:

- Dodge County Farmers for Healthy Soil Healthy Water
- Dodge County Farm Bureau
- Dodge County Land and Water Conservation Department

While farmers represent an overwhelming majority of the land use in the watershed, they may not always have that direct connection to the lake, however they do have a connection and understanding of the land and having tools available to better manage farmland should have a mutual benefit to Lake Sinissippi. Farmers rely on the land and watershed for crop production and drainage. No farmer wishes to see their topsoil migrate downslope or off their property. For this reason alone, an alliance with the agricultural community will be a must, and if nothing else the LSID must target this stakeholder group with continued persistence to maintain consistent dialogue. Language will be land specific and farm-first. In addition, providing communication that serves as a bridge to cost share beneficial programs will be important. Beyond maintaining good watershed practices for drainage and edge of field practices, the watershed plan developed by Dodge County LWCD had identified lake bottom sediment as a potential suitable soil amendment, for which farmers, given access can help rebuild appropriate soil structure and nutrient capacity. Farmers should also be given a means to develop acquaintance with the lake. Many will not have boats, so providing a means for developing an appreciation for Lake Sinissippi should be a long-term initiative.

Table A1: Watershed Stakeholders – Agricultural, Communication Plan:

Field	Guidance
Information	Cost share or cost beneficial program information and discussion. Some ideas may need to extend beyond traditional farmer lead programs, consider additional agreements through alternative crediting programs such as phosphorus trading, beneficial sediment reuse, tile repair program, etc.
Method	Consider potential for consistent messaging through a cadence electronic mailer and face to face options.
Timing or Frequency	Bi-monthly for electronic information exchange and bi-annually for face-to-face discussions may be preferable.
Sender	For the LSID, messaging should consistently come from the Chair, regardless of who is currently in that position.
Assumptions	Farmers will inherently want to do the right thing, which includes protecting the value or their land and maintaining it in a way that is beneficial to all parties.
Constraints	New programs may need time to launch and gain traction. The LSID may have to consider launching pilot projects to best demonstrate value on new initiatives.

Section A.2.b: Watershed Stakeholders – Non-agricultural

- Industrial land holders: There are a variety of mixed industrial land use within the watershed. Industrial users can produce both stormwater runoff and waste stream from the manufacture of end products. Development of large tracts of land with impervious surfaces increases stormwater runoff with the potential to pick up constituents which will be delivered to the lake. Additionally certain industrial users produce goods on site

which deliver nutrients to the waterways as a biproduct of the activity. This is typically permitted through the State and is cataloged via WPDES permits. Stormwater typically is permitted with a general stormwater permit. Industrial land use represents approximately 1% of the land in the watershed.

- Commercial land holders: Commercial land tracts are typically permitted under Wisconsin's general stormwater permit. Like industrial land users the amount of impervious surface can generate unneeded excess stormwater volume which need to be mitigated stormwater retention. Unfortunately, engineered systems do not mimic nature perfectly and conveyed stormwater can create localized erosion areas unless the end of pipe energy is appropriately dissipated. Commercial property represents less than 1% of the land in the watershed.
- Residential land holders: There are very few large residential tract-scale developments in the watershed, but residences themselves compact surface and introduce additional pavement. Landscape mulch is also another culprit to waterways and conveyance systems. Residential property represents 5% of the land in the watershed.
- WPDES permit holders: The State of Wisconsin regulates the discharge of pollutants through the DNR to waters of the state via the Wisconsin Pollutant Discharge Elimination System (WPDES) program. The program serves as a means for the state to facilitate appropriate tracking of discharges to WI waterways while applying sound science and engineering in the management for which stormwater and treated effluent affect existing surface and groundwater resources. Greater detail of the WPDES program and permittees within the tributary watershed to Lake Sinissippi and the Upper Rock River watershed are provided in Appendix A2. Some of the regulated permit groups are further summarized below:
    - Wastewater Treatment Facilities (WWTF): Public wastewater treatment facilities represent a significant contributor to nutrient waste streams to the watershed. The waste streams are important because although the discharged water typically appears clear, significant constituents of concern such as phosphorus are generally dissolved. In this form they are more bioavailable to nuisance vegetation such as algae and aggressive invasive plant species. WWTF are also more aggressively permitted by WDNR. There are 5 permitted facilities tributary to Lake Sinissippi. Each contribute different amounts of volume corresponding to the population of the user base.
    - Municipal Separate Storm Sewer Systems (MS4s): This group represents the municipal entities (cities, towns, villages, unincorporated areas, etc.) that operate a permitted storm sewer system in the State of WI. In Wisconsin, this generally of communities of 1,000 or more within a one square mile area. The purpose of the MS4 permit is to address storm water quality concerns associated with urban runoff and prevent to the maximum extent practicable the discharge of pollutants from municipal storm sewers.

- Other: This group largely involves industrial land users, further identifying the permittee based on the byproduct, i.e., food processing, metal stamping, etc. Certain industrial users may produce nutrient waste streams which are of concern to LSID.

- Non-For Profits (NFPs): NFPs support several local, community, and regional initiatives, but there are also a number of those that are also aligned with the ecological and beneficial recovery goals of LSID. The Lake Sinissippi Association (LSA), for example is such a group that currently collaborates with LSID and in doing such can utilize each other to reduce potential redundancies. NFPs can also hold Section 501c3 tax exemptions and assist in fiscal partnerships with LSID. Placed in this category, NFPs could likely existing within the watershed and yet represent overlapping goals with lake stakeholders as well.

Table A2: Watershed Stakeholders, Non-Agricultural, Communication Plan:

Field	Guidance
Information	For non-WPDES permitted commercial and residential users, green and environmentally conscious information on land use (lawn care, native plants, rain gardens). For WWTFs partnering options through existing programs when needed. For MS4 communities, watershed friendly projects through cost sharing grants through WDNR Surface Water Grant (SWG) program.
Method	Consider potential for consistent messaging through communities. Attendance at meetings when stormwater related subjects are agenda content.
Timing or Frequency	Bi-Annually through the respective MS4 programs. Furthermore, LSID may be able to advertise coordinating events through these respective communities.
Sender	For the LSID, messaging should be coordinated with the community under which these properties hold an address.
Assumptions	Permitted entities understand the obligations of their permits and may be open to mutual partnerships when the changes are financially beneficial.
Constraints	Level of education and willingness to adopt different ideas or accept change.

Section A.2.c: Lake Stakeholders

Those who are positioned at waterfront or nearshore property have additional incentive investment to protect which is often a reflection of the value of the lake. Whether it is a business that directly or indirectly obtains dividend from lake access or views, or a residence with property values associated with lake access or frontage, this group's need to maintain the lake at its best is in their own best interest and those of their neighbors.

Like those throughout the watershed, there are unique subsets of lake stakeholders who may have varying access and views when it comes to commitment and interest in maintaining the lake in perpetuity. Further breakdown and description of these users is provided below:

- Lakefront property owners: Due to their proximity to water, properties with waterfront access have the distinction of being able to heavily influence a localized area of the lake.

This can be both on a beneficial or detrimental front. Choices made at the property level can have ecological consequences as well as water quality impacts. The lake provides an immediate recreation and aesthetic benefit as well as a boost to the value of the real estate.

- Lake dependent businesses: lake reliant businesses depend on the waterway to varying degrees. Marinas for example can be greatly impacted if fishing is poor, navigation limited, or other factors exist which make other nearby lakes a more appropriate destination. Furthermore, other businesses such as wedding venues, banquet halls, or hotels can be hampered by nuisance odors or unsightly lake appearance (weeds, turbid water, etc.). In these cases, the lake is a revenue generating mechanism for which business would be non-existent to extremely hampered should lake services drop below a certain level of quality. Currently there is only one marina, Ox-Bow Marine, on Lake Sinissippi.
- Part time residential property owners: Like most regular lakefront property owners, these property owners represent a slightly different user base of which, as part time residents, they may not have the opportunity to see all the year round benefits the waterbody can bring. Non-locals are typically not aware of the full cross section of economic impact or issues to be *addressed* and furthermore may not have the commitment of full-time residents. While this may not be the case for all individuals in this category it can be a differentiator in terms of commitment and participation.
- Transient lake users: This group typically represents the lake user who is simply along for a weekend visit or occasional use. This stakeholder can be any general user of the lake who is not regularly associated with the lake and typically resides from outside the watershed. Users from this group are likely to not be aware of issues specific to Lake Sinissippi, particularly any local or lake specific rules and regulations.

Table A3: Watershed Stakeholders – Lake Stakeholders, Communication Plan:

Field	Guidance
Information	Copies of the Lake Management Plan, beneficial program information to enhance property value and lake value. For businesses consider a lake-friendly certification program
Method	Postings at businesses and high lake travel areas such as public boat launches
Timing or Frequency	Information should always be available, refreshed as needed on a quarterly basis
Sender	Ensuring the message of LSID and its constituency is a job for everyone; however, it may be beneficial to have a communications director to facilitate the process
Assumptions	LSID has the means to facilitate messaging, stakeholders will be responsive
Constraints	Needs commitment

Section A.2.d: Regulatory Stakeholders

There are numerous agencies that have a vested interest in Lake Sinissippi. Some of these agencies may have a regulatory interest, others may not. Some may have both. While the list below is not intended to be exhaustive, it is intended to help identify the nature of the interest the presented agencies have in the lake and watershed and how they can and should align with LSID:

- Wisconsin Department of Natural Resources (WDNR): As the supporting regulatory agency assisting the LSID in funding this LMP, the WDNR holds a vested interested in stabilizing and improving the trajectory of Lake Sinissippi. Through this action, WDNR also provides guidance and transparency. This action is beneficial to all parties. Implementation of projects becomes impartial and uniformly agreed upon making for better execution. WDNR is the lead agency spearheading much of the regulatory action necessary to carry out projects in the water and involved in any disturbance of upland projects in excess of 1-acre. Partnering on this LMP and in consistent messaging of the actionable items emanating from this plan should help speed the regulatory and permitting process to implement the necessary projects in a planned sequence. By improving Lake Sinissippi, its surrounding environment and ecology, WDNR is also helping to meet the needs of its expansive stakeholder base by passively improving conditions for fishing, hunting, conservation, and recreation.
- United Stated Fish & Wildlife Service (USFWS): The LSID is in a unique place in which is located in close proximity to the Horicon Marsh, the largest cat-tail marsh in the United States and managed both by WDNR and the USFWS. While the documented release of phosphorus and suspended solids from Horicon Marsh is an ongoing concern, the existence of overlapping needs and partnering should be understood. Improvements to Horicon Marsh and Lake Sinissippi benefits all parties and the improvement can be realized economically, socially, and ecologically. The more the two waterbodies can be managed together, the more efficient the use of resources.
- WI Department of Agricultural Trade and Consumer Protection (DATCP): While generally viewed as an agriculture first agency, DATCP has a vested interest in ensuring land within the watershed remains a viable resource to produce food, both vegetative in nature and for the animals that may graze on the land in the watershed. This requires the sound and sustainable use of the land and water resources.
- U.S. Corps of Engineers (USACE): Performing work in any navigable waterway, whether it be Wisconsin, or any other state is the purview of the USACE. For this reason, the USACE plays an important part in the preplanning of in-water work from a regulatory perspective. USACE also provided guidance to LSID through their 2009 alternatives report (USACE, 2009) and reconnecting with USACE for thorough interpretation may be beneficial to integrate the project into this LMP.

- Dodge County: The County has multiple departments which serve various functions that will interact with LSID, its stakeholders and ultimately the LMP. The County has a vested interest in the natural resources of the County which have the ability to enhance tourism and development, both of which represent financial equity. The County also facilities a component of development review process, specifically soil erosion and sediment control (SESC) in unincorporated areas.

Table A4: Watershed Stakeholders – Regulatory Stakeholders, Communication Plan:

Field	Guidance
Information	Open communication and vigilance progress and scheduling
Method	Phone and email and as information is available and made accurate
Timing or Frequency	Constant
Sender	LSID may want to facilitate different individuals to the various agencies to enable easier flow of information back and forth
Assumptions	Agencies are receptive
Constraints	Agencies operate during the daytime which typically opposes volunteer schedules

Section A.3: Working Group Formation

The purpose of the LMWG is to function as an advisory group to better facilitate guidance and ultimately project execution with full transparency and without agendas, allowing science and financials to best dictate a course of action. The LSID should work to develop a working group that considers representation from these identified stakeholder groups. While having representation from all is ideal, it is also likely not possible to facilitate the necessary meetings and decision-making process expeditiously. Furthermore, the purpose of the LMWG will not be in making direct decisions, but rather to provide a degree of technical expertise, through current knowledge, critical thinking, and discussion of appropriate pathways to success to allow the LSID to confidently make decisions and invest wisely where funding is ultimately limited.

For the purpose of the creation of the LMWG, it is suggested that the group consist of a minimum of six (6) individuals and no more than eight (8) which provide the following expertise:

1. Local knowledge of the lake from a residency standpoint (2 members)
2. Technical expertise of lakes, rivers, impoundments, fisheries, etc. (1 member)
3. Technical expertise and experience in agriculture, its processes, and economics (1 member)
4. Knowledge of real estate and property law (1 member)
5. If possible, a local municipal official or business owner (1 member)

The above list assumes a six-member board, of which #1 could be existing LSID members, additionally #3 would be ideal to have 2 members of which one is an actual vested farmer, and one is a departmental advocate or agronomist. The ideal LMWG size is seven (7) members to ensure not ties on any voting procedures. The identification of members shall be done by LSID.

The recommended goal for the LMWG is to be in place and functioning by 2024. Finding willing participants that meet the recommended capabilities may prove more difficult than anticipated and ultimately this will be a voluntary group with no mandatory requirements to participate or stay engaged. Minimizing day to day decision making and simplifying the role of LMWG members will be critical to their willing engagement and support. It may be necessary to assign an existing LSID board member or other interested individual to serve as liaison and ensure materials are properly coordinated and LMWG members can feel they are contributing effectively.

It is not the intent of this section of the LMP to dictate an operating procedure for which the LMWG conducts business or meets. There are numerous models for which this can take place which may best be identified by selected members of the LMWG upon creation. Provided in Appendix A3 is an example charter that could serve as a possible template for the further organization of the working group.

Section A.4: Methods of Communication:

Communicating in a way that is both efficient and effective to an extended group can be difficult. At the same time LSID will have to determine from the information below what is effective the LMWG, which may not be the same fit as the Board of Directors, or the general stakeholders of the lake. To maximize effectiveness currently, the LSID must have awareness of all available forms of communication and at times prioritize the use of one over another. The LSID does not have to use all means of communication all the time to be effective. Below lists some potential communication considerations for LSID:

Meetings: Prior to the pandemic, meetings typically meant a face to face with time devoted to travel and potential out of pocket expenses. A significant listing of such meetings that the LSID have been actively participating in over the last five years is documented in Appendix A4. People have now become familiar with online meetings and the benefit of having virtual communication is real and very convenient. For small meetings, virtual meetings should be a consideration going forth. Meetings with anticipated larger audiences could be done in person or via a web conference, where content sharing is possible. This information of course will need to be announced using one if not all of the following platforms listed below.

Hardcopy: Production of hardcopies will always be need. More and more people have portable electronic devices, but hardcopies are a necessity to post messages in the public eye, public spaces and passively deliver. Currently hardcopy production can still be performed at a reasonable price.

Telephone: Unless a person recognizes an incoming call, people are reluctant to answer calls, specifically with the amount of spam and unsolicited calls being encountered today. For LSID other than having a centralized contact number people can call to, phone communication may be restricted to a small group of stakeholders, committee and board members. Additionally, if

needed, a telephone maybe used for mass text sending, although there are numerous other digital outlets to perform this task from handheld devices.

Emails: Communicating by email is almost instantaneous, which enhances communications by quickly disseminating information and providing fast response to inquiries from stakeholders and other interested parties. Almost everyone has at least one email account, and effective email use can reduce over-dependence on face-to-face consultations and meetings. Emails can be used to share meeting agendas, minutes and other content that may be part of a planned meeting, or a meeting that has taken place. Careful practice needs to be maintained regarding personal and professional email practice, not everyone can intermix the two which can lead variable response times, however the ability to work with attachments make email a valuable means of correspondence.

Social Media: This reflects a host of digital media tools that is beyond the breadth of this plan; however, it is important that these tools not be neglected, regardless of the expertise of the LSID board. Currently LSID actively maintains a Facebook page which is updated frequently. Twitter and Instagram are other viable communication streams as they allow a person to communicate with a select group of followers, a single individual or everyone, which means LSID can personalize its own social marketing. The messaging takes effort to get used to, but it can also be a means of obtaining valuable information. In the social media world, many have found it beneficial to partner with high school programs or hire to aspiring college and high school talent to maintain messaging cheaply and efficiently while also staying in touch with a younger generation, who particularly will inherit the lakes.

Push Messaging/Automated Messages: Facebook is one example of a social media tool that allows for push messaging that will enable mobile device notices, but not everyone has interest in engaging in the multiple social media tools and their associated notifications. In an effort to reduce the amount of third-party applications, a simplified signup for text messaging may be preferable. Most everyone has a cell phone today where text messaging is now a free embedded service of the carrier. Text messages go to the phone number in a simple message service that is easy to accept and opt out of. Messages are sent out via mass text and can be listed with links or directions to look to other locations for further messaging. While push messaging and QR Codes can be valuable tools they may not best capture the desired age classes that LSID wishes to regularly reach. Automated messaging should provide a simple platform that is easy to provide to all age classes. The City of Burlington, WI has a simple sign-up example https://www.burlington-wi.gov/list.aspx. Assuming that all the phone numbers that LSID possesses in their contact repository want to be informed, the list could be developed to send out a mass text to the contact informing them to check the website, Facebook or alternate source for additional information.

District Website: Currently the District maintains a website at www.lakesinissippi.org and it is imperative that the information shared on this website remains up to date. Keeping the content up to date on the District's website helps build trust between you and your stakeholders.

Currently the website shares information regarding meetings, agenda and minutes, and other relevant information to District members. However, the website could be upgraded to allow for content management system (CMS), where staff can easily update website content and make the site more attractive to reflect the goals and mission of the district. Wordpress is one example of such a CMS. Maintaining the web address solidifies to constituents a location for contacts and historical perspective amongst the lakes of Wisconsin.

Section A.5: Recommended Approach and Action Items

The LMWG and Communications Plan for LSID needs to address a number of items. This includes the method and timeline for the creation and workflow of the LMWG and preferred means of communication for both the LMWG and LSID's general constituency.

LMWG Timeline

The timeline below is representative. It may take longer to initiate the process and should the process of building and maintaining the group prove burdensome, it may be necessary to adaptively create or maintain the group to enable its continual function. Having a group that provides neutrality will be important in guiding LSID and its stakeholders as chose projects become larger, more complex and require a larger financial contribution. Potential schedule below:

- September 2023 – Identify preferred individuals to serve on LMWG (method of selection can be vote, open discussion, other)
- October 2023 – Issue letter (email, call, other) to preferred individual requesting their assistance and means to address or answer questions pertaining to LMWG intent and function
- November 2023 – Address questions and solidify commitments
- December 2023 – confirm commitments and identify or recruit additional advocates as needed
- January 2024 – Inform individuals for assignment and upcoming schedule with meeting schedule intended to be quarterly or bi-monthly
- March 2024 – Hold first LMWG meeting
    - Establish base ground rules and roles
    - Review topics of interest from LMP
    - Review projects and budgetary alignment

Communications Plan Timeline

LSID is engaged in communications with any number of individuals, organizations, and agencies at any given time. The point of the Communications Plan is to minimize duplication, reduce effort and ensure efficiency. People are less likely to use telephone communication unless the source of the call is known. Other means prove less threatening and allow for a sense of convenience to the receiver. Communications plans provided within this section are guidelines

for consideration, but LSID must determine best fit given their constituency, group contacts, ease of use. Establishment of timeline does suggest existing communication needs to stop, but only be reassessed. Ultimately the goal is to reach more people with less effort and stress to the LSID.

- September 2023 – Review individual user group communications plans
- September 2023 – Identify each group's contact or contacts
- October 2023 – determine fit of each communication plan or necessary modifications based on contact preferences. It may be possible the existing approach is suitable and matches recommended guidance preferences.
- November 2023 – Establish the responsible individuals communicating with each group or develop plan for coordinating with each group. Track communications to make point of contact consistent and reduce errant feedback loop(s).
- January 2024 – Synchronize efforts, begin full execution.

Closing

LSID constituency has suggested that existing communication efforts amongst the group are not sufficient to gain the necessary traction to make stakeholders aware of ongoing efforts and obtain the necessary support needed to execute the anticipated large-scale projects that may be recommended as part of this LMP or elsewhere to benefit Lake Sinissippi. This Communications Plan is an effort to compile suitable information for LSID to consider their ongoing efforts as a group, establish common group, and find ways of reducing redundancy and ineffective practices. This needs to be flexible to consider communications platforms and technology of the times, LSID constituency and willingness to communication to those identified groups.

Section B.1 – Introduction

The average annual load of sediment projected to enter Lake Sinissippi is 9,600 tons (Hey & Associates, 2002). Associated with the sediment load is a significant amount of particulate phosphorus (Dodge County, 2019). U.S. Army Corps of Engineers (USACE) has determined that sediment has accumulated more than 5 feet in some areas (USACE, 2009). The LSID understands that sedimentation has an impact on the navigability of the lake and the linked phosphorus has associated issues impacting algal biomass, nuisance plant growth, and at times potential for dissolved oxygen issues. Due to the nature in which Lake Sinissippi aggressively accumulates sediment, it is important to document and provide discussion regarding the movement and control of sediment from its origin to the lake with consideration for managing options on both the land and in the lake.

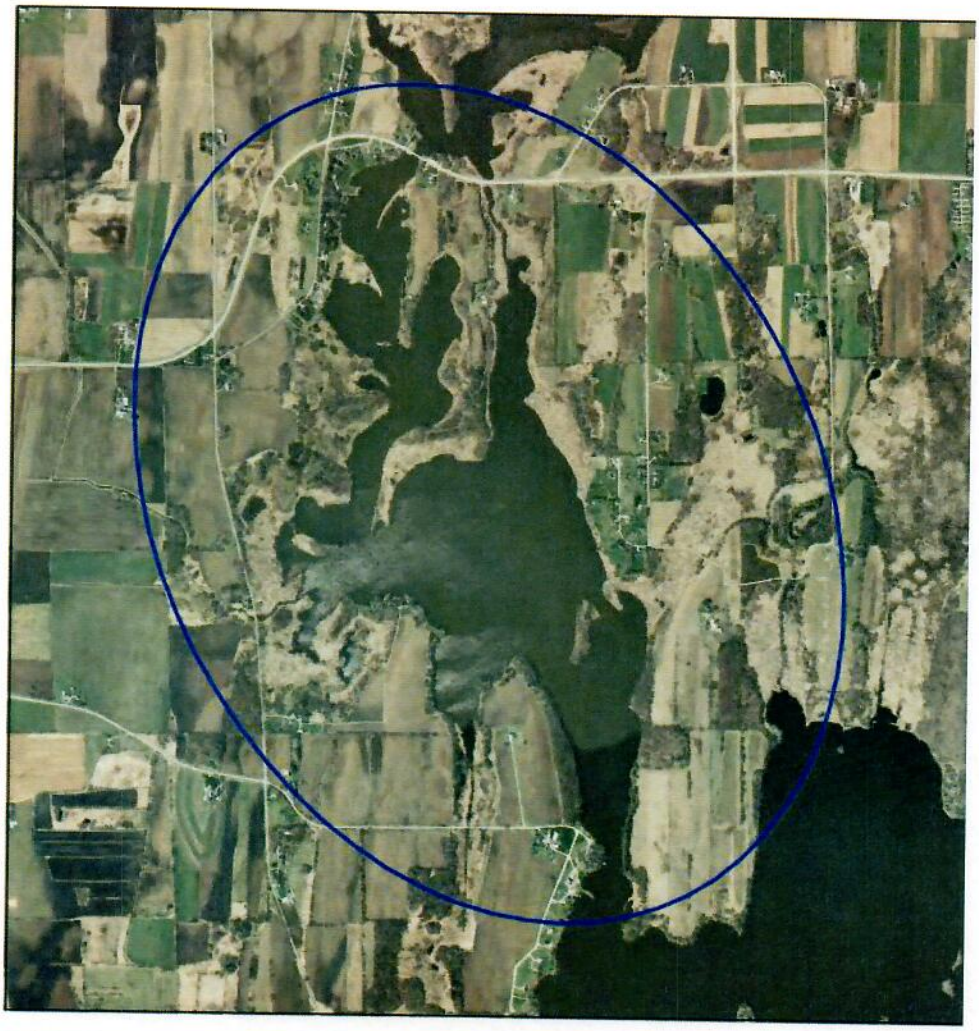


Figure B1: Area of navigational interest taken from LSID Conceptual Design Study (2014)

Lake residents have had a long growing concern regarding the buildup of sediment. Sediment has accumulated within the northernmost portions of Lake Sinissippi to the point where navigation has been limited to various forms of watercraft. Due to the reduced depth in these areas, the sediment is also prone to resuspension and transport when currents persist in the Rock River connecting the Horicon Marsh with Lake Sinissippi. Discussions around dredging date back over 20 years, with some success tied to smaller projects.

The LSID has committed ongoing funds to address sediment accumulation in Dead Creek. Dredging was performed Dead Creek in both 2009 and 2021. In 2006, a hydraulic dredge removed and filled a geotube to create an in-lake habitat barrier in the northeastern corner of the lake. The geotube was placed and filled so that the final height of the tube was 1 foot above the water surface, creating an offshore breakwater (ACOE, 2009). Additionally, the area behind the geotube was filled with additional sediment from the lakebed to create suitable water depth for aquatic plants. According to the ACOE report (2009), "*this project successfully demonstrated that sediment could be relocated from one area of the lake to provide habitat enhancement in another part of the lake; thus, achieving three goals of beneficially reusing lake sediment, reducing sediment depth in recreational areas, and re-establishing aquatic plants and wetland habitat.*" As part of the project, carp were removed and as a result, water quality greatly improved. Unfortunately, the geotube was breached and the carp and sediment returned.

The LSID along with local volunteers, continue to monitor sediment, coordinating training events to facilitate accurate data collection wherever possible. They have also committed significant funds to consultants to assist with data collection efforts and training of local volunteers.

Through the funding of this LMP, the WDNR has demonstrated its desire to partner with LSID in taking appropriate actions to best address sediment related issues. This includes understanding the degree of work that has been undertaken to research and better recognize the sources, resultant impacts, and recommended actions. This LMP involves evaluating various projects, considering their potential impacts and benefits, and selecting those with the highest return on investment and implementation.

Section B.2 – Previous Studies

Multiple studies in the past have been completed to investigate both the origin of sediment within the watershed and management perspectives from within the lake. These studies, however, tend to be individually focused and although information provided within these reports provides a suggested direction,

the LSID lacks the overall financial and group capacity to execute significant projects singularly or in concert with other applicable activities to take corrective measures within this report. To assist in the execution of such projects in the future, the LSID needs to consolidate applicable study findings into a more concise format to reassess costs, understand potential logic gaps, and develop a strategy to implement based on stakeholder driven feedback. This includes developing key partnerships and a collaborative environment with stakeholders as presented in Section 1 of

this LMP. The following list of studies are considered relevant in the development of a sediment management plan for the LSID:

1. *Long-Range Implementation Strategy, Hey & Associates, 2002.*
   Review: One of the first general guidance document compiled on behalf of the LSID, the document takes a shallow dive into the discussion of sedimentation process and impacts it has on Lake Sinissippi, acknowledging some of the early thought processes needed to facilitate such projects. As a long-range plan, it does not solely focus sedimentation but also other topics such as habitat, fisheries, and aquatic plant management.
   Importance: Based on undertaking a specific initiative in dredging or sediment management, the document is somewhat light, however, it does help identify the multitude of agencies that are necessary to begin discussion and the need for project approach feasibility, including appropriate sampling to understand the appropriateness of certain project approaches.

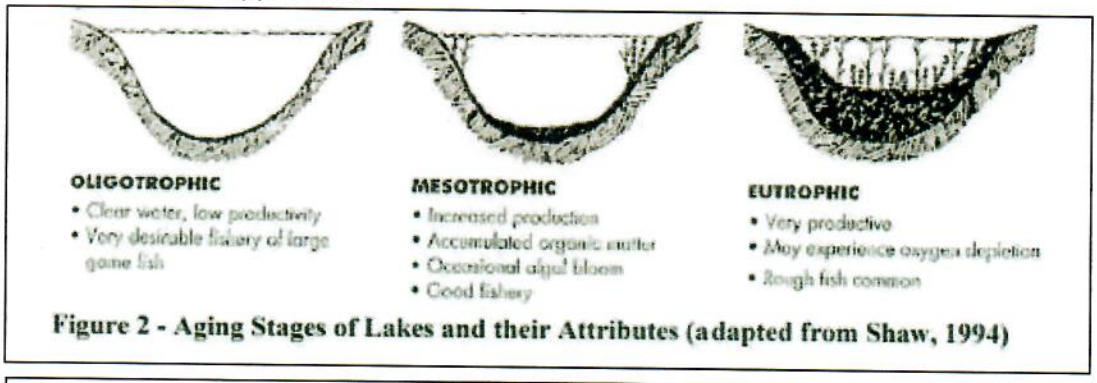


Figure 2 - Aging Stages of Lakes and their Attributes (adapted from Shaw, 1994)

Figure B2: The Long-Range Implementation Strategy (2002) focused on education and cost projection

2. *Lake Sinissippi- Rock River (LS-RR) Nonpoint Source Watershed Implementation Plan, Dodge County Land and Water Conservation Department (LWCD), 2019. https://www.co.dodge.wi.gov/home/showpublisheddocument/34566/637049985064000000*

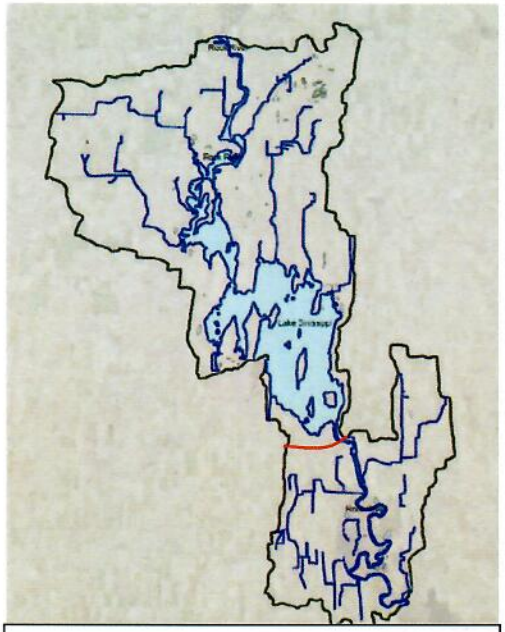


Figure B3: The LS-RR watershed plan completed by Dodge Co. provides recent loading estimates for Lake Sinissippi. The red line represents the watershed divide between the lake and the lower watershed of the Rock River.

Review: The Dodge Co. LWCD developed a Section 319 non-point source (NPS) watershed plan to review the current land uses within the watershed and their relative impact to Lake Sinissippi. The plan establishes goals and identifies challenges that could be encountered in trying to reach those goals. Discussion is provided to review the impairments of Lake Sinissippi which is degraded habitat, eutrophication, and excess algal growth due to total phosphorus, sediment/total suspended solids (TSS). The plan further provides recommended land management practices and actions that can be implemented to assist in reducing NPS loading from the watershed to Lake Sinissippi. This information is further broken down into a budgetary format and with quantified values for specific management actions.

Importance: The LSID has several studies discussing the management of sediment within Lake Sinissippi, however the LS-RR watershed plan highlights the importance of maintaining sediment on the landscape. The cost to remove sediment from an aquatic environment such as lakes and streams is considerably more than managing it on the landscape. Additionally, if dredging is undertaken, and the dredged spoils are placed on the landscape, the continuous influx of sediment from the surrounding watershed can compromise sediment management activities. Without proper land management practices, sediment from eroding soil, stormwater runoff carrying contaminants, and other sources will continue to enter the Lake Sinissippi, replenishing the sediment that was removed or managed. The LSID can use this report to serve as a scorecard against which can be used to tabulate cumulative watershed restoration initiatives with agricultural stakeholders in reducing NPS sediment and phosphorus inputs into the tributary streams with ultimate discharge into Lake Sinissippi.

While the watershed plan is beneficial and can be an effective tool for both visualizing and understanding the breadth of watershed-wide loading, the LS-RR watershed is not representative to that of the lake. As delineated within the plan, the watershed includes 12,100 acres beyond the Hustisford Dam, providing annual loading estimates for 28% of the watershed non-tributary to Lake Sinissippi. This is further shown on Figure B3. For the benefit of this report and to provide meaningful metrics for the LSID and lake stakeholders, watershed loading was prorated on a per acre basis. The basis for this approach is appropriate considering the general uniformity of land use within the

watershed. The following table better reflects the annual watershed contributions to Lake Sinissippi for a loading perspective:

Watershed	Area (acres)	%Contributing	Sediment Load (lbs)	Phosphorus Load (lbs)
LS-RR Tributary	31,100	72%	14,120,928	38,284.75
LS-RR non-tributary	12,100	28%	5,491,472	14,888.5
LS-RR (whole)	43,200	100%	19,612,400	53,173.27

Table B1: *Representative tributary loading to Lake Sinissippi from the LS-RR watershed as derived from the Dodge County NPS Watershed Plan. Loads projections are annual.*

3. *Lake Sinissippi Improvement District, Dodge County, Wisconsin Alternatives Report, U.S. Army Corps of Engineers (USACE), 2009.*

   Review: The USACE, using a Section 22 federal grant developed a planning level guidance document to review and identify potential options to address sedimentation within Lake Sinissippi. The document provides multiple considerations for how sediment may be managed and the potential pros and cons of in water management versus removal, including some permitting considerations. The document also provides discussion around restoration of lost wetlands and options that may be effective in their recovery, including methods of beneficial reuse using lake bottom sediments. The document is effective in introducing several topics associated with the accumulation of sediment while reviewing some of the physical properties, means for resuspension and mobilization.

   Importance: This is an important document which highlights the complexity of the lake's sedimentation issues. Perhaps more importantly there is a valuable discussion on in-lake management of sediment and beneficial reuse, including discussion regarding its use in wetland recovery. The report unfortunately does not do enough to discuss sediment removal altogether in an upland manner. Some base dredging costs are provided but at this point are grossly outdated, however the concepts for in lake management are viable, although how impactful is unknown.

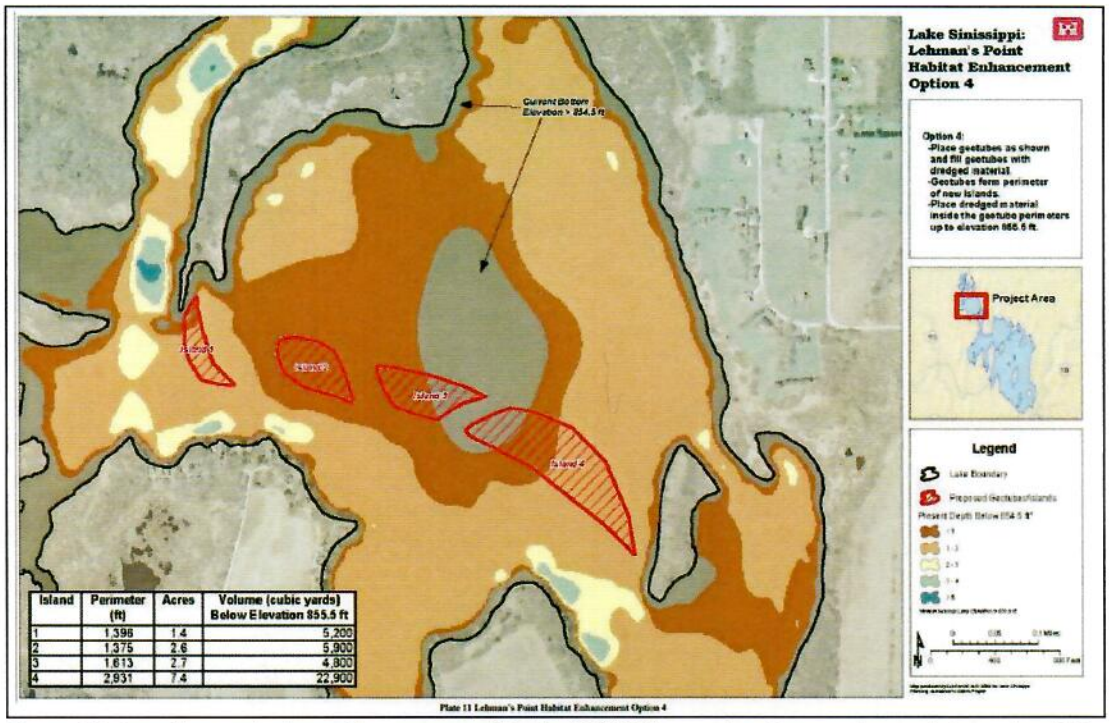


Figure B4: One of several alternatives presented in the USACE Alternatives Report, the study introduced the concepts of island building to support habitat development and sediment management.

4. *Conceptual Design Report – Rock River Channel Waterway Improvement Project, Stantec/Foth, 2014.*

   Review: The evolution of this document builds off the guidance approach provided in the 2009 USACE Alternatives Report, providing conceptual engineering for the consideration of island building to facilitate placement of sediment currently causing navigation impediment in a beneficial way within Lake Sinissippi. The islands could potentially restore some previously lost surface island and wetland habit. Proper positioning could also better maintain sediment pass through with improved hydraulics in the upper portion of Lake Sinissippi. The report provides a more detailed snapshot of the parameters analyzed to undertake a full design; however, the approach needs a much more up to date cost analysis to undertake and execute the specific project.

   Importance: This was the LSID's first step into investigating and understanding the science and engineering necessary to undertake a major in-water sediment management project that underscores the scope of work needed to finance and facilitate its execution. The report unfortunately does not provide a position on timeline to execute such a project from start to finish, nor highlight the broad context of necessary permitting needed, although it may have been beyond the consultant's scope.

Figure B5: The Foth-Stantec report provides further costs and design considerations from the 2009 USACE Study but represents and area (blue oval) north of LSID's jurisdiction. Another potential more suitable location may be located south (red oval).

While the report follows through on the logic previously presented in the USACE report, The LSID is considering a location further south as indicated in Figure 5B. This location represents a higher priority sediment/navigational bottleneck blocking lake access. Using an approach demonstrated in the USACE report and this Conceptual Design Report, the LSID hopes to improve navigational access by improving the hydraulics as described in this report.

5. *Horicon NWR Water Resource Inventory and Assessment (WRIA) Summary Report, U.S. Department of Interior Fish and Wildlife Service (USFWS), 2015.*

   Review: The report reflects the challenges he USFWS faces in the management of the Horicon Marsh National Wetland Refuge (NWR). The challenges are identified early in the report and flushed out individually in greater detail within the body of the report. Challenges include in-water management for fish, wildlife, and habitat and are driven by watershed inputs, water level challenges and invasive species.

   Importance: The general value of this document is the identification of multiple overlapping management issues with LSID. The report specifically identifies a host of issues driven by watershed-based practices and sediment management resulting in additional consequential impacts within the Horicon Marsh. Based on the documented findings in the report, LSID has a platform to engage with the federal/state government agencies and advocate for resource sharing to address combined basin-wide practices for the benefit of Lake Sinissippi. The report does mention the practicality of working with the LSID in these regards.

   In a meeting with representatives of the Horicon Marsh from USFWS and WDNR staff (E. Kilburg, K. Pechacek, B. Peterson, personal communication, October 18, 2022), the marsh is mainly managed with water level and the management of vegetation, therefore the main benefit to working with the Horicon Marsh are habitat related. In discussion with the representatives at the Horicon Marsh it was clear that they are largely interested in management discussions that lower the summer pool level of Lake Sinissippi. This gives the marsh greater flexibility in the way it is managed.

Figure B6: The Horicon Marsh is managed by flow, water quality, and water elevation data from the Horicon Gage

Section B.3 – Sediment Management Considerations

The sedimentation issues impacting Lake Sinissippi are well documented and information exists which can guide LSID to preposition for taking action. LSID has worked with partners on both the landscape and in the lake to collect data points and in many ways has established and maintained

incremental progress. While there is continual interest in executing a large in-lake sediment management project, any such projects need to be put into perspective.

The LSID commissioned and independent Conceptual Design Report (Foth/Stantec, 2014) and had hopes that it could bring the LSID that much closer to facilitating such a project; however, the initial phase was introduced at $1.5M which led to some lake constituents showing displeasure with the approach further causing LSID to pause on the project and reevaluate the issue. The costs as presented are not inappropriate for a conceptual level study, but some questions could persist regarding the lifetime of the proposed project when reviewing the position of the lake in the watershed and method in which sediment has accrued in Lake Sinissippi since the raising of the dam.

Lake sediment budget: The LSID is considering the undertaking of a scalable version of work described in the Conceptual Design Report, which is a deeper investigation into a presented alternative in the USACE report. The study describes two phases of work to manage 37,000 CY of sediment in-lake with a total cost of $4.85M. While there is no timeline associated with this work, there could be considerations for execution of a similar such project in 2024 if there is a consensus among constituents and funding avenues can be realized.

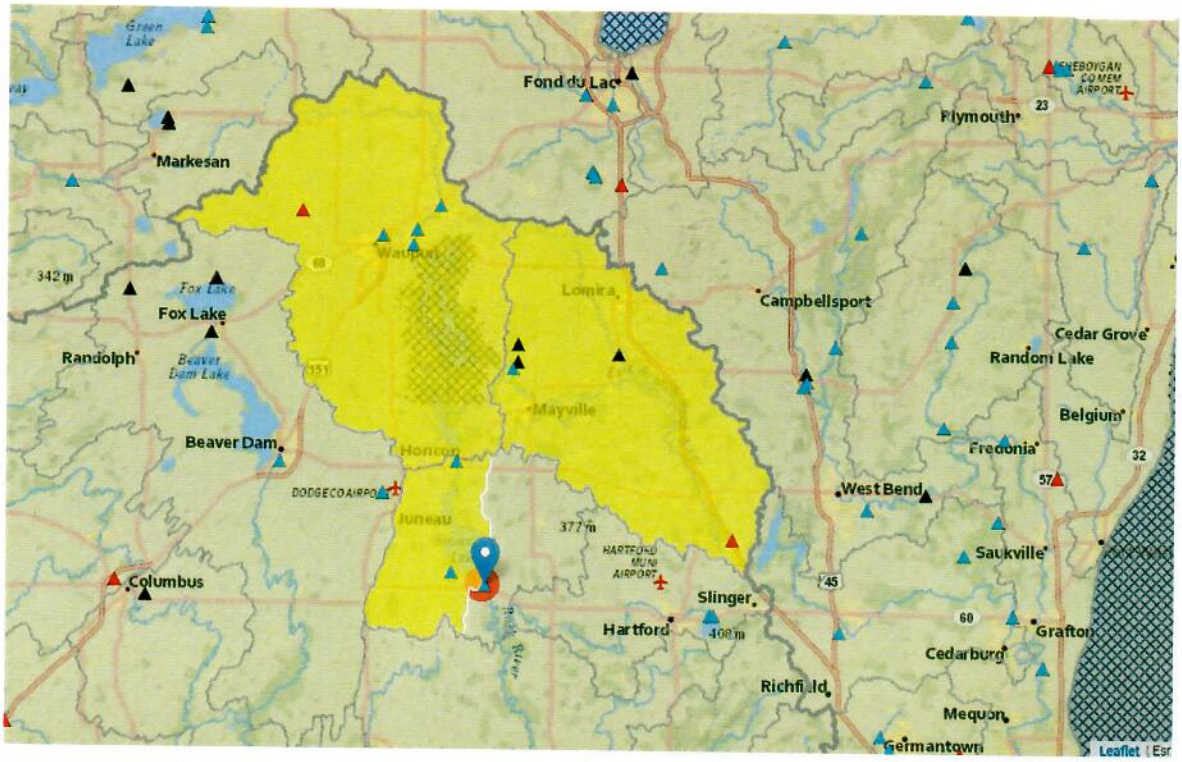


Figure B7: The tributary watershed to Lake Sinissippi is 526.5 square miles in total (watershed delineation from StreamStats)

With the anticipated financial commitment needed, it is important to put such a project into perspective. The average annual sediment load for the Lake Sinissippi – Rock River Watershed is 9,806 tons (19,612,000 pounds). The average annual phosphorus load for the Lake Sinissippi –

Rock River Watershed is 53,173 pounds. When averaged over the watershed, this is an average of 870.1 pounds of sediment and 2.4 pounds of total phosphorus/acre/year. The Lake Sinissippi – Rock River Watershed is 35.2 mi^2. In comparison, the entire watershed tributary to Lake Sinissippi is 526.5 mi^2 with a potential average annual sediment and phosphorus load of 284,000,640 pounds/year (142,000 tons/year) and 783,360 pounds/year respectively based on average per acre yield projections.

Based on the navigational impediments caused by sediment accumulation within Lake Sinissippi and the needs of local stakeholders, a navigational project could be a very beneficial project, however it needs to be highlighted that the project is a maintenance navigational dredge with an unidentified shelf life. Some additional considerations not specifically addressed in the report:

1. Average annual maintenance costs:
   For actively managed shoreline-based projects an annual inspection and annual maintenance budget should be allocated. Proposed in-lake islands will create a significant amount of new shoreline for which the first years will be critical in securely establishing the vegetation to help stabilize the final structure(s). For work of this nature, 2-5% of the project budget should be considered. More effectively, this cost could be included in the base cost to construct. Either way it can be significant and should eventually become less of an expense once the island structure fully stabilizes. Using costs from 3 recent dredging projects priced in 2022 (Geosyntec, 2022), the expected change in cost from 2014 is cost x1.45%. Therefore every 1.0 million dollars spent in 2014 is 1.45 million today. The shoreline component is a significantly lesser value, but the cost should not be ignored. Furthermore, in contemplating annual cost of sediment management, the USACE report identifies the annual sediment load to Lake Sinissippi to be 5,987 CY per year. Based on two recent Geosyntec projects $50/CY is a reasonable cost for the planning purposes of a dredging project. This suggests an annual budget of $300,000 to maintain current sediment storage capacity in the lake using standalone static projects.
2. Life expectancy of project:
   This is an important consideration for any project. Given the position of the lake in the watershed and the annual loading, the maintenance dredging as proposed in the Conceptual Design Report could be less than 10 years and likely closer to 5 years. This can be highly dependent on climactic factors, settlement of lakebed after project completion, and uncertain without focused modeling, however the annual load is significant and suggests being highly mobile in the northern and narrowest portions of the lake. Figure B8 displays the relative comparison of the greater watershed, the local watershed (Rock River-Lake Sinissippi Watershed), and the proposed phased Stantec-Foth in terms of sediment volume.
3. Hydraulic effectiveness of in-lake sediment placement on sediment storage:
   Strategic placement of sediment in Lake Sinissippi as suggested in the Conceptual Design Report (CDR) can be multi-beneficial. Sediment bottlenecks are removed to assist in better navigation. The sediment can effectively be placed to help create effective habitat

and mitigate what may have been previously lost or created opportunistically. The positioning of the islands as suggested in the CDR also provides an expected improved hydraulic capability to reduce settlement of constituents in the narrow channel area. This increases the potential lifetime of the suggested project, but at the cost of downstream lake sediment storage, essentially reducing the downstream depth of Lake Sinissippi albeit at a much slower rate.

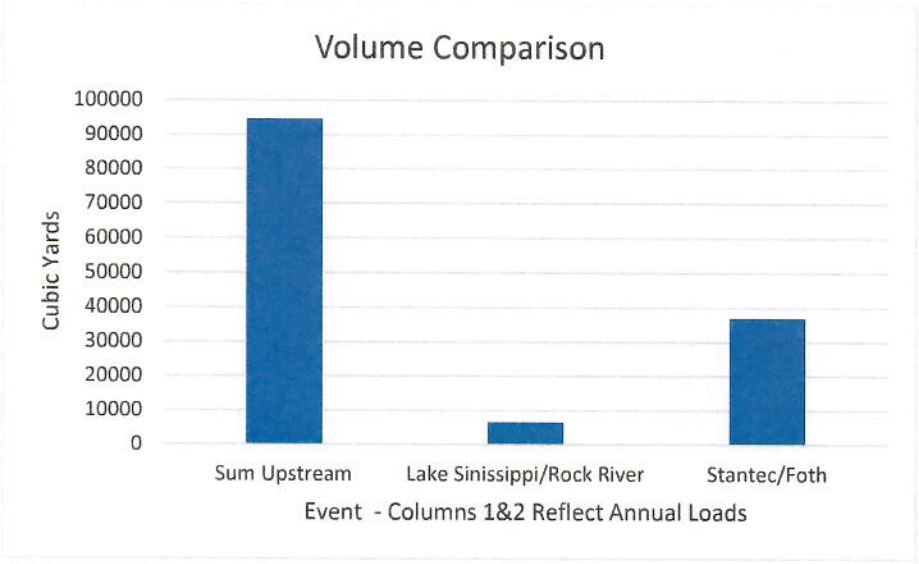


Figure B8: Representative annual sediment loading from the entire upstream watershed, the LS-RR Watershed and the associated sediment removed from the previously assessed Stantec-Foth design alternative.

Dredging – Project Driven Considerations

While the beneficial aspect of a sediment removal project is typically associated with in-water activities, the details surrounding the removal and disposal often dictate the viability of the project and ultimately its potential for success. To this end the method of sediment disposal almost always drives the cost of the project and its final execution. For in-water work, projects are typically identified with being either hydraulic or mechanical, but there can be varying degrees of differentiation.

Hydraulic Dredging

The 2009 Alternatives Report by USACE does a good job of discussing many of the techniques and approaches to hydraulic dredging, and for that reason provides a useful primer which will not be reiterated in this plan. Based on past projects and the basis of the Stantec/Foth Report, it appears to be assumed that any significant project which takes place in Lake Sinissippi will be hydraulic in nature and it is often viewed by many to be a less destructive approach. While this can be the case for hydraulic dredging, this method may also require significant management of the sediment once it is removed and eventually relocated. Constituent sediment also requires

time to dewater to be manageable for further transport or use. Greg Farnham, former LSID President drafted a report to the LSID Board entitled "Comparative Cost Analyses and Considerations of Sediment Dredging" in February 2010 which provides a good primer on hydraulic dredging, including considerations for upland placement and the potential for the LSID to acquire and operate their own hydraulic dredge. While the reference costs are outdated, the general concepts are sound and underly the importance of proactive scouting of upland sites for temporary dewatering and permanent placement of sediment. The Farnham report is provided as Appendix B1.

Figure B9: Cutter head dredge (left) and polymer injection (right – red oval)

Mechanical Dredging

As a standalone introduction to inform the LSID about hydraulic dredging, placement and ownership considerations, the Farnham report is well-informed and appropriate. However, the document is devoid of discussion related to mechanical dredging which could be a viable option for Lake Sinissippi given the shallow nature of the proposed work area. To an extent, the USACE report is not overly optimistic about mechanical dredging, however amphibious excavators are now quite common and with advancements in technology quite adaptable to a variety of environments, including those applicable to Lake Sinissippi. Hydraulic dredging also has minimum depth restrictions that can sometimes be problematic as the cutterhead must maintain minimum submergence. More advanced amphibious equipment can also switch implements to go from hydraulic to mechanical dredging. Mechanical dredging using amphibious equipment can allow for greater finesse in tight locations and are much less disruptive to the bed of the lake or stream than standard mechanical excavators which may have been employed in the past.

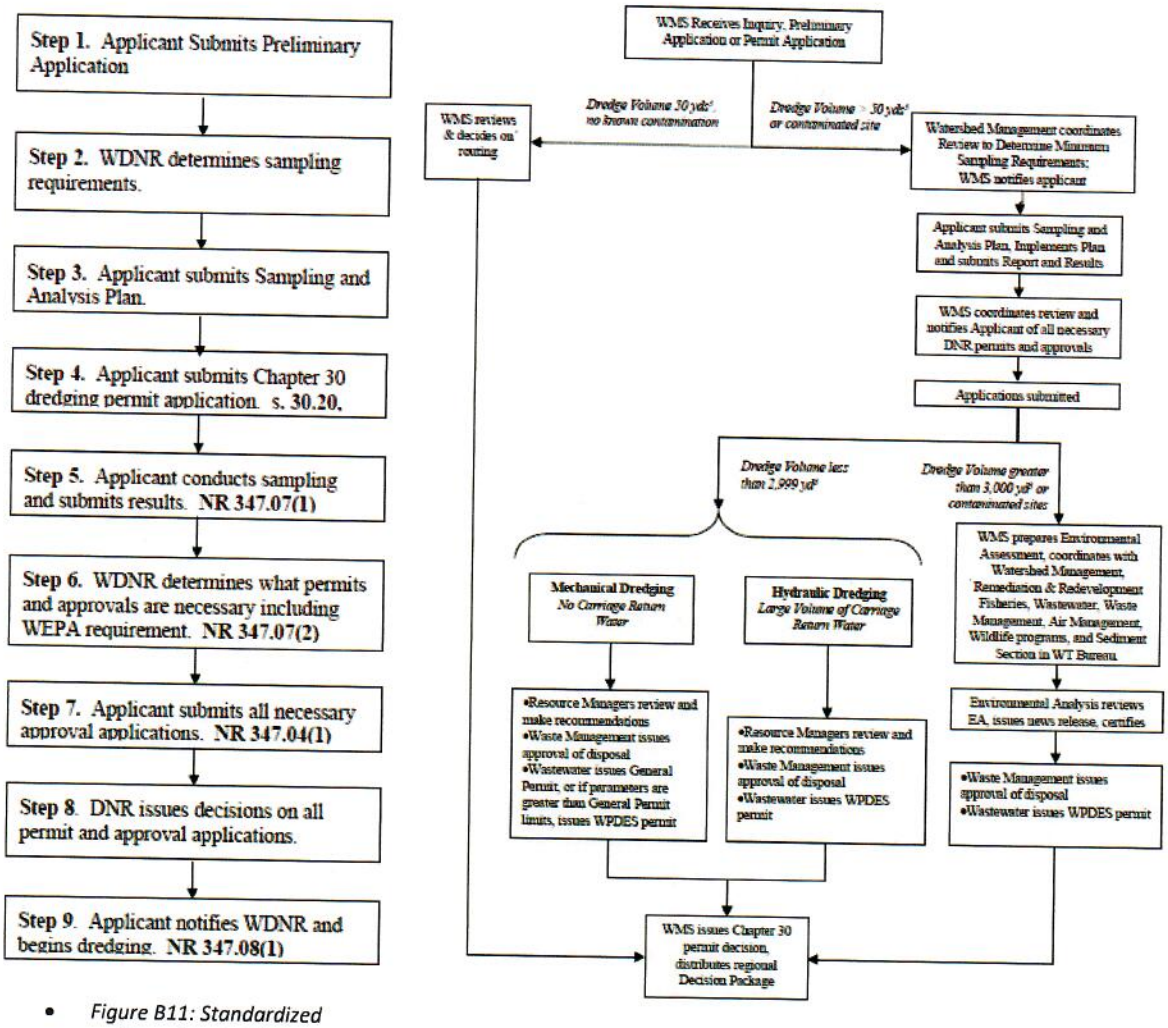
Figure B10: Amphibious long reach excavators (image courtesy of Fox Waterway Agency and Aldridge Marine, respectively)

Dredging – Permit Driven Considerations

The selected approach to dredging can very well dictate much of the permitting pathway (Figure B11).

- Permitting timelines: Any dredging project, hydraulic or mechanical will take over a year to plan, design, permit, and construct. It is important to remember that a dredging project typically takes place on two fronts, in-lake activities and on the land with tasks needed to dewater sediment. Even projects that are typically straight forward from an executable standpoint are often layered.
- Construction timelines: The ability to execute a dredging project is often impacted by elements that are not easily controlled.
    - Public comment: It is standard procedure that a dredging project exceeding 50 CY of removal should anticipate a public comment period minimum of 30-90 days.
    - Wildlife – fish> amphibians> macroinvertebrates: DNR has taken great strides to minimize impacts with key wildlife functions. Presence of federal or state Threatened & Endangered (T&E) species can also play an important factor. Avoidance of fish spawning patterns and pre-hibernation patterns are vital considerations for the DNR.

Standard dredging workflow:



- *Figure B11: Standardized pathway for dredging plan operation in Wisconsin.*

Dredging – Cost Driven Considerations

Cost estimates for dredging are almost always provided in cost per cubic yard (CY). While this is a convention in the industry, the details of what costs are included in that quote are important to understand. Many of the projects presented in the USACE Alternatives Report present dredging costs for $13 per CY or less. These are atypical prices and not indicative of anything other than a maintenance dredging projects with limited mobilization and permitting efforts for dredging projects of 3,000 CY or less. Small projects such as those presented had immediate disposal sites with limited secondary handling and no hauling. These functions greatly influence the cost. For example, the 2006 geotube project pumped directly into a placed tube for settlement (no hauling, limited handling). Both Dead Creek projects were mechanically dredged

and side-casted onto the adjacent farm field. The material was then dried and leveled with conventional farm implements. For any project of significance, additional handling and hauling should be anticipated which is recognized by the >3,000 CY permitting process administered by WDNR. As noted in the Stantec-Foth report the 37,500 CY project is significantly higher at > $100 per CY.

The vast disparity in costing out dredging projects can make it a perilous process to undertake and further communicate to constituents. For all dredging projects, the cost should take into consideration the total cost for construction. Engineering and permitting is often subjective to the means for which the project is undertaken and is likely 10-15% of the total project costs. For any lake district, association, or other waterway improvement association, maintaining annual dredging projects to avoid larger projects can help keeps costs under control.

For many projects >3,000 CY (sometimes less) the following must be considered:

- Dredge material placement (may require engineering and permitting)
    - Where will the material go?
    - Where can the material go? – this can be dictated by sediment characterization
        - Clean sediment
        - Dirty sediment (toxicity)
            - Manageable toxicity
            - Non manageable
- How will it get there?
    - Hauling (may require roadway usage approval)
        - Wet haul
        - Dry haul
    - Direct discharge – pumped or placed (requires engineering and permitting)
- Is the sediment dewatered? – saves on hauling (requires engineering and permitting)
    - Dewatering site
        - Geotubes
        - Sediment dewatering facility (SDF)
        - Other (belt press, geopool, etc)
    - In-lake placement (additional engineering and permitting)
- Construction
    - Bidding and Construction (Engineering)
    - Self-Perform
        - Training
        - Equipment costs
        - Maintenance

There is no standardized process for dredging, but rather a series of events that must be carefully reviewed and assessed based on the waterbody to be dredged, the assessed material to be

removed, availability of land to dispose or place the material upon, and ultimately having equipment and money to facilitate that process. Failure to assess each of these adequately at each step in the process can lead to time delays, additional costs, unforeseen permitting challenges and ultimately a frustrated constituency.

In-Lake Management Options: In lake management of sediment suggests that built up impediments be further managed within the lake, eliminating the need to manage the material on land, either to dewater or haul away as is.

- Shoreline enhancement: Eroded shoreline can provide a significant and immediately available source of nutrients to Lake Sinissippi. Using tools like Hesco Barriers or geotubes buoyed by stone, can replace lost shoreline or more appropriately replace below water substrate that may have been flushed or scoured and relocated elsewhere. Many areas of the Rock River between Horicon and Lake Sinissippi have been diagnosed as sloughing into the river bottom, resulting in widening of the surface area of the channel, and impacting the median depth and hindering navigation. In-situ sediment can be used as a tool to reestablish shoreline and near shore riparian areas.
- Habitat enhancement: The LSID has successfully worked with and managed sediment in-lake, creating a geotube break wall in 2005. While a true break wall is typically created to shelter areas from heavy wind and wave action, this project essentially served as a habitat and sediment curtain, which based on available accounts also served as a carp barrier of sorts until the barrier was breached by local stakeholders wishing to access the area.
- Islands: The key approach to the Foth-Stantec conceptual design report (2014), was the concept of island building using reclaimed lake sediment. The islands were a major focus in-concert with flow redirection to facilitate movement of flow and sediment into a more centralized manner allowing for sediment to push further downstream rather laterally in the upper portions of the lake. The methodology is generally sound but presents significant permitting hurdles from both the State of Wisconsin and USACE.

Figure B12: Artificial Island creation by the Fox Waterway Agency (IL), Grass Island, 27 acres, in Grass Lake using geotubes. The Agency is currently exploring a second island of 17 acres.

Lake sediment removal options: Standard dredging approaches typically involve the removal of sediment from the water and subsequent management of the material on land. Techniques and technology have changed over the years; however, the approach remains relatively unchanged.

- Standard removal – haul off (wet): This describes the process for which sediment is hauled wet, without extracting excess water out prior on land management.
    - Mechanical or hydraulic: The process of hauling wet sediment typically only applies to mechanically harvested sediment as the hydraulic pumping process adds significant water to the process, sometimes upwards of 10:1 creating a "slurry" to move the sediment. At this point hauling consists largely of water making the hauling expense significant. Mechanical harvesting of wet sediment can still be done efficiently and economically on smaller jobs assuming the disposal site is relatively close since there is less investment in mobilization and fuel. Direct slurry haul-off projects can be utilized with tanker truck for small jobs but must be done under the discretion of the local governmental entity. The loaded weight of a tanker truck requires a stabilized pad due to weight and may need to be restricted to certain roadways properly rated to hold such a weight.
    - Land application: Wet sediment is typically hauled to a predetermined disposal site such as a certified waste disposal center or landfill. Under certain conditions it could be land applied. Due to the highly liquid nature of the sediment when mechanically harvested it will still flow across a landscape making perimeter SESC measures extremely important to manage the material.

- Standard removal – haul off (post dewatering): Due to the cost to haul sediment which can be largely liquid if not dewatered, many permittees opt to manage the sediment on land to separate out the water from the sediment to make it more manageable and economic to handle.
    - Geotubes: This technology consists of utilizing an elongated, porous tube consisting of geosynthetic fabric to collected pumped sediment slurry. The fine holes within the tube pass water when sufficient internal pressure exists from the pumping and generated pressure. The tube will continue to dewater to state consistent with the type of soil mixture received. For most planning purposed an approximate dewatering dewatered sediment percentage is assumed to be approximately 50%. Once this process reaches an acceptable degree of dewatering, the geotube can be opened and the sediment harvested for ultimate disposal or other uses.

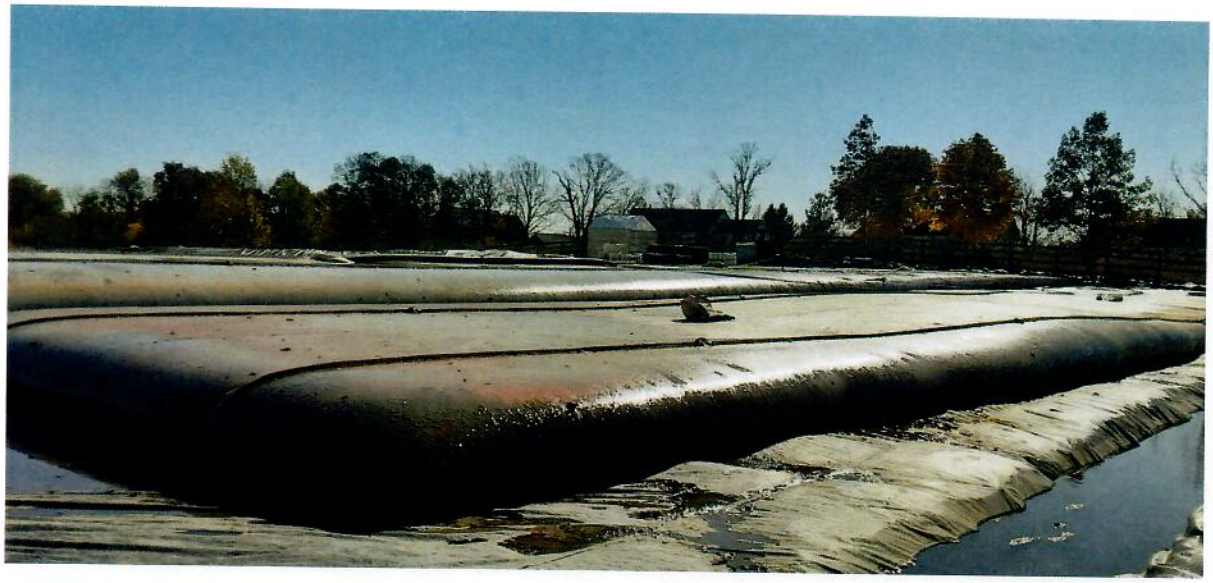


Figure B13: Standard 150' Geotubes used in a lake dewatering project.

- Dedicated dewatering area: In situations where permittees have access to land either through direct ownership or ongoing land agreements the construction of a more permanent dewatering facility can be designed and constructed. These facilities can occupy a land area of just a few acres to significantly more. The purpose of such a facility is to provide a permanent site to undertake project dewatering in a repetitive manner. The dewatering site is permitted on a negotiated return basis. Collected project sediment is directly pumped or placed into the area (hydraulically pumped from dredge site or dumped) where it dewatered over time. Dewatered material can they be used by or distributed to various end users. Any decant water from the dewatering process may need to be treated to meet regulatory requirements prior to discharge. A permit to discharge to a waterway will need to be acquired from WDNR.
- Winter excavation: Another means to help control costs when timing and biological impact can be controlled is perform removal during winter months. This typically done in conjunction with a coordinated impoundment drawdown. Excavated sediment is non-fluid and can be better handled from simple management standpoint and even land applied if desired. Impoundment drawdown must consider the impact to dormant wildlife species and the available water depth to fish to minimize the potential for oxygen deprivation which may be difficult in shallow impoundments.

- Sediment Dewatering Facility (SDF): Development of a permanent SDF can be beneficial for any permittee that may need to perform repetitive maintenance dredging. The SDF helps control costs by providing a consistent disposal site regardless of if dredging is carried out directly by the permittee or a selected contractor. The selected location for an SDF should be within close proximity to the water body of need, an appropriate

roadway sufficient for dump truck traffic and should not be sited near wetlands, floodplain, porous soils, or in areas with a high-water table. Development of an SDF is a major endeavor and should be undertaken of other specific project related dredging efforts.

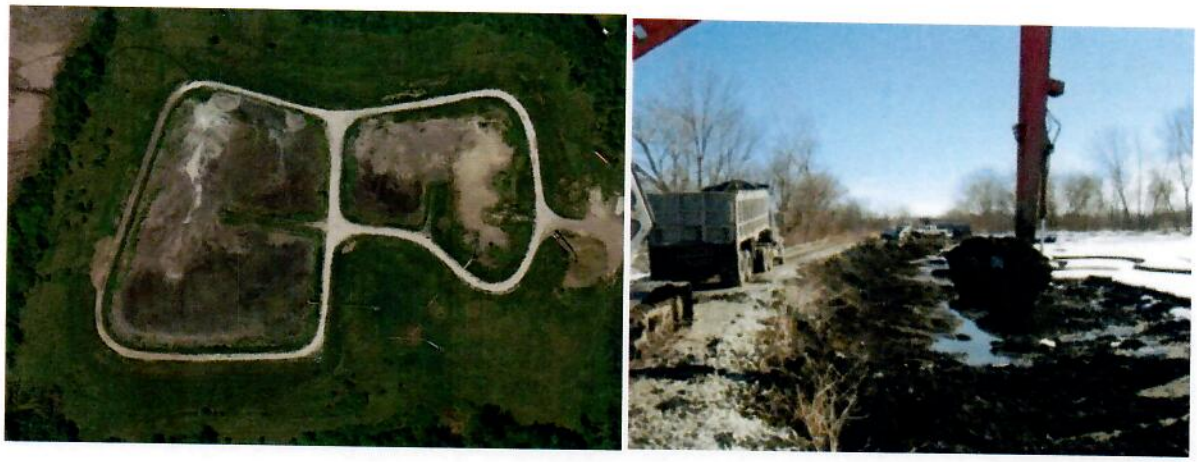


Figure B14: Sediment dewatering facility (SDF) allows for permanent sediment and dewatering. Once sediment is dewatered it can be harvested for reuse. Photos courtesy of Google Earth and Fox Waterway Agency respectively.

Removal methodology: Certain features of a project, including project size, water depth, time of year, and disposal opportunity can sometimes dictate the preferred means to approach a project. Each method has versatility and benefits that the other does not which should be reviewed on any particular project.

- Mechanical: this method of sediment removal typically implies removal through excavation with a standard reach arm and bucket. Often viewed as more invasive, mechanical excavation can be more cost effective under a number of scenarios:
    - Smaller jobs – with the effort that is sometimes needed to properly prep and maintain a formal dewatering area outside of the waterbody being dredged, smaller jobs can often be faster to the gate and more cost efficient to mobilize and demobilize, making it potentially ideal for maintenance dredging projects <3,000± CY. Less money is used to prep and maintain dewatering and can be put directly into trucking costs which are carrying a larger fraction of water than dewatered material. Depending on some variables to extensive to list, mechanical can also have a less rigorous permitting pathway.
    - Shallow areas – Mechanical excavators are not restricted by minimum depth. This includes the machine and the bucket, making mechanical a valuable asset in shallow marshes and impoundments. The shallow the water the smaller the hydraulic dredge will need to be leading to significant challenges and inefficiency when compared to mechanical means.
    - Contractor availability – The range of equipment that can be used under many mechanical removal scenarios makes mechanical dredging a service that can often

be performed using standard excavation equipment and typical dump trucks which is typically available to most construction firms. The commonality can drive up competition and ultimately drive a more competitive bidding process dure to the expended contractor pool.

  - Less material restriction – Hydraulic dredges are somewhat limited on weight and materials composition. While cutterheads can typically be modified to address heavy macrophyte conditions, stones and woody debris will be a challenge and potential risk for equipment damage and clogging. Mechanical systems can generally manage any material that the arm can reach.

- Hydraulic: removal of sediment hydraulically relies on sediment collection and mixing with additional water into a highly liquid state for ease of pumping to a destination site for dewatering. Like mechanical dredging, hydraulic removal has the following realized benefits:
  - Depth of access – While dredging to excessive depths is typically not recommended, hydraulic dredges can access depths in locations where a mechanical reach is impractical. This includes centralized lake areas, deeper pools and areas where track and road access are too costly to implement.
  - Environmental impact – Hydraulic sediment removal is viewed as less destructive in general. The standing area of impact to the lakebed is on the cutterhead since the barge is typically afloat, rather than an entire track system which can agitate the substrate when movement is required.

Landscape Capture – Every effort should be made to improve the lifespan of a dredging project by improving the management of tributary land use with field scale practices focused on reducing movement of sediment and nutrients into Lake Sinissippi. The following considerations should be cataloged to continually demonstrate the effort of the LSID on reducing sediment on the landscape from functioning as a source. The following considerations are provided and need pilot level implementation and stakeholder feedback:

- Minimize field – space commitments: It is important to farmers in particular that applications to farm fields to minimize erosion but also minimize the amount of productive farm field that is anticipated to be impacted. Goals should be focused on using less productive areas of the field based on the farmer's experience and topographical/visual assessment.
- Maximize trapping volume and service lifetime: The Agricultural Runoff Treatment System (ARTS) provides a variety of management tools to address runoff and sediment volume in agricultural areas. The concept behind ARTS is to capture, treat, and manage agricultural runoff before it enters water bodies, thereby reducing the amount of sediment, nutrients, and other pollutants that can negatively impact water quality. The ARTS process usually relies on a combination of various best management practices (BMPs) tailored to the specific needs of the area.

The ARTS can be further enhanced with a phosphorus filter to better address the dissolved reactive phosphorus (DRP) fraction. DRP is largely responsible for algal blooms and growth of nuisance floating aquatic vegetation. ARTS are sometimes compared to Iron Sand Filters which are heavily reliant on interception of tile flow rather than surface water which can make the design and maintenance a challenge. Even a little sediment blocks bonding sites for the phosphorus. The ARTS or eARTS is therefore highly recommended to be coupled to watershed hotspots as valuable landscape practice.

- Inventory of Watershed Protection Practices: There would be value to the LSID in developing an inventory of farmers in the watershed employing sound land and farming management practices. Such an inventory would provide important information for assessing the current state of agricultural practices in the area and identifying farmers who are already implementing effective strategies to address runoff and sediment volume. By working cooperatively with the agriculture community on this effort, LSID will help foster sustainable agricultural practices, protect water resources, and build a resilient farming community in the watershed.

Section B.4 – Ongoing Sediment Management

The LSID has not been idle in the area of sediment management. A partial list summarizing past activities of ongoing and past programs, along with past projects is provided below. Current activities include the cost share and commissioning of this sediment focused lake management plan, dredging in Dead Creek, ongoing lake volunteer sediment monitoring, coordinating field survey of lake sediment bathymetry, and ongoing membership in the Dodge County Alliance for Healthy Soil – Healthy Water.

In the past the LSID has coordinated and commissioned a number of studies, many of which are cataloged on the District's website (https://lakesinissippi.org/2017/environmental-documents/) and others that are further summarized earlier in this Chapter. While not all of these studies are sediment focused, several demonstrate that the LSID and its stakeholders understand the challenges of managing the lake and the incoming sediment. LSID has also been active in taking periodic, small scale sediment management projects. Past sediment management projects include:

Geotube project: In 2006 the LSID dredged 3,000 CY of lakebed to construct the containment berm to the tune *$30,000*. What was the goal of this project? The berm? sediment removal?

Dead Creek1: In 2007, LSID contracted out a small-scale sediment removal project in an isolated segment of Dead Dog Creek for approximately 1,000 CY. The material was side casted and later graded into the local field. Documented total cost was approximately $2,500.

Dead Creek 2: in 2009, an additional *$7,500* was allocated to maintenance dredge an approximate 3,000 CY of sediment in Dead Dog Creek. The materials were similarly side casted and incorporated into the adjacent farm field.

Bear Creek: In 2000, Bear Creek, *$3,500*

Annual participation in Dodge County Farmers for Healthy Soil – Healthy Water

Other annual education/programmatic efforts:

Past LSID expenditures exceed *$43,500* in localized in-lake maintenance efforts and annual costs for educational/partnership efforts. While LSID continues to be selective in financing of both landscape and in-lake sediment projects, the undertaking of this LMP was to identify and prioritize the management of sediment project(s) at scale. With the identified sediment budget of Lake Sinissippi, and the fixed budget of LSID, any large-scale sediment removal project will need to carefully be undertaken and compensated with additional follow up maintenance activities.

Lastly it is important to review the opportunity to self-perform sediment removal work. This appears to be an option of exploration for many lake districts in Wisconsin as they reach a crossroads with what appears to be a large, multiyear project with the realization of limited funding. For a waterway such as Lake Sinissippi maintenance dredging will always be a challenge due to the annual sediment budget. This was the nexus of the 2010 Farnham document (Appendix B1), which describes in detail many of the nuances of hydraulic dredging, including equipment and cost to buy, maintain, and operate (self-perform). It unfortunately is limited to hydraulic means. The content is still relevant given the reader can apply a 30% increase to account for minimal inflationary increases.

Self-performing dredging work is often contemplated by Lake Districts that have some degree of competency in lake-based maintenance. It has often been viewed, at times as an extension of a weed harvesting program, but that highly understates the necessary articulation needed to be safe and efficient with the use of the expensive equipment in and around what can be confined areas. Self-performance by regional agencies such as the FWA in Illinois took years to develop into an efficient model. Machinery and staff notwithstanding, numerous infrastructure improvements, access locations, sediment management areas, and a negotiated 10 year permitting strategy all took time, effort and money to become established. It is suggested that LSID would need significantly greater bandwidth to consider this as an option.

Section B.5 – Long Term Sediment Management Options

A. Investment in In-Water Management

The commissioned Foth-Stantec Conceptual Design Report provides a glimpse of the magnitude of what a significant dredging and sediment management project might entail. The LSID has invested in minor maintenance dredging projects before, however these are minor undertakings compared to the scale of an anticipated in-water island building project. This project or any of similar scope will demand a substantial and strategic approach to funding. Any such project is likely a multiyear endeavor from planning (and funding) through design and permitting, and eventually construction. Upon completion of the project, annual maintenance will continue to be needed. The adjusted 2014 budget of 4.8M for the island building project is anticipated to be approximately 6M when adjusted to today's costs.

Anticipated dredging may also be focused as an annual cost, such as a line item in a budget, if not on a rotating basis. Along this front, the LSID might be suited to develop cyclic budget and permitting framework with the WDNR to allow for dredging on a predetermined return interval in select locations up to a negotiated volume. This approach would be based on a conditional permitting strategy. In this instance, the WDNR would develop a specific permit issued solely to the LSID to undertake the work in set location(s) at specific times of the year to a negotiated maximum volume. Typically, the more repetitive the work, the more streamlined the process can be made and budgeting becomes more predictable.

The purpose of an annual or cyclical program allows for the LSID and its constituents to remain focused on the areas that matter while managing budgetary expectations to routine work that has been deemed valuable by consensus. This shortens the time to execute and undertake since the agreement is pre-negotiated. In terms of volumes the LSID should consider something that is financially sound and sensibly achieves long term sediment management objectives. This should not deter the LSID from undertaking other sediment management or removal projects, but rather focus on sound maintenance dredging objectives. This may be better decided should the LSID acquire their own equipment and develop a dedicated parcel of land to manage dewatered sediment or collaborate to create a network of agricultural partners who understand the value of the sediment and can routinely utilize the dewatered material and utilize it as a soil amendment to the benefit of their individual farm fields. Although this approach is heavily reliant on in-water management, removed sediment cannot be successfully processed without at least some minimal upland land resources.

B. Invest in Land Management

For the cost of design, construction, and long-term maintenance of a project such as the one described in the Foth-Stantec study, a significant amount of capital can be invested in agricultural land management, with the idea of keeping the sediment out of the water. Beyond the investment used to buoy the Dodge County Alliance for Healthy- Soil Healthy

Water, dollars would be allocated to offset the cost to construct upland soil health and sediment management projects focused on holding soil in place within the watershed and reducing annual loading to Lake Sinissippi. To provide some perspective to the scale of focused expenditures on land management practices, consider the cost to implement agricultural BMPs such as no till at the watershed level:

- Cost to subsidize upstream watershed in no-till*: $5.73/acre (subsidized at 75%)
- Cost to subsidize upstream watershed in no-till: $17.48/acre (unsubsidized)
- Total agricultural land upstream of Lake Sinissippi = 212,285 acres
- Cost to subsidize total agricultural land upstream of Lake Sinissippi = $1.22M- $3.71M
- Sediment load reduction per acre treated (T/yr)** = 2.5 or 58.5%
- Total reduced annual load*** = 142,000*0.585 = 83,070 T/yr
- Reduced annual load converted to in-situ sediment volume = 55,382 CY

**Cost provided by WI NRCS for 2022*
***Acre reductions average of residue practices for 30-59% and over 60% per WI NRCS for 2022*
**** Upstream watershed loading taken from Lake Sinissippi-Rock River Nonpoint Source Watershed Implementation Plan (Dodge County, 2019)*

While these numbers represented are approximations, they provide the summation of thought processes at scale which can be compared to the cost to manage sediment once accumulated in Lake Sinissippi. While the ability to programmatically subsidize agriculture for the entire upstream watershed is highly infeasible from a logistics standpoint, it helps demonstrate the value of land management on controlling the pulse of sediment to the lake. The 55,382 CY of sediment represented above is a static runoff load calculation. It does not equal the actual annual sediment load which enters Lake Sinissippi.

The management of land at a watershed scale will likely become increasingly important in conjunction with climate change. Field scale resiliency and state of the art watershed management will be critical as rainfall patterns continue to show increasing intensity. This intensity will have a higher propensity to dislodge unprotected sediment from its landscape position and deliver it downstream. Without upland intervention, watershed loading will be projected to increase on an annual basis, further demonstrating the benefit of watershed and soil health. The general problem that persists is an ability to populate enough upland property with beneficial runoff reduction projects to cumulatively equate to that of a singular high-impact sediment removal project.

C. Traditional Sediment Management

For most, traditional sediment management is the standard practice of implementing singular projects on an independent as needed basis. From a strategical standpoint, it does little to address the source and may not necessarily address the areas of highest need, but rather focuses on singular targets with sometimes limited consideration for long term value and how it may or may not benefit other stakeholders. Any project completed most certainly will

benefit some stakeholders, but can also have a limited shelf life at significant expense if not evaluated within he context of the entire lake.

D. Hybrid/Balanced Management of Land and Water Options

Using a mixture of management options for Options A&B above, LSID may be better suited to fiscally manage both fronts. Development of a prioritized placement of agricultural BMPs may be best coordinated with Dodge County Alliance for Healthy Soil-Healthy Water. In lake dredging or sediment management should be focused maintenance and navigational dredging. While this may start will a significant in-water sediment management project, it would leverage future sediment management endeavors on reducing sediment inputs while maintaining navigation with consistent annual removals.

This approach suggests prioritizing and targeting specific areas that have been identified as heavy sediment input areas and focusing on a stewardship approach that is beneficial for both parties. Prioritization and suggestions have been provided in both the Dodge County Watershed Plan for sediment erodibility and management approaches (Section 6.0) and USACE Study (pg 14, 71), for potential sediment placement locations. These documents provide general guidance from which the LSID can further investigate key issues such as ownerships rights, willingness to participate, or ease of access.

Further prioritization down to the parcel level may not be immediately appropriate until LSID develops a recommended approach, however prioritizing parcels with greater proximity to the lake and tributary waterways make the most sense as research indicates the connection between travel distance and nutrient impact (Zhang, 2010).

E. Allocation Management

The LSID must consider the realities of the necessary resources to maintain the current lake effectively given the means currently available. Even with an investment in a significant in-water sediment removal project, the effective lifetime of the project may be limited, leading to renewed navigational limitations and a frustrated stakeholder base. This option considers the implications for reestablishment of the river corridor with a backwater area. The primary goal of this initiative would be a loose separation of the Rock River from the open water area effectively separating the sediment source (Rock River) and reducing its capability to continually deposit sediment in the lake. Lake Sinissippi is an extremely effective sediment trap. This option considers an approach to reduce this natural trapping tendency and push to the maximum extent practical, sediment downstream.

Based on discussion with the U.S. Fish & Wildlife Service who manages the northern portion of the Horicon Marsh and the WDNR which manages the southern portion of the marsh, it is clear that neither entity is engaged in any sediment management, but rather maintain the habitat via water elevation manipulation alone. In a discussion centered around the structures which provide minor impoundment of the marsh, the two agencies largely employ

flow-through weirs which discharge at the bottom of the dam rather via spillway. Such an obstruction allows for both water and sediment to flow freely through the impoundment(s) which are largely near capacity or past their capacity to hold any more sediment.

Utilizing similar concepts employed at the Horicon Marsh the LSID and its stakeholder could consider management allocation directed at managing the River Corridor and the backwater areas independently. This would largely consist of two key management considerations:

1. Dam operations and Lake level control: The purpose of this approach is to maximize the hydraulic energy of the existing river flow to more effectively push sediment through the system in a natural way. This could be accommodated by lowering the lake level (up to 6" seasonally) and modifying the hydraulic operations of the dam in Hustisford. This approach would allow for a more natural flushing effect of the sediment load and slower accumulation time. Additionally, there would be significantly less cost to modify dam operations than undertake a multiyear dredging project.
2. Management of lake into back water areas: In concert with dam modification and seasonal lowering of the normal water level of Lake Sinissippi, LSID would endeavor to locally isolate the river corridor in local areas of the lake, creating more efficient sediment passage. The only difference between the Foth-Stantec approach (Figure B14) and the allocation management approach (Figure B15) is the amount of sediment utilized and additional lost open water. The Rock River corridor and the backwater zones would be locally separated by an elevated zone of heavily vegetated lakebed. The purpose of this area will be to act as vegetative filter wall to separate

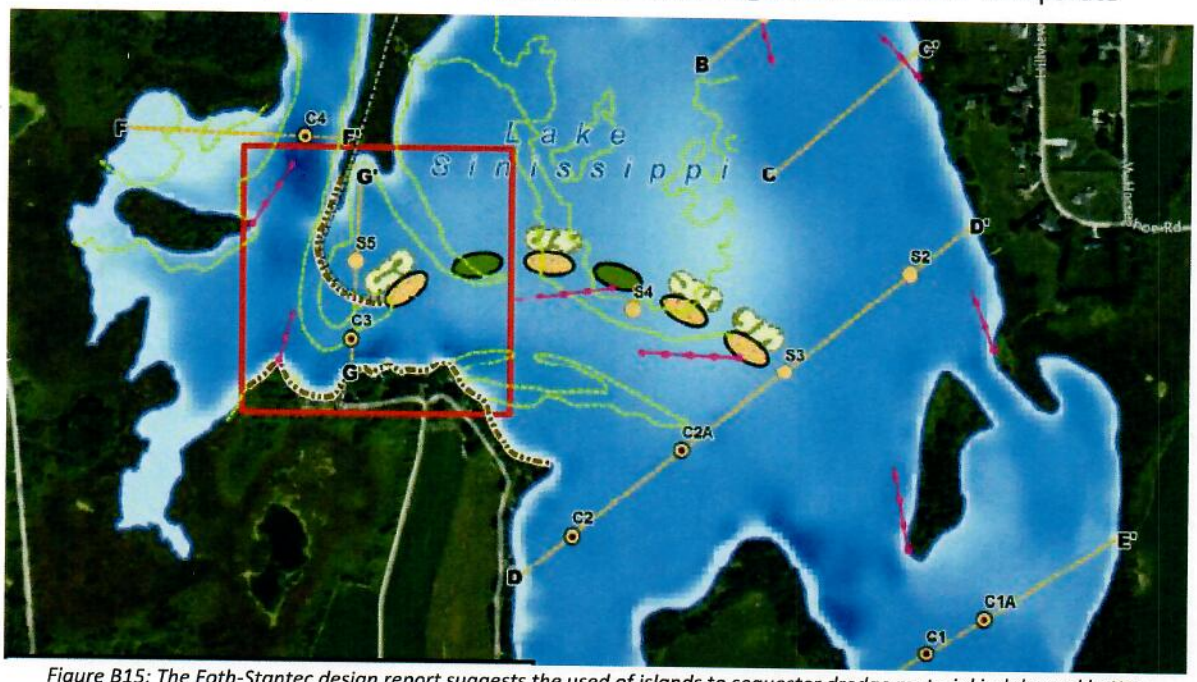


Figure B15: The Foth-Stantec design report suggests the used of islands to sequester dredge material in-lake and better facilitate movement of sediment downstream into the lake.

suspended sediment from the river during short periods of high water, manage wind resuspension, create habitat zones and assist in hydraulic conveyance of the sediment through the system. See Figure B15-B17. Separation of lake via the geotube project in 2005 showed the effectiveness of system disconnection in improving clarity.

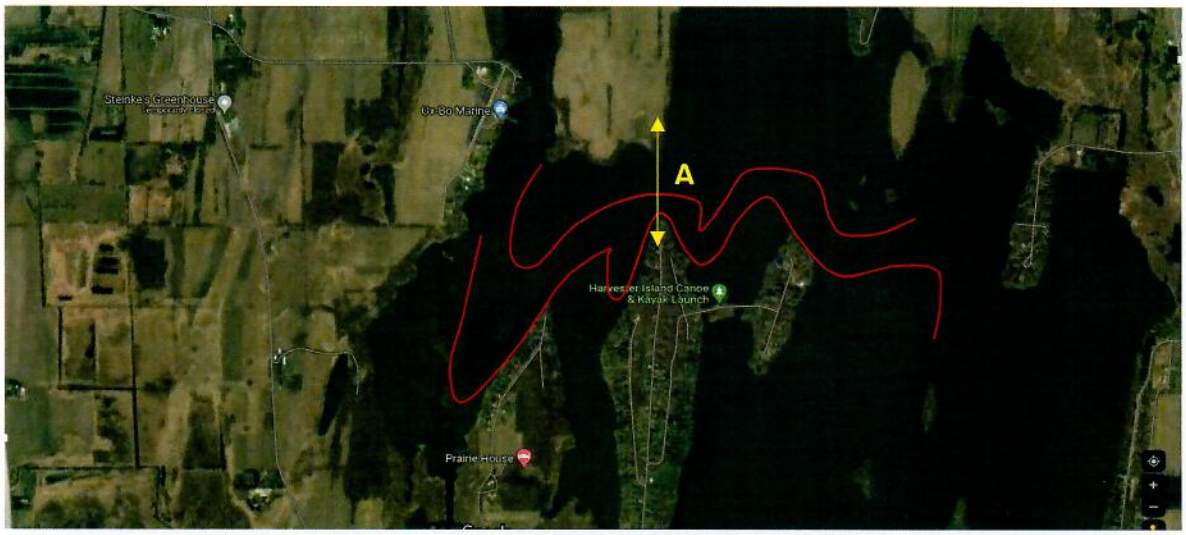


Figure B16: Allocation management as presented within this LMP simply provides a less expensive alternative to the Foth-Stantec approach, committing less money to in-lake sediment storage while continuing to promote sediment transport.

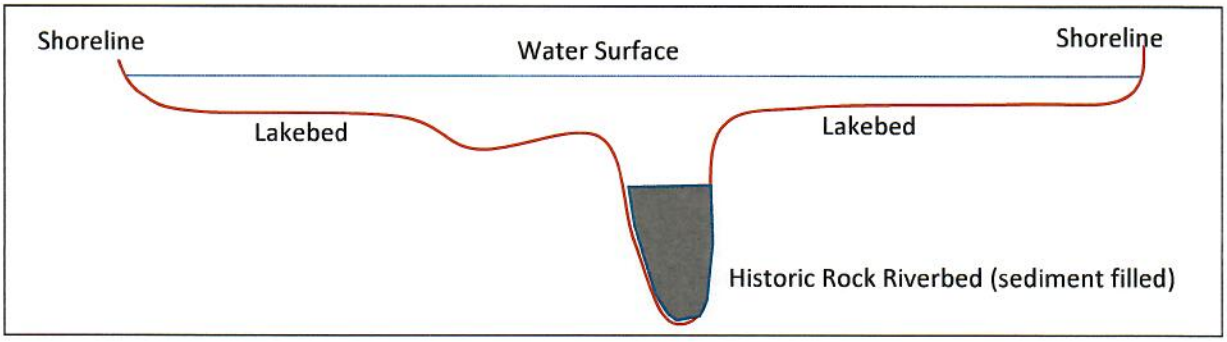


Figure B17: Existing cross section 'A' as represented in Figure B15. Historic river channel filled with sediment and indistinguishable from Lake Sinissippi lakebed.

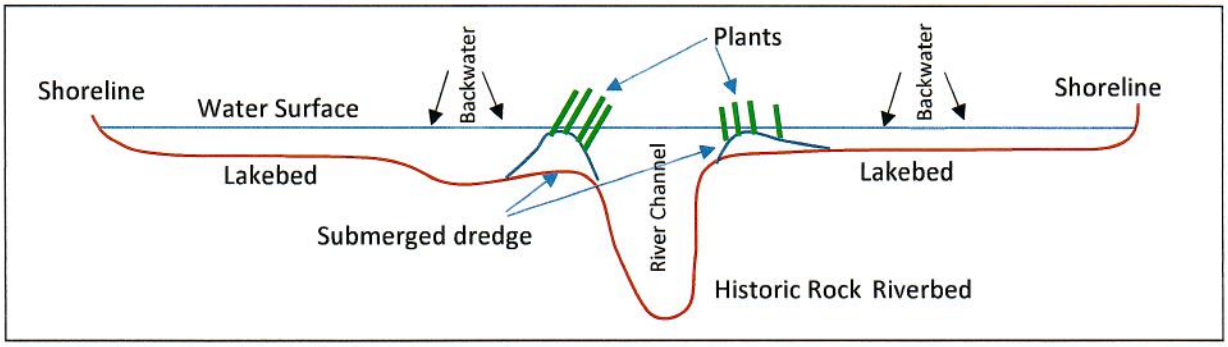


Figure B18: Proposed action to wall of channel sediment from lake with underwater placed sediment embankments. The embankments can serve as access for equipment to maintain river channel depth.

By allocating system resources and employing water surface changes (both temporary and potentially permanent), dam operation modifications, strategic dredging coupled with sediment management, and vegetative management can serve as tools for the management of Lake Sinissippi. This approach once established allows for a much more passive means for sediment management using water level and vegetation as a control mechanism much like the way the Horicon Marsh is managed. Much like Management Option A., above, it would be advisable to undertake a scaled project to better understand the feasibility on lake wide application, entertain feedback from residents, and ultimately the DNR from a permitting and management perspective. In many aspects the option considers beneficial concepts from the 2005 geotube habitat enhancement project and the Foth-Stantec design to centralize the hydraulics of the Rock River, for better sediment mobility and increased in-lake habitat.

Bedrock Ledge – The outlet for the lake is the formal dam located approximately 1,600 feet downstream of the main portion of Lake Sinissippi in a channel reforming the Rock River. Throughout the years, notation of a historic rock ledge was discussed near the outlet of the lake immediately upstream of the channel outlet. While the rock ledge can have some localized implication for sediment management near the outlet and south end of the lake at this time it is believed to have minimal bearing on sediment hydraulics on the northern end of the lake. This could change as lake improvements are implemented. Further discussion is provided in Section 4: Water Level Management Guide, portion of this LMP.

Table B.2: Long Term Sediment Management Options – Decision Matrix

A. Investment in In-Water Management

Pros	Cons
• Minimizes sediment handline cost • No need to design off site facilities • Sediment can be used to enhance habitat • Works to address sediment passage	• Increased permitting costs and timelines • Increased maintenance costs • Reduced open lake area

B. Invest in Land Management

Pros	Cons
• Technically most cost-effective measure for sediment management per acre • Little to no reliance on in water activities • Plenty of farmers and Ag programs- cost subsidized	• Does not address sediment already in Lake Sinissippi • High degree of agricultural interaction necessary • Results may not be easily observed • Does not address sediment passage

C. Traditional Sediment Management

Pros	Cons
• Accomplishes a direct, focused need • Addresses needs a project develops	• Non-prioritized approach • Typically addresses the result, not the source • Can lead to inefficient use of funds and limited project returns

D. Hybrid/Balanced Management of Land and Water Options

Pros	Cons
• High flexibility • Land availability for land processing options	• Will require need to permit and design project on land and in water • Does not address sediment passage

E. Allocation Management

Pros	Cons
• Habitat enhancement • Wind control • Maintenance access • Can use approaches from all options • Cheaper cost to develop similar concept to Option A • Helps address sediment passage	• Requires both in-lake and on land sediment management • Areas of lake with restricted depth • Will require changes to boating patterns

Recommended Approach and Action Items:

Given the constraints of a realistic budget, LSID must carefully consider the available options and choose an approach that aligns with their goals, priorities, and budget. No approach will be perfect, and the best approach may not be an alternative that LSID can immediately afford, therefore the chosen approach may be balanced, aggressive towards land management, or focused on a large project. If LSID cannot immediately afford the best approach, it should consider a phased implementation plan. This allows for progress to be made over time, with smaller projects or initiatives initially, while building towards the desired long-term approach that achieves the LSID goals.

Options A and D present similarities with and added emphasis on sediment passage. Option C presents a slightly more traditional approach. Option B identifies ways of keeping sediment out of the lake. Option D presents options which will require elements of Option C as well. Option A as presented earlier to the LSID constituency was voted down but is still a viable

option. No recommendation in itself will be perfect, and all options will result in the need to obtain funding and provide continual oversight.

LSID Sediment Activities Timeline: Since the undertaking of any significant sediment management project will require the expenditure of significant funding, establishing a consensus approach early as possible will be valuable.

August 2023: Introduce sediment management approaches at annual meeting. Approach will consist of two themes:

1. Long term approach: Decision matrix suggestions from A-D above.
2. Short term project: Investment in a significant, singular project focused on sediment removal or management focused on navigational improvements. Suggested projects are further identified below in Section B.6.

September 2023: Tabulate votes to establish common goals and cohesive approach. This process will be considered a de facto approval of the plan by LSID and its constituents.

October 2023: Document decision approach in LMP and submit for approval to WDNR. This includes decisions for both long term and short term and be informed by feedback from WDNR.

November 2023: Develop group understanding for initiating pathway for existing funding on long term approach and proposed funding for short term project.

January 2024: Launch campaign for short term project, consider application timelines of budgeting allows.

June 2024: Assess success of campaign, initiate conceptual designs and costs for short term project. If island approach selected, consider proceeding to preliminary design and pre-application with WDNR. Consider opportunity to apply to Recreational Boating Facilities Grant (RBFG) in September or complimentary funding from Surface Water Grant (SWG) program in November.

August 2024: Assess with stakeholders financial progress, any discussions with WDNR, conceptual or preliminary design(s), and estimated costs. Approval to apply for RBFG funding.

January 2025: Assess status based on results of grant application.

Section B.6 – Short Term Sediment Management Projects

Any of the following significant project could be considered for short term implementation:

1. Island Development – Advancement of Stantec-Foth Island Conceptual Design: either at the originally implied location or at an alternate location such as the sediment bottleneck identified closer to Oxbow Marine. Adjusted for today's cost the estimated funding to undertake the project as suggested is:

a. *Phase 1: (17,000 CY), $2.2M adjusted to today's costs*
b. *Phase 2: (20,000 CY), $2.6M adjusted to today's costs*

Timeline (Phase 1 only):

Year 1 – Use existing concept as proof of design (WDNR acceptance): $20K
Year 2 – 60% design, permitting: $85K
Year 3 – Final design, bidding: $45K
Year 4 – Construction: $2.05M

2. Rock Ledge Modification: The LSID has commissioned work to positively identify the extents and depth of the rock ledge which resides near the channel outlet of the lake. Initial work has been inconclusive, but it is evident that an obstruction exists between the lake outlet and channel upstream of the dam. Lowering or removal of this obstruction should have a positive impact on sediment passage from Lake Sinissippi, although the exact magnitude is unknown. The goal of the project would be to lower the rock ledge to the elevation of the outgoing Rock River Channel. The cost assumed the ledge is conclusively identified. *Estimated cost: $425,000*

   Timeline:

   Year 1 – collect data, conceptual approach, and design (WDNR acceptance). Upon acceptance continue to 60% design: $70K
   Year 2: Permitting and final design, bidding, and construction: $355K

3. Sediment removal traditional: This effort would be focused on navigational improvements at the north end of the lake as suggested in Figure B5. Removal would likely be hydraulic dredging or mechanical dredging using amphibious equipment. Material would be barged (mechanical) or pumped (hydraulic) to a nearshore area for dewatering and disposal. *Estimated cost: $2.8M for 50,000 CY of navigational dredging*
   Timeline:

   Year 1 – collect data, conceptual approach, and design (WDNR acceptance). Upon acceptance continue to 60% design: $85K
   Year 2 – Permitting and final design, bidding: $55K
   Year 3 – Construction: 2.6M

4. Sediment removal hybrid: This approach suggests the implementation of #3 above with ala carte options as suggested below through Allocation Management:
   a. *Baseline cost (#3 above): $2.1M for 50,000 CY of navigational dredging*
   b. *Development of reusable sediment dewatering facility (SDF): $880,000 (offsets sediment disposal costs from #3 above)*
   c. *Optional: Raised vegetation for sediment passage: $350,000 (further reduces sediment disposal costs)*

   Timeline:

Year 1 – collect all data, conceptual approach/design (WDNR acceptance): $115K
Year 2 – 60% design, permitting for SDF: $75K
Year 3 – 60% design and permitting for dredging activities, final design, and bidding for SDF: $75K
Year 4 – Construction of SDF, final design, and bidding for dredging activities: $715K
Year 5 – Construction (in-lake dredging activities): $2M

It is important to remember that conceptual design for #1 has been undertaken and includes concepts of island building and sediment passage although it has not been reviewed with WDNR or other regulatory agencies. #1 and #4 have more elements and cost, as they are likely phased, multiyear projects. Multiyear projects can be 2 or more years. This applies to construction only. All projects will be multiyear when considering planning, engineering, permitting, and construction.

Section C.1: Introduction and Background

The Lake Sinissippi Improvement District (LSID) recognizes the importance of enhancing and preserving the value of the shoreline and nearshore areas of Lake Sinissippi. The shoreline not only contributes to the aesthetic appeal of the lake but also provides numerous ecological benefits. There are 42 miles of shoreline within Lake Sinissippi (WDNR, 1971), of which only 10 miles have been developed (Hey, 2005). This represents a significant asset to the stakeholders of the lake and provides positive impact on property values, as many residents and visitors value the scenic beauty and tranquility of a lake with an unspoiled shoreline. By maintaining the natural state of the shoreline, the LSID ensures that property owners can continue to enjoy the ecological, physical, and aesthetic benefits associated with a healthy shoreline. By developing a Shoreline Habitat Improvement and Protection Plan (SHIPP), the LSID demonstrates its commitment to sustainable lake management and long-term health of Lake Sinissippi. This plan will hopefully provide a roadmap for preserving and enhancing the shoreline's ecological value, ensuring that future generations can continue to enjoy the benefits it provides.

Shorelines can be influenced by several factors. For example, eastern shorelines or reaches of the lake with a long prevailing fetch can be largely impacted by prevailing winds and potential ice heave in early winter and during spring thaw. Certain popular recreational boating areas can be impacted by repetitive wake action during heavy boating periods. Continual high water can oversaturate soil and influence plant mortality. Plant mortality can lead to unstable soil and slumping shorelines if plant communities are not adapted to variable conditions and the changes yet to come.

It should also be noted that for the sake of this SHIPP, "vegetation" from a general sense is typically intended to refer to native vegetation which is natural to Wisconsin and furthermore to the ecoregion in which Dodge County resides (Southeastern Wisconsin Till Plains). While other vegetation exists, they may be further identified as invasive or ornamental suggesting they are not natural to the area and provide little to no benefit directly to the local ecosystem either as a food source or an ecological habitat enhancement. It is important to also understand State and local ordinances regarding these plants as it may be illegal to plant such species unless specifically acquired from licensed or certified providers.

In May 2023, LSID Volunteers performed a shoreline inventory of Lake Sinissippi (Figure C1). The inventory extended from the Hustsiford Dam at the very south end of the lake to approximately 7,000 feet downstream of County Road S, where the shoreline is primarily unaltered. The shoreline was inventoried and classified as being:

1. Natural – unprotected shoreline
2. Stone Riprap – good condition

3. Stone Riprap – poor condition
4. Bulkhead – good condition
5. Bulkhead – poor condition

Using this inventory, LSID can work with lake stakeholders to prioritize and evaluate properties well suited for grants or other cost share arrangements which are likely to harbor successful installation and ongoing stewardship by the owner or other partner. Property owners consist of private property owners, businesses, and local government. Any investment made by one property benefits the watershed, lake, and downstream properties.

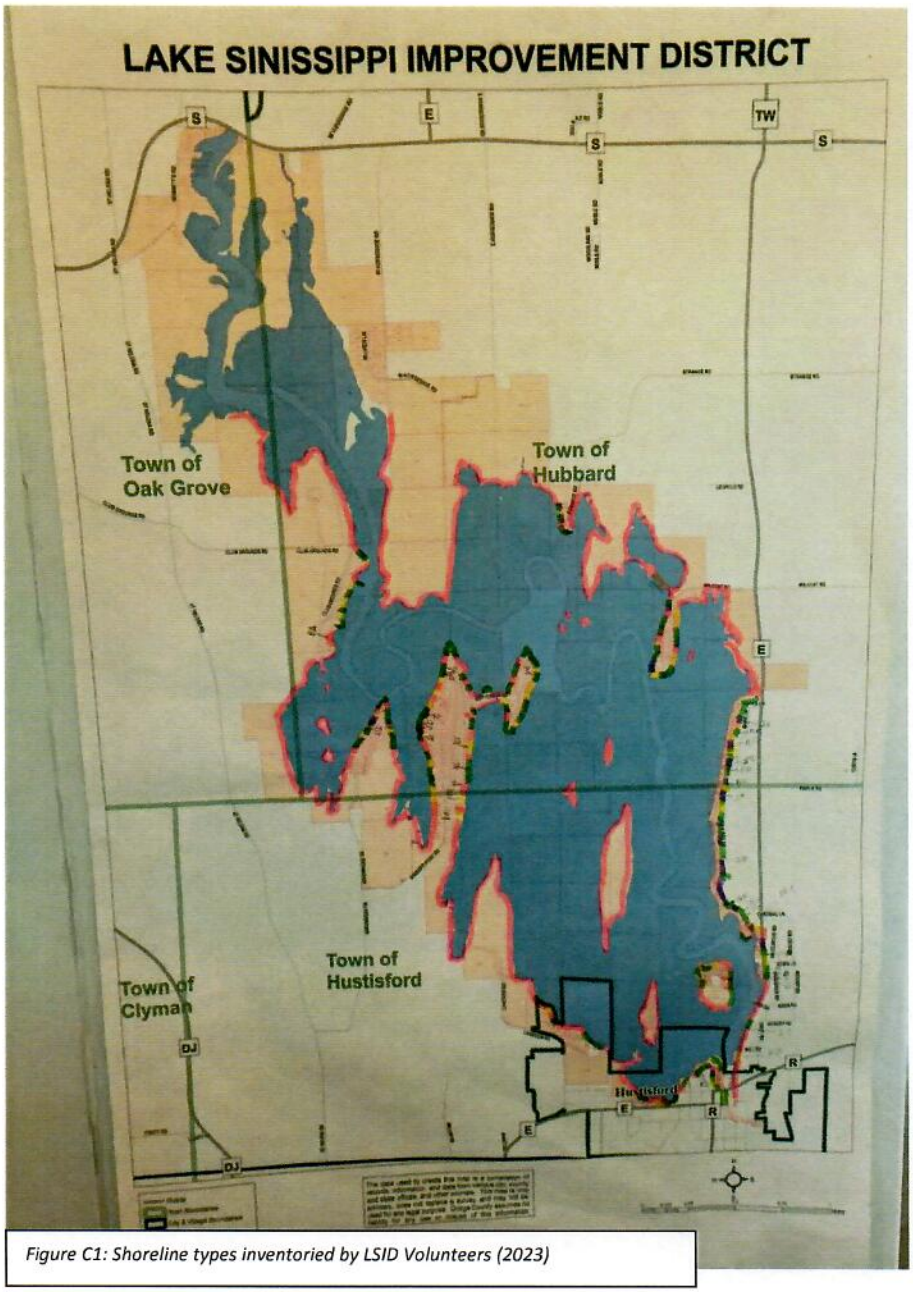


Figure C1: Shoreline types inventoried by LSID Volunteers (2023)

LSID hosted a "Shoreline Stories" planning session on October 29, 2022, at the Hustisford Library (event flyer in Appendix C1) to get direct input from shoreline property owners and other interested lake stakeholders to identify specific trouble areas on Lake Sinissippi that might be identified within the LMP and considered for project prioritization. Property owners expressed concern over disappearing shoreline and falling trees and vegetation.

LSID hosted a second session on February 28, 2023, to obtain additional feedback. There was growing concern and sentiment regarding

the location and proper identification of the historic stone ledge and what role it might play in managing water level, and ultimately the management of sediment and the lake's shoreline.

While many of the management objectives of this LMP have interrelationships, the findings of the rock ledge are discussed in further detail in Section 2 and 4 of this LMP. For the benefit of the SHIPP, the focus will remain on the identifying areas of the lake and their benefit to the property owner, LSID, other lake stakeholders and the overall water quality benefit to Lake Sinissippi and the Rock River Basin. This will include looking at simplistic and reproducible shoreline treatments that can be installed economically with historically successful results and high ROI and owner acceptance.

The following tables below were developed with assistance from LSID, property owners and information collected by LSID volunteers who performed the field inventory.

Section C.2: Typical Shoreline Treatment(s)

The SHIPP for the purpose of this LMP is based on protection and restoration. For this reason, projects which do not provide at least the minimal amount of habitat protection or enhancement are of little value to the LSID. Furthermore, to qualify for State matching funds, any shoreline project will need to provide a benefit to the general public and not just the private property owner. Seawall, concrete bulkheads, and revetment would therefore be discouraged for cost share dollars. Typical projects that might be encouraged by LSID would fall under one of three general categories:

1. Conditional hardscape practices (riprap): Typical vertical shoreline bulkheads would be generally discouraged as they generate little benefit to the biological community. Bulkheads refer to formed concrete wall, sheet pile or seawall, and other abrupt, vertical treatments specifically placed to hold the shoreline (either structural or non-structural). Sloped riprap is considered a viable hardscape that can provide beneficial energy dissipation and minimally functional substrate for biological interaction. For this reason, it is an armoring technique that can be sought after for reimbursable grant dollars.

Figure C2: Conventional Riprap (left) and flagstone (right used for shoreline protection.

2. Soft practices: Utilization of practices that are intended to mimic the natural environment are often categorized as soft or native practices. Such practices can consist of artificial media, native seed and plants, or slope regrading with a combination reestablishment of shoreline appropriate plants. Soft practices, while highly encouraged are not always site appropriate. Wind and wake activity can make vegetative reestablishment difficult at specific locations and therefore working with an experienced ecologist or botanist can identify site appropriate plant species to improve the likelihood of success. As vegetation is reestablished, monitoring of plants for mortality and invasive species becomes and important aspect in long term success.

Figure C3: Coir fiber logs used to protect a sensitive habitat area.

3. Bioengineering: Incorporating a mixture of armoring with ecological enhancements, particularly vegetation and rooting structure has become highly preferred and shown to provide a degree of resilience that #1 and #2 are unable to provide singularly under most circumstances. While bioengineering is unnatural in the way that it is manmade construction, the use of materials used is largely consistent with native materials such as stone, wood, soil, and vegetation. The foundation of most shoreline bioengineering is typically stone, interlaced with wood and vegetative components wrapped in soils to encourage growth and natural connectively of roots systems to soil and stone. The foundation stone is typically referred to as the "toe" stone and the soil and vegetation on top is sometimes referred to as the "lift". An example is shown in Figure C4 below. Many property owners who utilized bioengineered shoreline practices have found a more "walkable" shoreline after the project was completed. The stone placed beneath the vegetation appears to provide a more stable shoreline foundation that is less susceptible to deflection.

Figure C4: Bioengineering base during installation (left) and establishment of vegetation atop base (right).

Design Considerations: Reasons for protecting, restoring, or even enhancing the shoreline and near shore lake zones can vary amongst various property owners, regulators, environmental enthusiasts, and other stakeholders. These reasons can be driven by need to protect against loss, desire to enhance habitat or views, or in some instances improve access. Regardless of the desire to improve, understanding the needs and limitations are important considerations in the proper application or treatment applied. Furthermore, if the improvement is not properly maintained, chances for long term sustained success of the improvement is unlikely. Below is a list of basic design considerations:

1. Erosion control: erosion in and around the lake can come from both the lake and landwards sides. In some instances, both must be considered. The WDNR has tools to help mitigate simple drainage and shorelines further described later in this Section.
    a. Erosion source landward: Through the course of home ownership, many property owners find themselves working with lot drainage issues, modifying, and managing how water ultimately leaves and enters the lake. It is important to manage concentrated flows so as not to make them problematic. Simple things such as downspouts and patio transitions concentrate water but can also generate enough energy during storms to mobilize sediment and transport it to the lake.

Figure C5: Basic yard erosion that can make its way to local waterways.

b. Shoreline erosion: While waves and wake are typically a central theme that attracts most of the attention, simple property owner decisions can minimize this impact. Growing turf grass to the waters edge makes shorelines less resilient due to shorter root systems. Additionally appropriate plant species along the shoreline that are less resistant to dieback due to persistent high water are preferred. Exposed shorelines can become even more exposed when root systems are absent and spring thaw pushes sheets of ice against unprotected property.

Figure C6: Turf grass grown to the water's edge provides little support (photo credit: Clemson University).

c. Water clarity: The transparency of water is important on multiple fronts. Lack of water clarity favors non-predator species as many larger game species are reliant on sight to locate their food source. Water clarity has also been shown to enhance the value of waterfront property. With increased light penetration, nearshore vegetation, such as aquatic plants and algae, can thrive and grow more vigorously. These plants play a crucial role in stabilizing the substrate or bottom of the lake. Their roots and shoots help anchor the sediment, preventing erosion and maintaining the integrity of the shoreline.

2. Wave and wake protection: There are limited best solutions available to best address wave and wake impact. Traditional bulkheads have been commonly used in the past, but they can have both direct and indirect impacts on the in-water environment and adjacent properties. Research has shown that rip rap, coupled with bioengineering techniques, can offer a more balanced approach to wave and wake protection while providing ecological benefits. Rip rap refers to the use of large rocks or stones placed along the shoreline to dissipate the energy of waves and wakes. This helps to reduce erosion and stabilize the shoreline.

   Minimal design considerations can include:

   a. Lateral migration: Shoreline lateral migration typically occurs slowly over time, making it somewhat elusive to identify. In many cases it may take several years for a shoreline to move only one foot. This makes the impact difficult to assess

and at times even more difficult to document. Lateral migration is often the result of cumulative impacts associated with wave, wakes, and high water leading to soil loss and vegetative mortality, ultimately causing the shoreline to slough into the water.

b. Wave height: The WDNR requires the determination of wave height for most hard armoring applications, including bioengineering practices. The value of the exercise can also help owner better evaluate the wave height and not overpay for more stone than is needed. Wake height is not as easily determined. Local understanding or rules, typical vessels sizes, style and speed help determine wake height. In some local studies, wake heights have been shown to persistently reach crest elevations 25%-50% higher than that of typical wave depending on location. This can be an important factor in developing appropriate height for protection.

c. High water: Climatic shift has been documented to have increased precipitation both in volume and intensity. While retrofitting or adapting existing fixed infrastructure can be challenging and costly, it's important to prioritize resilience and consider the long-term impacts of changing rainfall patterns. Therefore, more rain takes a continually longer period to draw down lake levels. This can lead to impacts to existing vegetation mortality and less protected shorelines. To address this issue, it may be necessary to carefully assess the suitability of the existing vegetation for the new conditions created by wave and wake protection measures. Some plants may be more resilient and adaptable to the changes, while others may struggle to survive. In cases where the existing vegetation is not well-suited to the new conditions, it may be advisable to consider the placement of more appropriate vegetation species. Selecting plants that are tolerant of wave and wake impacts, such as certain types of native grasses, shrubs, or aquatic plants, can help ensure their survival and provide the necessary ecological benefits.

3. Habitat enhancement: Lake Sinissippi still enjoys a large majority of undeveloped shoreline. There is a large population of avid fisherman, and while accounts indicate that the fishing is good, the necessity for stocking typically indicates an inability to facilitate a self-sustaining fish population. Enhancing nearshore habitat can be beneficial for a range of fish species, including game fish. Providing a variety of habitats, such as submerged vegetation, underwater structures, and shoreline cover, can support the different life stages and feeding habits of various fish species. By creating a mosaic of habitats, the lake can support both game fish and other species.

    a. Forage: Near shore habitat and littoral areas are a critical space for young-of-the-year (YOY) fish. These are the post hatch growth zones for immature fish species to eat and develop into viable predators. These areas need cover and be attractive to invertebrates and other sources of biological activity to favor a habitat conducive to growth and development. New areas can be explored, and existing ones should be protected or enhanced. These are not only important for game

fish development, but also small minnow-like species that serve as food sources to so many fish and avian species within the lake.

b. Spawning: Like forage areas, spawning areas are often ignored and tend to be species specific. By investing in the creation of spawning habitat, instead of spending funds on yearly stocking, LSID can creating suitable spawning habitat that can provide the necessary conditions for fish to reproduce and contribute to the long-term sustainability of the fishery. WDNR fisheries biologists are an excellent resource to access should LSID consider shoreline improvement projects to support spawning game fish.

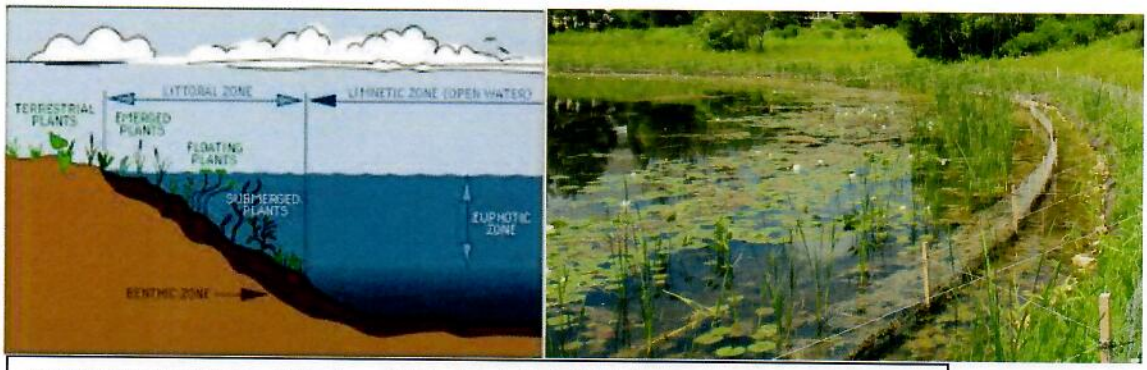


Figure C7: Graphic depiction of littoral zone (left) and photo (right), (left photo credit: UW Stevens Point).

4. Aesthetic beauty: Flooded river bottoms and marshes have a natural beauty to them which are further enhanced by a wide variety of wildlife. It is not until humans develop these areas when this beauty becomes fragmented and unnatural. Below are a few considerations for how aesthetics can play into the design of shoreline protection and enhancement:

    a. Viewshed: the geographical space that is visible from a fixed location is referred to as the viewshed. The is the value of the natural view versus the look and feel of a parking lot. To some open water and an uninhibited view of the shoreline is ideal, to others the look of nature maximized on the shoreline has a greater aesthetic appeal. These near shore areas attract wildlife and serve as habitat for shallow water species including enhancement of forage for YOY. Regardless of whether this area is sloping or gentle in grade, solutions exist to protect and enhance this space. WDNR has money to enhance these areas and additional information to landowners wishing to take advantage of this program.

Figure C8: Example viewshed, (photo credit: ScenicHudson.org).

b. Property value: Native or vegetated shorelines offer a more natural and scenic view compared to bare or developed shorelines. The presence of trees, shrubs, and other vegetation provides a visually pleasing landscape that enhances the overall aesthetics of the shoreline. Many property owners and potential buyers appreciate the beauty and tranquility of a naturalized shoreline, which can contribute to higher property values.

Ideally a solution exists that encompasses many of the treatment ideas that area suggested above, but that may not always be the case or the actual desire of the property owner. Certain aspects can be undertaken as an informed lakeside property owner if desired, however, for more technical or large-scale projects, partnering with the LSID and knowledgeable professionals is indeed advisable.

Section C.3: Funding Programs

The State of Wisconsin has available funding that can be acquired for larger improvement projects down to the individual homeowner level. These are cost share reimbursement programs facilitated through the WDNR Surface Water Grant (SWG) and Healthy Lakes & Rivers program. While all three practices listed above in shoreline treatment are acceptable approaches which may qualify for grant dollars under funding programs listed below, #2 and #3 will almost always outscore the conventional hardscaping of #1, however #3 will be most costly on a per unit basis. Treatment type #2 is highly preferred and typically the least expensive on a per unit basis but may not provide the protection of a resistant toe unlike #1 and #3. This has led to the popularity preference for bioengineering practices as tool that can uniformly provide stability and energy

dissipation as well as a maintain a stand of vegetation if constructed properly and maintained appropriately.

Surface Water Grants: https://dnr.wisconsin.gov/aid/SurfaceWater.html

Surface Water Restoration and Management Grants are a specific grant within the Wisconsin SWG program and provide an excellent funding mechanism for shoreline restoration and/or enhancement. They should not be confused with invasive species grants which is another source of grant funding altogether. These grants provide a much-needed benefit for scalable projects that sometimes need consulting assistance and permitting to complete. These may be projects that include a bioengineering element, analysis, prolonged stewardship or are otherwise more complicated to take on by a singular property owner. They can include projects that can be funded up to nearly 75K considering the necessary financial or in-kind match. These grants are typically due in November based on the current SWG cycle.

Healthy Lakes & Rivers Program: https://healthylakeswi.com/

This grant exists as a specific pool of money to promote and encourage individual landowners to undertake improvement projects for the betterment of lake and river water quality. Allowable projects include one of five "best practices" 1)fish sticks (in-water habitat); 2)Native Plantings (shoreline); 3)diversion (lot drainage); 4)rock infiltration (lot drainage); 5)rain garden (lot drainage- water quality). The focus of this grant is self-improvement but there are numerous tools included in the award to provide homeowners advice and additional staff resources when needed.

In addition to public funding sources, LSID could consider themselves as a funding resource to local cooperators, applying a varying return based on the identified opportunity. The cost

Identify shoreline opportunities for stabilization (riprap): $2/foot

Identify shoreline opportunities for restoration (approved soft practices): $1/foot

Identify shoreline opportunities for stabilization and restoration (bioengineering): $5/foot

Additionally, LSID can serve as a project sponsor (Delavan Example).

Section C.4: Recommended Approach and Action Items

This SHIPP is intended to simplify the shoreline stabilization and restoration process at Lake Sinissippi. With so much shoreline at risk, it is valuable to streamline a process for stakeholders that provides them access to resources and information that can help them make a decision and is ultimately supported by the LSID and the constituency of the local lake community.

SHIPP Prioritization

The Shoreline Erosion Report of 2005 provided a blanket perspective of the potential for shoreline erosion throughout the lake but did not provide much guidance to the LSID, shoreline property owners, or other lake stakeholders on how to best prioritize, which can be highly subjective based on opportunity, costs, risk, and willingness to participate in the recommendations of the SHIPP. With finite financial resources, the LSID will not often be able to buoy projects through monetary contributions, but rather through educating individual property owners on the value each section of shoreline has to protection of localized habitat and the general ecology of the lake. In many instances the burden to improve the shoreline to address erosion of lost property (both physical and value-wise), will be highly incumbent on the specific property owner.

Utilizing the current, identified shoreline types, the following prioritization matrix will be utilized:

1. Prevailing eastern shoreline (1 point): prevailing wind in WI is west to east.
2. Poor stone rip rap (2 points): provides bioengineering opportunity, stabilization, and habitat component.
3. Poor bulkhead wall (1 point): stabilization opportunity
4. Unprotected shoreline, with evidence of horizontal movement/migration (2 points), stabilization and habitat protection opportunity.
5. Unprotected shoreline adjacent to bulkhead wall (1 point): protection against adjacent shoreline wave echo.
6. Good stone rip rap (1 point): candidate for bioengineering habitat enhancement.
7. No previous funding (1 point): higher likelihood for funding success.
8. Greater than 100 feet of contiguous shoreline (2 points): higher return on investment.
9. Public property (2 points): higher likelihood of implementation success.
10. Other documented or supported gradatory issue (1-2 points max).

Highest score does not suggest lower scores do no make good projects. High scores not only indicate potential for degradation but also likelihood for success and continued stewardship. Not all shorelines qualify for all points, but the higher the composite score the more support recommended for the project and education to owner. For example, a greater than 100-foot section of poor riprap owned by the Village of Hustiford, located on an eastern shoreline could score as high as 8 points assuming it has never been funded for a shoreline project by the State of Wisconsin. Additional considerations could be provided under #10 above.

SHIPP Timeline

Once projects have been identified, the SHIPP would operate on an annual cycle. The LSID can act as a sponsoring entity to assist in the application and stewardship of prioritized shoreline projects with minimal financial obligations or may participate with higher engagement based on available funding. The forward mission of the SHIPP should be enabling stakeholders to realize the benefit of protecting their shorelines from a personal and holistically beneficial manner. The LSID can then dictate what level of participation they can provide based on stakeholder interest

on an annual basis. Based on the proposed SHIPP, below is the proposed annual approach to shoreline management.

- January 2024 – Develop GIS version of shoreline by type (based on LSID volunteer inventory): *Cost $1,500*
- March 2024 – Host Map online through website: *LSID Cost* (N/A)
- May 2024 – Host informal meeting for property owners identified in prioritized shoreline area(s): *Cost $200*
- July 2024: Discuss opportunity for LSID sponsored bulk shoreline or large shoreline grant with WNDR (LSID would sponsor the application and serve as fiscal agent, but not fund the projects)
- August 2024: Prepare application for identified property owners (optional): $2,500
- October 2024: Finalize decision for shoreline projects
- November 2024: Submit for DNR Surface Water Grants to support identified prioritized shoreline projects.

Section D.1 – Introduction

The surface water elevation in Lake Sinissippi is controlled by the Hustisford Dam located approximately 480 feet downstream of Tweedy St. Its daily and long-term operation is facilitated by the Village of Hustisford who owns the dam. The structure is approximately 160 feet wide and consists of an 82-foot spillway and two (2) 37-foot adjustable gates. Engineering design plans are included in Appendix D1. The depth of impounded water behind the dam is 7 feet per WDNR inspection records. The current normal pool level of Lake Sinissippi is 97.70 Mean Sea Level (MSL). The main components of the dam are depicted in Figure D1 below. Per the dam's inspection schedule, it was last inspected in 2013 and is currently on a 10-year inspection cycle. A copy of the last inspection report is provided in Appendix D2.

Protocol for managing the level of the lake has been established for several years. The elevation of Lake Sinissippi can impact the hydraulics of the Horicon Marsh, and to that end any considerations for modifying the existing procedures for the water level of Lake Sinissippi would be required to undergo review by both the Village of Hustisford and formal approval by the WDNR. Precedence for establishing the normal pool operating level is provided in Appendix D3.

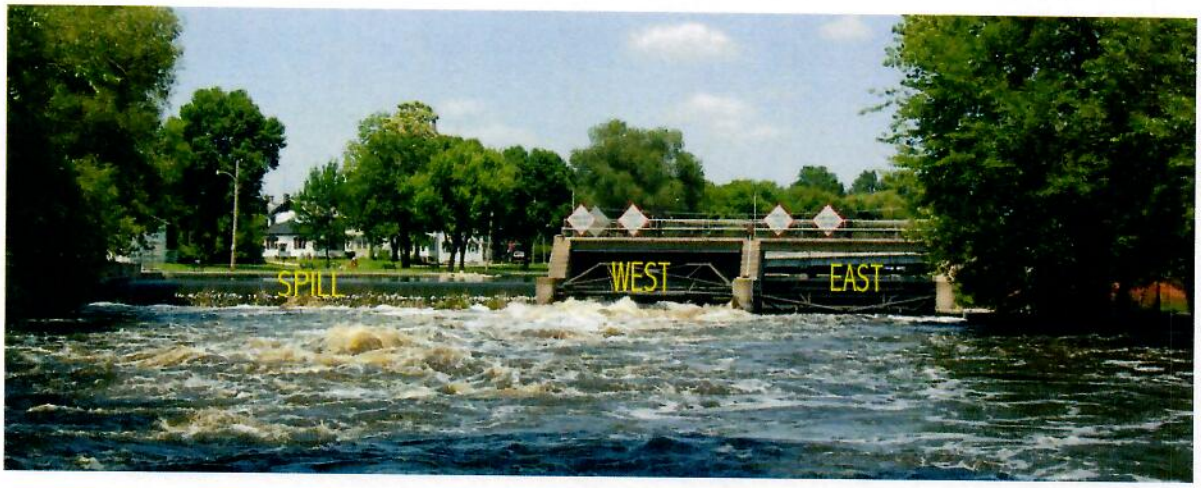


Figure D1: North facing image of the Hustisford Dam (Image courtesy of Village of Hustisford)

Water level plays an important part in the management of Lake Sinissippi, not only in the management of projects, but the function and ecology of the shoreline and near shore areas and recreational activities. Due to the landscape and topography of Lake Sinissippi, small fluctuations in water level can inundate and impact significant amounts of shoreline property. Information provided in the Horicon NWR Water Resource Inventory and Assessment (USFWS, 2014) highlights the impact of changing climate on the ecology of the Horicon Marsh, and the hydraulic changes beginning to occur in Lake Sinissippi. The LSID wishes to better understand protocols for managing water levels of the lake, with one immediate outcome of interest being the drawdown timing prior to ice formation to better manage piers, boat removal and shoreline care.

Section D.2 – Evolving Lake Dynamics

Increasing precipitation events have been documented throughout the State of Wisconsin over the last 56 years. Fond du Lac and Dodge Counties have shown an average annual increase in precipitation of 2.95" over the last half century (USFWS, 2014). The increase in precipitation within the watershed has resulted in increased stream tributary discharges to Lake Sinissippi and other reference streams within the Rock River basin (Figure D2). While the impacts are considered insignificant within the Horicon Marsh, the same cannot be said for Lake Sinissippi which relies on an established stage – discharge relationship at the Hustisford Dam and numerous lakeside residents that rely on a consistent water elevation for boating, pier placement, and shoreline protection. The dam spillway elevation and discharge relationship are fixed, and increased precipitation and runoff volume requires a longer time for the lake to return to normal water level between rain events. Longer drawdown periods result in longer periods of soil saturation which can have a detrimental impact on shoreline vegetation mortality and lakefront property stability.

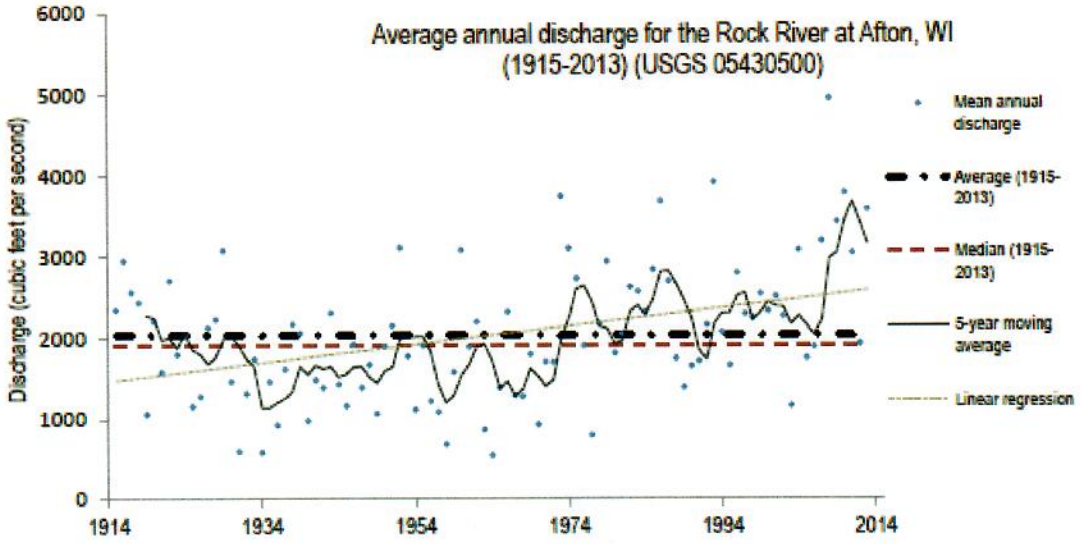


Figure D2: Demonstrated increase in average annual discharge on the Rock River

Sustained high water elevations put undue stress on existing shoreline plant communities which may take decades to adjust or acclimate to changing conditions. The plant communities along the shoreline of Lake Sinissippi play a crucial role in providing habitat and stabilizing the sediment. While not all shorelines in the lake may experience significant erosion, the continuous loss of vegetation can lead to gradual sloughing of the shoreline. Additionally, when water levels remain high for extended periods, there is an increased risk of wave action, which can have long-term effects on structures such as hard armor, bulkheads, and seawalls. These variables may undermine or cause settlement of these protective measures over time.

Also detrimental to the system is higher average annual temperatures leading to reduced annual ice cover. Records from the Wisconsin State Climatology Office show significant variability in the length of the ice-cover season, with a continuing trend towards fewer ice-cover days over time. As a nearby example, over the past 150 years Madison area lakes have shown decreased ice-cover days by over a month (https://www.aos.wisc.edu/~sco/lakes/msnicesum.html). Warmer temperatures also allow for more precipitation to fall as rain rather than snow, exposing new shoreline to wave action and ice heave. Residents have expressed concerns over loss of shoreline (property) which has also been lightly discussed within the Conceptual Design Report (Stantec, 2014).

Additional supporting evidence of climatic impacts to Lake Sinissippi include a rising water table (Figure D3). While the groundwater table may be 60-70 feet below land surface at referenced specific locations on the landscape, it rises to meet the surface at locations where water bodies exist (lakes, streams, rivers, and creeks). This supports the evidence of sustained and elevated water levels in Lake Sinissippi and elongated periods of shoreline oversaturation.

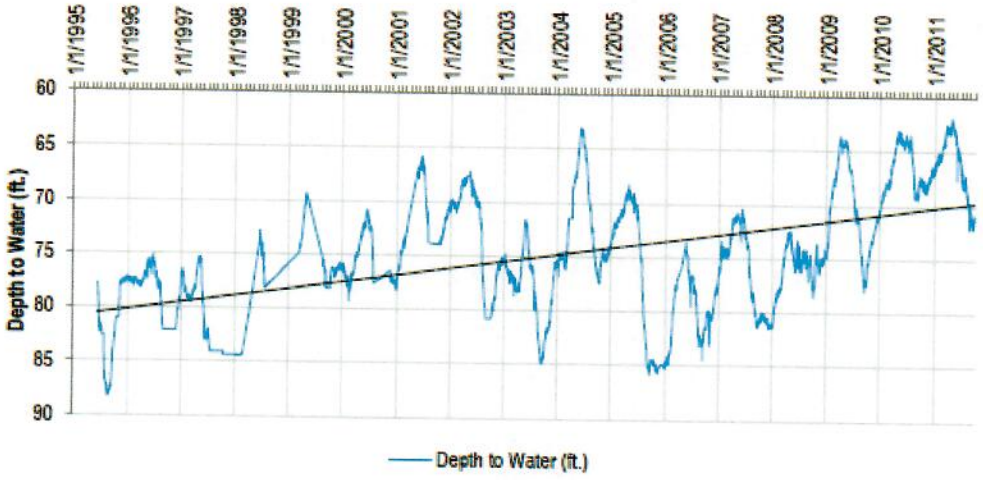


Figure D3: Depth to groundwater has risen significantly over a recorded 15-year span.

Although not the main purpose of this LMP, these conditions could support the consideration for future investigations into the time needed to drawdown to normal pool elevation and limit the potential impact that may be associated with sustained high water. Investigation into the benefits for seasonal lowering were previously investigated (Hey & Associates, 2005), but results proved to be inconclusive, with less than expected beneficial return. For the purpose of this section of the LMP, the primary goal is to understand the considerations for managing the normal pool elevation of the lake without needing to revisit existing studies. More importantly, documenting the process for typical lake drawdown, the timeline that might be necessary to establish this change and the time to perform the drawdown given normal hydrologic and hydraulic conditions.

Section D.3 – Lake Level Management

To better evaluate options to LSID for adjusting water level, meetings were held with representatives of the Horicon Marsh to evaluate the influence of Lake Sinissippi on the management of the marsh. Furthermore, the operation of the Hustisford dam needs to be better understood to enable sound decision making in facilitating requests through the Village of Hustisford (or WDNR) for temporary or permanent changes to standard operating procedure.

Village of Hustisford Dam Operations

An informational presentation was provided by Todd Tessman of Hustisford Utilities on behalf of the Village of Hustisford to LSID on November 8, 2022, to provide detail as to how the Village views their procedures. Any proposal the LSID wishes to put forward to the Village will be considered, however, for water level management to be modified, the public notice process would be required and need to be agreed upon by the constituency of Lake Sinissippi. Any requested changes can influence a number of in-place operational protocols and procedures, including hydraulic analyses, operational procedures, inspection and monitoring schedules.

Water level readings at the Hustisford Dam are limited with the last known recording in 2002. Gage records at the Horicon – Rock River Gage (USGS# 05424057) are inconsistent, with some data that reflect average discharge. Figure D4 shows the mean daily discharge from October 2021 to September 2022. The greatest inflow into the lake occurs with the spring snowmelt and then periodic episodic rain events that bring the Rock River above its baseflow (325 cfs).

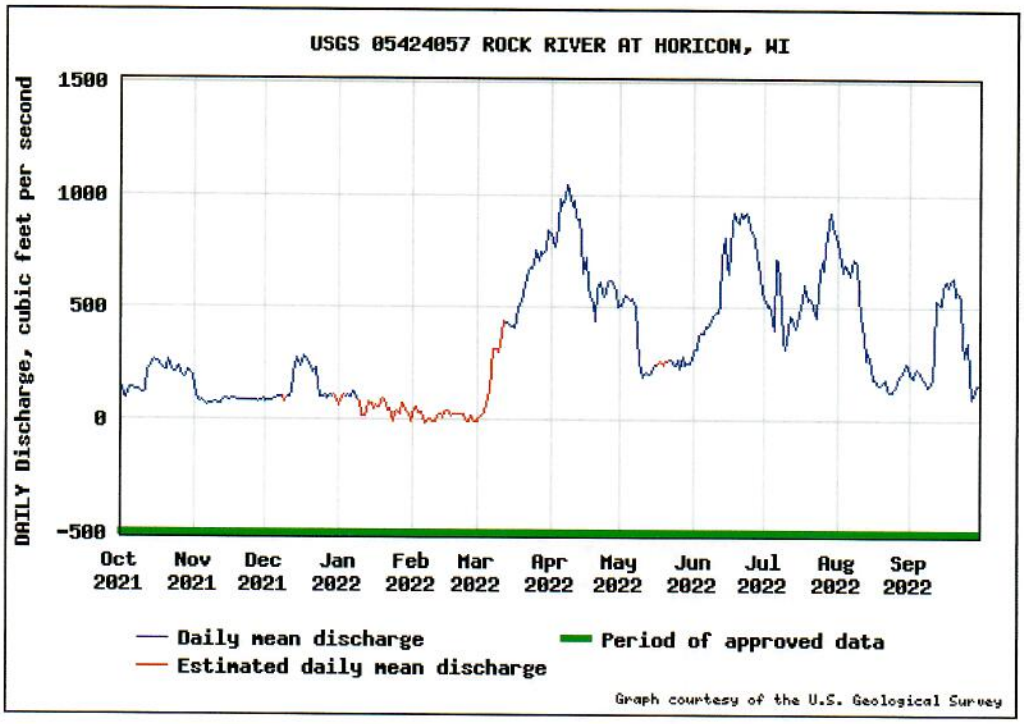


Figure D4: Experienced flow conditions at Horicon Gage from October 2021 to September 2022

Horicon Marsh Operations

Discussions regarding water level management were held on October 18, 2022, with representatives of the WDNR and USFWS in Horicon. During the discussion it was suggested that reductions to the normal water elevation of Lake Sinissippi would likely be beneficial for the management of Horicon Marsh. Lowering the water elevations in Lake Sinissippi may also enhance the ecological conditions within the marsh. It can promote the growth of native vegetation, improve water quality, and provide habitat for a variety of wildlife species. These factors contribute to the overall health and biodiversity of the Horicon Marsh ecosystem, however a consistently lower normal pool elevation is not conducive to many of the day to day recreational endeavors or current management considerations of Lake Sinissippi.

Water Level Management

The LSID endeavors to more proactively undertake in-lake projects which may benefit from short term reduction in water level. Under certain circumstances, the equipment needed to access or perform specific actions may benefit from lower water elevations. Additionally based on discussions with USFWS, WDNR and others, there may be benefits to a slightly lower normal summer pool elevation. Consideration related to short term and long-term water level management are further discussed below.

Rock River at Horicon, WI - 05424057

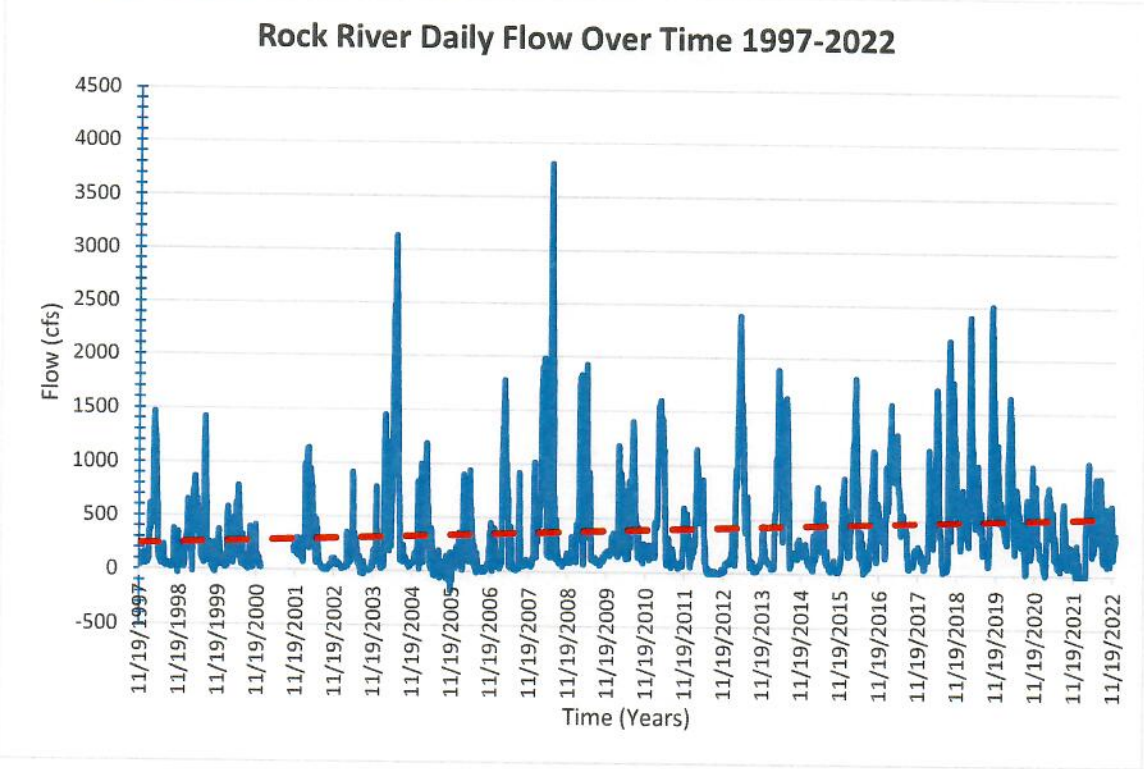


Figure D5: Increase in average annual discharge on the Rock River at Horicon Gage

Section D.4 – Water Level Management – Short Term:

Based on information provided in the Horicon NWR Water Resource Inventory and Assessment (USFWS, 2014), and further supported by a smaller historical data trend at the USGS gage in Horicon, the watershed is undergoing hydrologic change due to higher annual precipitation falling as rain. Although the amount of volume delivered to the Rock River and flowing through the system is greater, the dam will not passively adjust, meaning the length of time required to pass the larger volume may be greater and occurring more frequently. Additionally, as more precipitation events occur as rain and less as snow, the likelihood of increased system load (sediment and nutrients) is also greater.

To support the need for adjustment and to develop monitoring of the lake level as a long-term best practice, the LSID might consider establishing water surface elevation monitoring protocols. To monitor surface water elevation, simple actuator devices can be strategically placed in key areas of interest along the shoreline or within the lake.

The collection of this data, in concert with USGS gage data collected on the Rock River downstream of Horicon will provide the LSID and their constituency with the ability to make more informed decisions. Having continuous knowledge of water surface elevation throughout the year, including during specific projects or critical periods, is highly valuable. Technological innovations, such as remote monitoring sensors, can provide real-time data and alerts when important thresholds or conditions are reached. Any such installation should be coordinated with a capable vendor and WDNR to best ensure success.

Operation of the dam and the water level of Lake Sinissippi is further managed through the application of multiple hydraulic models used by the WDNR to inform the public when there is a potential threat of flooding. Typical, statistically driven flooding is regulated and managed by the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS). The FIS produces Flood Insurance Rate Maps (FIRMs), which delineate areas prone to flooding and assign flood risk zones based on the probability of a flood event occurring. These flood risk zones are categorized as Special Flood Hazard Areas (SFHAs), including high-risk zones labeled as "100-year flood zones" or areas with a 1% annual chance of flooding (Figure D5).

Figure D6: FEMA Floodplain map of south end of Lake Sinissippi into Rock River (Source: FEMA)

Emergency models are also developed to represent the time-critical conditions associated with dam failure and resulting rush of lake volume to the Rock River (dam breach). These models are largely associated with background data from the FIS, with increased statistical magnitude (500 year – 1,000-year return intervals). These same models can be adapted to investigate incrementally increased water surface intervals, or reductions. Alternatively, this can potentially be investigated using an informed regression approach. The goal of this exercise is to determine with a degree of informed certainty, how the lake has responded to increased flow volume and if it is appropriate and beneficial to operate the lake at lower levels to better manage storm driven events, seasonal high water, or normal pool levels. Using this information, the LSID can further work with WDNR and the Village of Hustisford to determine if changing lake levels necessitate adjustment to dam hydraulics such as gate operation, spillway lowering, or other considerations that might modify they release of water from the Hustisford Dam. The anticipated change in water surface level can then be discussed with lake stakeholders to better inform any issues that might impair lake access points, navigation, general aesthetics, or biological processes. As an example, when lake levels are lowered before ice over, it can expose more shallow areas or create uneven lakebed topography. These exposed or uneven areas can affect the formation and stability of ice cover. Shallow areas may freeze faster than deeper sections, leading to variations in ice thickness across the lake. Additionally, the exposed lakebed or uneven topography can create air pockets or weak spots in the ice. These weak areas can be susceptible to cracking, shifting, or even complete failure of the ice cover, posing safety risks for recreational activities, such as ice fishing or snowmobiling. Another effect of lowering the lake before the lake freezes over, is that there may be increased water movement under the ice, when ice over

occurs. This increased water movement, combined with freezing and thawing cycles, can further contribute to the formation of unstable ice conditions.

Section D.5 – Water Level Management – Long Term

Water level management, while a short-term action can be undertaken to result in long term change. Water level management can directly impact the ecology of the lake edge and surface area of available water. While this can be important for property owners, lake access and navigability, it can also allow for sediment settlement, causing Lake Sinissippi to be a more effective sediment trap. Like the strategy employed at the Horicon Marsh, water level reduction in concert slightly modified hydraulic function at the Hustisford Dam could allow for more efficient transport of fine-grained sediments through the system.

The current hydraulic flow patterns in Horicon Marsh provide little if any ability to mitigate sediment from the watershed. Hydraulic structures function with a bottom orifice and the spillway becomes engaged more routinely under higher flow conditions only. Lake Sinissippi can no longer function as the sediment trap for the entire upstream watershed. The lake is already in a state where navigation has been locally impacted and the minimum recommended dredge will be a significant undertaking from a time and cost perspective. Increasing sediment mobility through the lake will increase the service life of these maintenance dredging projects, providing a passive benefit.

When considering reductions in water levels, it is important to consider the potential impacts and trade-offs associated with reducing the water elevation of Lake Sinissippi. The effects on recreational activities, navigation, and other stakeholders should be thoroughly evaluated. A comprehensive modeling study would be necessary to assess the feasibility and potential outcomes of lowering water levels in the lake. Furthermore, and as previously noted, previous seasonal drawdowns have had less than desired impacts on lakebed consolidation and sediment settlement. Because of this, obtaining consensus for anything other than a temporary drawdown associated with a significant project will be unlikely for the stakeholders of Lake Sinissippi.

The best long term management option for LSID may be to begin to understand how the lake is responding locally and how that forecasts into the future. Accumulating data at the Hustiford Dam and establishing a relationship with the Horicon Gage on the Rock River will make for a more precise understanding of lake response from storm events and dam releases. Undertaking of pilot projects/studies such as the suggested modification to existing prewinter drawdown will help better understand the rate at which drawdown is occurring now as opposed to years prior. The LSID may need to make a case that the lake is being impacted by increased flows (and sediment) from the upper watershed which may provide impetus for changes in the hydraulic operations to the Hustisford dam. To support this initiative, it will be important to provide DNR with supporting information rather than anecdotal observations. Collecting data close to the Hustisford Dam can be very valuable in this regard.

Section D.6 – Funding for Dams (Pursuant to Water Level Management)

The WDNR's Municipal Dam Grant is an important funding source for many projects involving dams in lake districts. This grant program provides financial assistance on a competitive basis to support a range of initiatives related to dam repairs, safety measures, rehabilitation, and other relevant projects.

The Municipal Dam Grant, being an annual reoccurring grant, offers opportunities for lake districts and municipalities to secure funding for their dam-related projects on a regular basis. The competitive nature of the grant means that applicants need to meet specific criteria and demonstrate the significance and feasibility of their proposed projects.

The grant funds can be utilized for various purposes, including but not limited to:

1. Dam repairs and maintenance: The grant can help finance necessary repairs and ongoing maintenance activities for dams, ensuring their structural integrity and functionality.
2. Safety initiatives: Funding can be allocated towards implementing safety measures such as installing or upgrading safety equipment, signage, or barriers to enhance public safety in and around the dam area.
3. Rehabilitation and restoration: The grant can support projects aimed at rehabilitating or restoring dams, improving their performance, and preserving their historical or ecological value.
4. Environmental enhancement: Funding may be available for initiatives that promote ecological enhancement or habitat restoration in dam-affected areas, contributing to the overall environmental health of the region.

It is important for grant applicant (in this case, the Village of Hustisford) to carefully review the grant guidelines and requirements, including the application process, eligibility criteria, and project evaluation criteria. Developing a well-defined project proposal and demonstrating the significance of the proposed project in line with the grant objectives can increase the chances of securing funding.

The village should also be aware of the specific deadlines and any additional reporting or monitoring requirements associated with the grant. Collaborating with relevant stakeholders, such as dam engineering experts, environmental consultants, or community organizations, can also strengthen the project proposal and improve its competitiveness.

By utilizing the WDNR's Municipal Dam Grant, the village can access funding resources to support critical dam-related projects, ensuring the safety, functionality, and environmental sustainability of these important structures. The Village has successfully applied for and received funding through this program in the past, but to support an LSID initiative they will be serving as a sponsor. While the application process is essentially the same they would be held responsible for

the final product and would therefore need to be heavily engaged with the LSID throughout the process.

Section D.7 – DNR Protocol for Modifying and Ordered Water Level

Provided within this section is a list of the typical steps in the process of making an "update to an ordered water level," which is Wisconsin Administrative language for requesting a modification to a previously established and documented water level elevation. The information below has been largely provided directly from WDNR through Will Disser, Water Management Engineer for the region. This process is mostly used for permanent water level order changes but could also be applied to a temporary drawdown (though the considerations in temporary drawdowns can sometimes be different, since there's an understanding that the reduced water level will not be permanent). Due to the differences in the multitude of lake throughout Wisconsin, there is no one-size-fits-all approach, and intermediate considerations may be needed throughout the progression. The WDNR is working on a more consistent/comprehensive process, but the general outline below identifies the baseline process.

1) Meet with DNR staff (Water Management Engineer, Water Management Specialists, etc.) to discuss goals/potential new operating ranges. Discuss what the most appropriate option might be for the specific need, as well as whether other actions (dredging, seasonal level adjustments, etc.) might better address the concerns that are prompting the desire for a new level order.
2) Submit a "petition" to change the level order, in a form of a letter from the dam owner, the LSID, or another appropriate interested party. There are no specific format requirements for a petition, but it should include information about what desired level range(s) would be, the reasons for the change, supporting entity of the change (including any signatures obtained), potential benefits/drawbacks of a change, etc. While there is no minimum level of support needed to initiate the process, having initial support on the front end of the process is valuable – members of the public have a right of appeal in any decisions that the DNR would issue related to water level, and increases in water level also require appropriate legal arrangements with landowners whose property would be flowed (subject to impact) by an increase.
3) Submit a petition to the DNR Water Management Engineer (in this case Will Disser). Staff will route the petition to additional internal WDNR staff to discuss potential concerns with the proposal (impacts to fisheries, floodplain, water quality, endangered species, wetlands, etc.). This step is mostly a courtesy review to look for major red flags and doesn't necessarily guarantee a new order will be approved, but it does save you time/the cost of a permit fee if it's clear from this review that the proposed levels would not be approvable.
4) Submit a permit application that best describes what LSID is planning to do (dam repair/reconstruct, dam raise/enlarge, dredging, etc.) and include the proposed level order adjustments with that application. If other permitted work is not proposed, reach

out to the Water Management Engineer to determine the most appropriate route to get the order adjustment logged into the State's ePermitting system.

5) DNR will perform a full review of natural resource checks that were screened in step (3), asking for any additional information as necessary. At this point, DNR will determine whether additional signature documents, easements, permissions from landowners, etc. will be necessary.
6) After reviewing the submitted materials, if they are approvable based on resource review and within the operable dam ranges, DNR will proceed to any public notice/hearing requirements that are outlined in WI statutes. These public notice/hearings generally depend on the nature of the underlying work being performed (for instance, there are specific requirements for public notice for various Ch. 30 actions on navigable waterways). Water level changes in and of themselves may not require a public notice period under current statute, but it is often advisable to facilitate an opportunity for public comment, given the public's vested interest in levels on the lake, and their right to appeal an eventual order issued by DNR.
7) Once the above steps are completed, DNR can proceed to finalizing a new level order, which may have some additional conditions to fulfil prior to going into effect (easements/legal arrangements noted in (5), approval from FEMA if there are changes to flood elevations, changes to the dam's inspection and operations manual, etc.)

Section D.8 – Recommended Approach and Action Items

1. Obtain and install water level gage (or suitable device) to record water level observations in the upstream proximity of the Hustisford Dam. The cost and upkeep of the gage will be highly dependent on the selected unit, location of installation, and degree of desired automation. The gage would record water surface elevation readings and discharge can be ascertained by correlating that same elevation at the Hustisford Dam.
2. Develop a pilot program for assessing a higher pre-winter pool elevation, for once established would evaluate the benefits or impacts associated with higher water level in the lake before ice formation. The goal of this pilot program is benefit lake residents in removing piers, boats, and shoreline management activities. The evaluation of this pilot program would be for 5 years. The development of this program will also serve as a demonstration project for managing the protocols for making a change to and ordered water level.

Water Level Management Schedule – Timeline for Monitoring Equipment

- December 2023 – Meet with WDNR to determine eligibility for monitoring equipment for lake level recording: *Cost $7,500-$15,000 depending on Municipal Dam Grant Award. Annual maintenance approximately $750.* Determine if grant is good fit or an alternative funding source may be appropriate.

- January 2024 – Meet with Village of Hustisford (as dam owner) to facilitate application for Municipal Dam Grant: *Cost N/A*
- February 2024 – Prep Municipal Dam Grant package: *Cost $4,500*
- March 2024 – Submit Municipal Dam Grant package prior to March deadline: *Cost N/A*
- Follow up with alternate program is Municipal Dam Grant is not suitable program based on discussion with WDNR.

Water Level Management Schedule – Timeline for Pilot Program

Based on the steps identified in Section D.7 above, the anticipated timeline for modifying an ordered water level is 9 months, mostly committed to develop the necessary supporting information for the petition, meeting time, and correspondences. Significant time is anticipated to coordinate with WDNR staff. Suggested timeline and cost are provided below. Costs assumes LSID will have a consultant engaged at various steps throughout the process.

- January 2024 – Meet and have preliminary discussion with WDNR staff: *Cost $1,500*
- February 2024 – Prep and develop petition support: *Cost $5,500*
- March 2024 – Submit formal petition to WDNR staff Will Disser: *$1,500*
- May 2024 – Submit permit application: *Cost $7,500*
- July 2024 – Anticipated meeting and follow up materials needed: Cost *$4,500*
- August 2024 – Issue public notice: *Cost $2,500*
- October 2024 – Coordinate change in operation with Village of Hustisford

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