Edenville Dam Restoration Project

Habitat Conservation Plan

Prepared by:

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LIST OF ACRONYMS AND ABBREVIATIONS

ºC	degrees Celsius
AMM	Avoidance and Minimization Measure
BEHI	bank erosion hazard index
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
Boyce	Boyce Hydro Power
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
CPUE	Catch Per Unit Effort
EA	Environmental Assessment
EGLE	Michigan Department of Environment, Great Lakes, and Energy
EIS	Environmental Impact Statement
EMR	Eastern Massasauga Rattlesnake
ESA	Endangered Species Act
FEMA	U.S. Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FLTF	Four Lakes Task Force
Four Lakes	Secord Lake, Smallwood Lake, Wixom Lake, and Sanford Lake
GEI	GEI Consultants
HCP	Habitat Conservation Plan
in situ	in the natural position
IpaC	USFWS Information for Planning and Consultation tool
ITP	Incidental Take Permit
LID	Low Impact Development
LiDAR	Light Detection and Ranging
LLO	Low-level Outlet
m^2	square meter
MBTA	Migratory Bird Treaty Act
MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
Merjent	Merjent, Inc.
mg/L	milligrams per liter
MNFI	Michigan Natural Features Inventory
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NREPA	Michigan Natural Resources and Environmental Protection Act, Public Act 451 of 1994, as amended
OHWM	Ordinary High Water Mark
Part 307	Part 307 (Inland Lake Levels) of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended
Permit Area	includes a portion of the SER that is located between the defined normal (legal) lake level's upstream limit of Wixom Lake [43.868469, -84.431900] to the north, and the Dale Road bridge to the south
Permit Term	30-year ITP from USFWS

Project	Edenville Dam Restoration Project
run-of-the-river	dam gates are operated to maintain the normal (legal) lake level, such that the outflow from the dam is equal to the water flowing into it for drought, normal, and flood flows
SAD	Special Assessment District
SCADA	Supervisory Control and Data Acquisition
SER	Snuffbox Evidence Reach
SESC	Soil Erosion and Sedimentation Control
SHPO	State Historic Preservation Officers
SSA	Species Status Assessment
Streamside	Streamside Ecological Services
TBO	Tobacco River
TBW	Tittabawassee River
THPO	Tribal Historic Preservation Officers
USACE	U.S. Army Corps of Engineers
USDA-NRCS	U.S. Department of Agriculture Natural Resources Conservation Service
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 INTRODUCTION

The Edenville Dam, which impounds Wixom Lake, is one in a series of four dam-impounded lakes along the Tittabawassee River located in Gladwin and Midland Counties, Michigan. It was constructed in 1925 to provide storage and headwater control for the purpose of hydroelectric power generation. The Edenville Dam is an uncommon earth embankment dam that impounds two rivers, the Tobacco River (TBO) and Tittabawassee River (TBW), approximately 1 mile upstream of their confluence. The Edenville Dam impounds Wixom Lake which has a hydraulic connection between the TBO and the TBW. The dam structure, which includes earth embankments, concrete spillways with three Tainter gates on the TBO side, three Tainter gates on the TBW side, and the powerhouse, is approximately 6,600 feet long and 54 feet high at its tallest point. The earthen embankments are the longest feature of the dam, totaling 5,800 feet in length. The TBO side of the dam is that part of the Edenville Dam west of Michigan Highway M-30; the TBW side of the dam is that part east of Michigan Highway M-30. The Edenville Dam is identified as a High Hazard Potential Dam by the State of Michigan Department of Environment, Great Lakes, and Energy (EGLE) dam safety regulators. The Edenville Dam was previously classified as failing to meet dam safety standards by EGLE dam safety regulators.

Michigan experienced several days of heavy rain across the TBW watershed in May 2020. The rain was particularly heavy in the northern portion of the watershed, reportedly totaling up to nine inches in some areas over a short amount of time. Saturation of the ground, in combination with potentially frozen ground conditions in some areas, followed by additional rain resulted in heavy runoff into the upper TBW and its tributaries. Specifically, over a two-day period from May 16 to May 18, 2020, the TBW watershed incurred heavy rainfall with a total ranging from 6 to 8 inches concentrated in Gladwin and Midland Counties. Saturated conditions, combined with additional rainfall starting in the evening of May 18 through the early afternoon of May 19, resulted in the TBW surpassing flood stages in many areas.

On May 19, 2020, Wixom Lake's water surface elevation rose to an elevation of 680.61 feet and was within 1.5 feet of the embankment crest of the Edenville Dam when a portion of the left embankment failed, causing an uncontrolled release of the reservoir. The surge resulting from the flood overwhelmed the Edenville Dam and downstream Sanford Dam, causing them to fail. The upstream Secord and Smallwood dams were also damaged by the flood and the Federal Energy Regulatory Commission (FERC) ordered the private dam owner, Boyce Hydro Power (Boyce), to fully lower those more northern impounded lakes for inspection and repair. Ten thousand people were evacuated, a national disaster was declared by the president of the United States, and the community was left with extensive economic, environmental, and property damage. Boyce filed for bankruptcy protection and is insolvent.

The Edenville Dam was operated as a storage and headwater control dam for the purpose of hydroelectric power generation until September 2018 when the FERC revoked the license[1,2] to produce hydroelectric power. At the time of the impoundment failures, the Edenville Dam and Sanford Dam were no longer controlled by Boyce. The September 2018 FERC order[2] revoked the license from Boyce due to their history of non-compliance and failure to provide adequate spillway capacity. At this point, hydroelectric generation ceased and jurisdiction over the dams was transferred to EGLE.

[1] FERC, 1998.
[2] FERC, 2018.

To protect the safety, welfare, and environmental future of the lake communities, Gladwin and Midland Counties took the Boyce properties through their eminent domain authority. The Four Lakes Task Force (FLTF) was established and became the "Delegated Authority" of the Four Lakes (Secord, Smallwood, Wixom, and Sanford) and their dams (Secord, Smallwood, Edenville, and Sanford) for Midland and Gladwin counties prior to the issuance of a FERC order terminating previous licenses by implied surrender from the previous owner[1,2]. FLTF petitioned the Circuit Courts in Midland and Gladwin counties to order a lake level for Wixom Lake under Part 307 of Michigan Public Act 451 of 1994 (Part 307). The Lake Level Order[3] was issued in June 2019, legally determining both summer (675.2 feet) and winter (672.2 feet) normal lake levels on Wixom Lake, creating a Special Assessment District (SAD), and designation of FLTF as the Delegated Authority under Part 307 to repair, maintain and operate the Edenville Dam and other dams located within the Four Lakes system.

FLTF has developed a Recovery and Restoration Plan[4]. This Plan includes flood recovery, environmental recovery, dam and lake rebuilding plans, and results of a public survey conducted within the SAD. FLTF has the authority to acquire, repair, and then operate the Edenville Dam on behalf of Midland and Gladwin Counties. Therefore, the Plan identifies the primary purpose of the Edenville Dam to be to enable management of Wixom Lake's water levels. The Plan does not include restoring hydroelectric generation.

1.1 PUBLIC ENGAGEMENT

FLTF has actively engaged the public by providing public outreach opportunities through development of a transparent public-facing website, offering a subscription service for email updates and mailings, a community public survey, monthly informational sessions, board meetings, and lake meetings (which included an in-person technical symposium), and notice of the Habitat Conservation Plan (HCP) development presented to tribal, state, and federal governmental organizations. Such opportunities are described below. FLTF has provided these opportunities to obtain stakeholder and technical input from a variety of sources, both public and private, on the proposed action and associated Project.

- A public-facing website[5].
- Availability to subscribe for routine email updates and mailings.
- Community Survey held from January 13 to March 12, 2021[6].
- Informational Sessions
    - Monthly web-based informational sessions, board meetings, and lake meetings with posted meeting minutes, webinars, presentations, questions, and comments[7].
    - In-person *Path to Four Lakes Restoration: An Engineering and Technical Symposium*[8] held on October 20, 2022, at the Midland Center for the Arts.

[3] State of Michigan Midland County Circuit Court, 2019, Lake Level Order
[4] FLTF, 2020, Recovery and Restoration Plan
[5] FLTF, n.d., Website Homepage
[6] FLTF, 2021a, Community Survey Results
[7] FLTF, n.d., Events
[8] FLTF, 2022, Technical Symposium

- Notice of the HCP Development[9] submitted on April 4, 2023, to:
  - Tribal Governments
    - Lac du Flambeau Band of Lake Superior Chippewa Indians of the Lac du Flambeau Reservation of Wisconsin
    - Little Traverse Bay Bands of Odawa Indians, Michigan
    - Menominee Indian Tribe of Wisconsin
    - Miami Tribe of Oklahoma
    - Saginaw Chippewa Indian Tribe of Michigan
    - Sault Ste. Marie Tribe of Chippewa Indians, Michigan
  - Michigan Department of Natural Resources (MDNR)
  - EGLE
  - U.S. Fish and Wildlife Service (USFWS)

1.2 EDENVILLE DAM CONSTRUCTION

Work related to the Edenville Dam Restoration Project (Project), which involves rehabilitation of the failed infrastructure, is currently underway. This work will not influence the current water levels of Wixom Lake and therefore does not affect the Proposed Action described within this HCP. This work includes the following:

- **Increased Spillway Capacity** – Prior to the Edenville Dam failure, the Tainter gate spillways could pass approximately 20,670 cubic feet per second (cfs) at the zero-freeboard elevation of 682.0. According to the latest flood analysis, a total spillway capacity of approximately 52,800 cfs is needed to pass the inflow design flood of 56,300 cfs with freeboard.

- **Dam Embankment Stability Improvements** – A significant reach of the upstream portion of the embankment was damaged due to rapid reservoir drawdown caused by the embankment breach. Remaining sections of embankment that were not breached are overly steep, have narrow crests, insufficient slope stability under normal and flood pool conditions, and no embankment or alluvial foundation soil seepage cutoff walls or internal graded filter/drain systems to protect against seepage-induced internal erosion along unfiltered clay drain tiles that showed evidence of silt and sand migration during the May 2020 flood event.

- **Construction of Low-Level Outlets** – Without hydropower operation and the associated powerhouse, discharge conduit, and outlet structures, there is no low-level outlet (LLO) to pass normal flows or means to draw down the impoundment below the invert of the spillway sill.

- **Michigan Department of Transportation M-30 Bridge Replacement** – Currently, the Michigan Department of Transportation (MDOT) has a temporary steel truss bridge crossing the former reservoir. MDOT is developing designs for a

[9] FLTF, 2023, Notice of HCP Development

permanent bridge replacement. Construction of the new bridge replacement is slated for 2024. This bridge replacement will require a design that allows for equalization of flood pool levels between the two sides of Wixom Lake (TBO and TBW) with appropriate hydraulic opening. While MDOT will be responsible for construction of the actual bridge, the Project will account for the final bridge design and operation.

- **Reconstruction of the Left Embankment** – The breached left embankment needs to be reconstructed in the original footprint with provisions for an auxiliary spillway to release floodwater downstream along a regraded breach channel to the TBW river. A temporarily reconstructed embankment is currently in place.

1.3 ENDANGERED SPECIES ACT

The ongoing Project has a primary goal to construct dam improvements in accordance with EGLE requirements and to restore the legally defined lake level for Wixom Lake. This entails compliance with FLTF's legal obligations under Part 307. Final construction of the Project will provide a modern dam that meets current engineering and safety standards and restores Wixom Lake to the pre-breech pool level. In addition, FLTF must comply with other federal and state laws such as the federal Endangered Species Act (ESA), the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA; as implemented by the USFWS), the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), and state statutes related to state-protected species and resources. This HCP has been developed to ensure compliance with the ESA.

Section 9 of the ESA prohibits take of any fish or wildlife species listed as threatened or endangered. "Take" is defined in the ESA as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[10] In 1982, Congress amended the ESA to allow for incidental take of ESA species that would result from non-Federal activities (i.e., activities which are not funded, carried out, or otherwise authorized by a Federal agency). Section 10(a)(1)(B) of the ESA provides an exception to Section 9 take prohibitions for activities that result in incidental take of listed species. Incidental take is that which is incidental to, and not the purpose of, carrying out an otherwise lawful activity.[10]

In order to apply for a permit authorizing incidental take under Section 10, project proponents must develop an HCP for the Project that meets the specific requirements identified in Section 10(a)(2)(A) of the ESA and its implementing regulations at 50 Code of Federal Regulations (CFR) 17.22 (for endangered species) and 17.32 (for threatened species).[10] An HCP must:

1) define the impacts that will result from the taking;

2) describe the steps the applicant will take to minimize and mitigate the impacts of the taking (the conservation measures) as well as the funding that will be available to ensure their implementation; and

3) describe the alternative actions that have been considered to avoid take, and why the alternatives were not pursued.

[10] USFWS, 2016a

FLTF has developed this HCP to quantify the impacts of restoration of the normal (legal) lake level of Wixom Lake on snuffbox mussels (*Epioblasma triquetra*), and the conservation measures that must be incorporated into Project activities to minimize and mitigate take of this species, as well as identifying the funding necessary to implement the conservation program defined herein. The HCP will fulfill the requirements necessary to apply for an Incidental Take Permit (ITP) from the USFWS, for restoration of the normal (legal) lake level activities to remain in compliance with the ESA.

2.0 HABITAT CONSERVATION PLAN

2.1 PURPOSE AND NEED

The purpose of this HCP is to provide a framework by which FLTF can remain in compliance with the ESA as implemented by the USFWS while delivering on promises to landowners and community partners to repair damage from a catastrophic flood event which caused the failure of the Edenville Dam and an uncontrolled release of the waters of Wixom Lake in Gladwin and Midland counties, Michigan in May 2020. FLTF is working cooperatively with Midland and Gladwin counties, EGLE, MDNR, MDOT, U.S. Federal Emergency Management Agency (FEMA), FERC, U.S. Army Corps of Engineers (USACE), U.S. Geological Survey (USGS), U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS), and the USFWS on plans and actions to comply with these agencies' laws and regulations, as well as recover from flood damage, advise downstream communities of managing future flooding downstream, improve dam safety, begin recovery of the environment, and restore an important community recreational and natural resource in Wixom Lake, while also contributing to the conservation of a listed species.

An effects analysis for the Project has found that the refilling of Wixom Lake to the normal (legal) lake level as described in Section 5 is reasonably certain to cause incidental take of federally endangered snuffbox mussels (*Epioblasma triquetra*). While FLTF is working closely with the federal agencies listed above, none of these agencies is issuing a permit, funding, or in any way authorizing the action; as such, there is no federal nexus driving consultation under ESA Section 7. However, Section 9 of the ESA prohibits take of any fish or wildlife species listed as endangered and threatened. "Take" is defined by the ESA as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[10] In 1982, Congress amended the ESA to allow for incidental take of ESA species that would result from non-Federal activities (i.e., activities which are not funded, carried out, or otherwise authorized by a Federal agency). Section 10(a)(1)(B) of the ESA provides an exception to the Section 9 take prohibitions for activities that result in incidental take of listed species. Incidental take is that which is incidental to, and not the purpose of, carrying out an otherwise lawful activity.[10]

Without a federal nexus driving consultation under ESA Section 7, FLTF must develop an HCP for the Project that meets the specific requirements identified in Section 10(a)(2)(A) of the ESA and its implementing regulations at 50 CFR 17.22 (for endangered species) and 17.32 (for threatened species)[10] in order to remain in compliance with ESA. An HCP must include:

- an in-depth effects analysis that quantifies the extent of the proposed take/the impact of the taking, and demonstrates the action will not jeopardize the continued existence of the species;
- commitments to measures that will minimize and mitigate the impacts of the taking;
- commitments to funding to ensure the implementation of those measures for the life of the permit; and
- other measures that may be required as necessary or appropriate for the purposes of the plan.

2.2 GEOGRAPHIC SCOPE – HCP PERMIT AND PLAN AREA

2.2.1 Permit Area

The Permit Area is the geographic area where the impacts of the activity(ies) occur for which an ITP is requested (i.e., the covered activities). Activities within the Permit Area are reasonably likely to cause take of federally listed species, in this case, snuffbox mussels.

The Permit Area is contained within a larger area referred to as the "snuffbox evidence reach," or "SER" (see Figure 1 below). The SER was first referred to in a report titled *General 2022 Mussel Survey Results of Wixom and Sanford Lakes, Michigan with Focus on Snuffbox (Epioblasma triquetra) Data*[11] prepared because of FLTF-funded Project efforts by Central Michigan University. Note, this report was an early-release version of the full mussel survey report.[12] Within these reports, the SER is defined as an area of the upper reach of the Tobacco Arm of Wixom Lake where one live female snuffbox and 46 snuffbox shells (valves) were found. As such, targeted survey efforts were completed for this area in 2022 and ongoing studies (report pending) were completed in 2023. The SER consists of 302.73 acres of land that was previously wetted at or below the normal (legal) lake level of Wixom Lake. Presently, a total of 53.70 acres of the SER are wetted as the TBO.

The Permit Area for this HCP includes a portion of the SER that is located between the defined normal (legal) lake level's upstream limit of Wixom Lake [43.868469, -84.431900] to the north, and the Dale Road bridge to the south (see Figure 2 below).

Within the Permit Area, Central Michigan University documented high species richness, a high number of live unionids (mussels), and very different habitat than the further downstream sites; very lotic and having diverse substrate. Within the Permit Area, shorelines are lined with trees and vegetation unlike most of the surveyed sites in other parts of the SER. This location contains riffles, gradually sloping shorelines, and is lacking eroded channelized vertical banks that were typically identified in other portions of Wixom Lake. Within this portion of the SER, a live snuffbox mussel and several Snuffbox valves were identified, and suitable riverine habitat for snuffbox mussel is currently present. This portion of the Permit Area is 69.21 acres with a current wetted area of 18.17 acres. As proposed, the normal (legal) lake level will return and wet an additional 51.04 acres within this portion of the Permit Area. This area would be reduced to a wetted surface of 50.64 acres (reduction of 18.57 acres) during annual winter drawdowns. This is discussed further in Section 6.0, Covered Activities.

As described in the 2022 survey reports, areas of the SER downstream of the Dale Road bridge are not included in the Permit Area because survey and habitat data suggest that this area does not contain suitable snuffbox mussel habitat and that those areas are not likely to contain live snuffbox individuals based off the sampled mussel community. Downstream of Dale Road bridge, the survey resulted in collection of significantly fewer live mussels and non-supporting mussel habitat features such as unstable fine substrate materials. A diverse mussel community was not found downstream of Dale Road. At this time, a diverse mussel community is defined as one that includes at least four mussel species within the area of direct impact and associated buffers. This

[11] Woolnough et al., 2022
[12] Laszlo et al., 2022

value is based on mussel survey data from several Michigan watersheds known to support federally listed species.[13]

The primary covered activity which will require incidental take coverage is the refilling of Wixom Lake to the mandated normal (legal) lake level. In its currently dewatered state, this portion of the TBO is riverine in nature. However, refilling Wixom Lake to the normal (legal) lake level will inundate this area, converting it back to lacustrine habitat and rendering it unsuitable for snuffbox mussels.

Operations and maintenance activities have also been defined as covered activities; this entails conducting seasonal drawdowns and refills to maintain the summer and winter elevations. However, these seasonal changes will not be enough to return the SER to suitable habitat.

2.2.2 Plan Area

The Plan Area (see Figure 3 below) is comprised of all areas that will be used for any activities described in the HCP, including covered activities and the conservation program. This includes areas of related Project work that are not reasonably certain to result in take of a federally listed species, in addition to the previously described Permit Area. For the Project, the Plan Area consists of three distinct yet connected areas:

1. Wixom Lake at and below its normal (legal) lake level, as well as lakefront property owners within the defined SAD. This includes the entirety of the Permit Area.

2. The Edenville Dam property area where dam construction activities are planned to occur and that would ultimately influence the water levels of Wixom Lake.

3. The TBO located upstream of Wixom Lake, from the end of Wixom Lake's normal (legal) lake level influence to the next upstream physical barrier, the Beaverton Dam.

Prior to the dam failure, Wixom Lake typically had a surface area of 1,908 acres, a shoreline of more than 84 miles, and a maximum depth of 40 feet. Based on the data available in early 2021, it was estimated that approximately 1,510 acres of surface water were lost from Wixom Lake. This has resulted in the complete loss of Wixom Lake's shorelines and a reduction in total surface water area to approximately 398 acres. The SAD community that surrounds Wixom Lake consists of 3,524 parcels, of which 3,158 are assessable, meaning that they have a direct benefit related to Wixom Lake.

The Edenville Dam property area is the location where dam construction, operations, and maintenance activities will occur. As stated within FLTF's agreement with the Counties and the SAD, FLTF only has the authority to acquire, repair, and operate the Edenville Dam on behalf of Gladwin and Midland Counties. As it exists today, FLTF does not have the authority to conduct weed management, fish stocking, additional shoreline improvement projects, additional debris and vegetation management, or other activities beyond what is stated in their agreement with the Counties. These additional activities may be completed by local lake associations, townships, or weed control districts and FLTF may support these efforts by facilitating discussion, educating the public, and providing input to related planning documents.

[13] Mulcrone et al., Unpublished data.

The Plan Area also includes portions of the TBO upstream of the normal (legal) lake level of Wixom Lake where it will remain riverine, from the boundary of the normal (legal) lake level of Wixom Lake (43.868469, -84.431900; areas above elevation 675.2') upstream to the tailrace of the Beaverton Dam, where suitable snuffbox mussel habitat and a known snuffbox mussel population are currently found. This portion of the Plan Area contains 110.49 acres of wetted riverine habitat.

Activities that FLTF will conduct within the Plan Area include routine drawdowns of Wixom Lake for maintenance inspections and repairs. This includes controlled annual water level lowering to the winter normal (legal) lake level and controlled annual water level rise to the summer normal (legal) lake level. During the winter normal (legal) lake level drawdown, FLTF proposes to conduct routine dam maintenance inspections on a 3-year cycle. The purpose of these inspections is to identify required maintenance and repairs. These inspections are completed via visual observations and use of a dive team to evaluate conditions below the water's surface. All inspections would occur within the permitted normal (legal) lake level.

Maintenance activities may be identified that would require work on portions of the Edenville Dam spillways that control the normal (legal) lake level. To ensure lake level changes do not occur during these maintenance activities, FLTF has designed the Edenville Dam reconstruction to incorporate a stop log system so that a stop log can be placed to maintain the normal (legal) lake level during repairs. This stop log system will be in place for potential maintenance of both the proposed crest gates and LLO.

Maintenance activities may be identified that would require work on portions of the Edenville Dam embankment. To ensure lake level changes do not occur during embankment maintenance activities, FLTF has designed the reconstruction of the Edenville Dam to contain a newly installed cutoff wall through the center of the embankment. This cutoff wall would prevent the lowering of the normal (legal) lake level while work is performed on the embankment. An isolated cofferdam may be installed at the localized repair area to allow for dry working conditions along the embankment.

FLTF does not plan, in the foreseeable future, to ever drop Wixom Lake's water elevation below the defined winter lake level elevation. Routine operations and maintenance of the Edenville Dam will continue to maintain the established summer and winter normal (legal) lake level. The reconstruction of the Edenville Dam has been designed, as such, to avoid the need for a future emergency drawdown of Wixom Lake. In the unanticipated and unfortunate event that a dam failure was to occur or an imminent failure was to take place, FLTF would lower the elevations of Wixom Lake to a level ordered by the EGLE Dam Safety Program. At this point, the elevation of Wixom Lake could be lowered to the top elevation of the dam's LLO outlet structure (649 feet) and it would be anticipated that a modification to this HCP would be required.

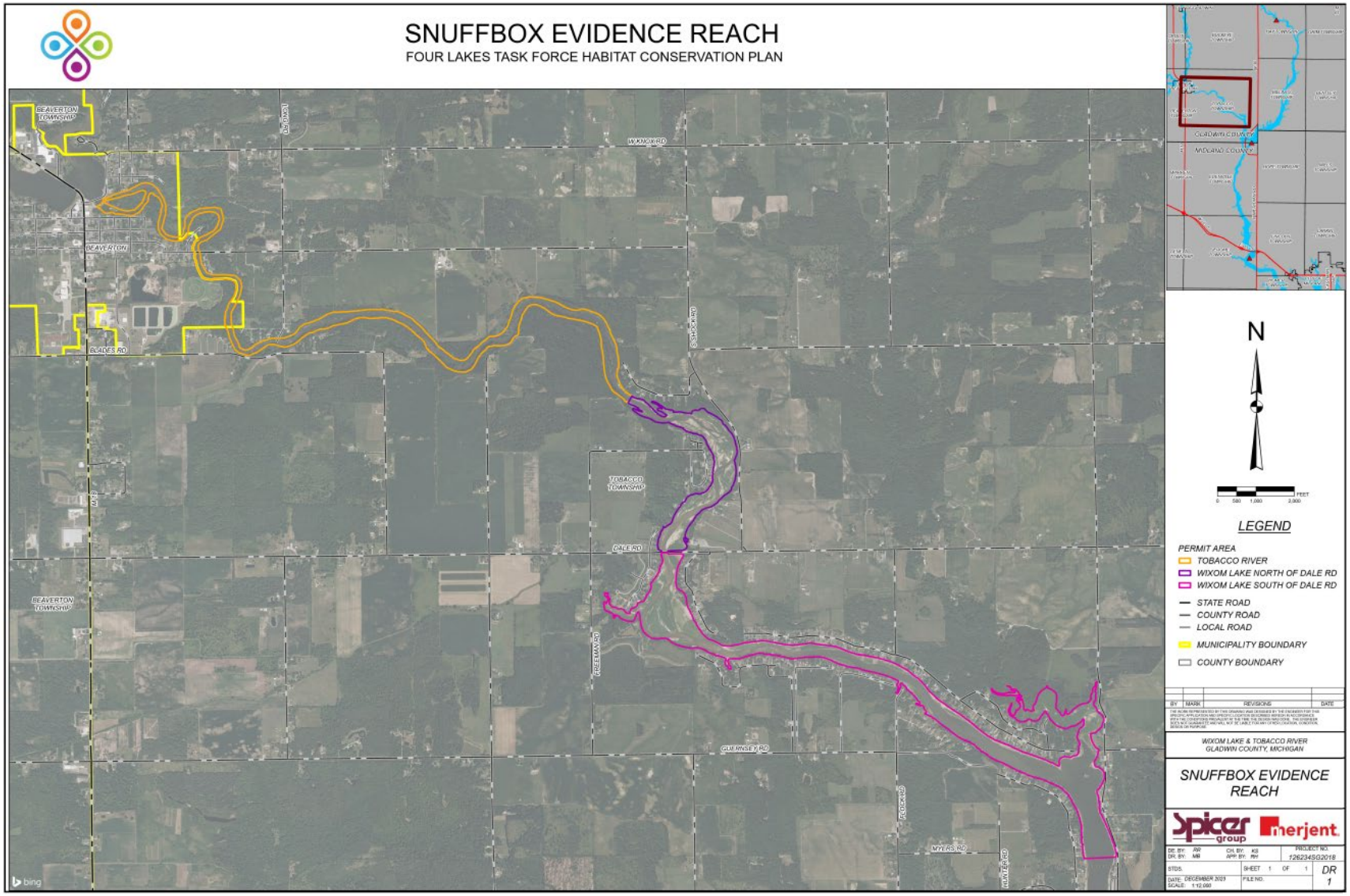

Figure 1. Snuffbox Evidence Reach

Figure 2. Permit Area

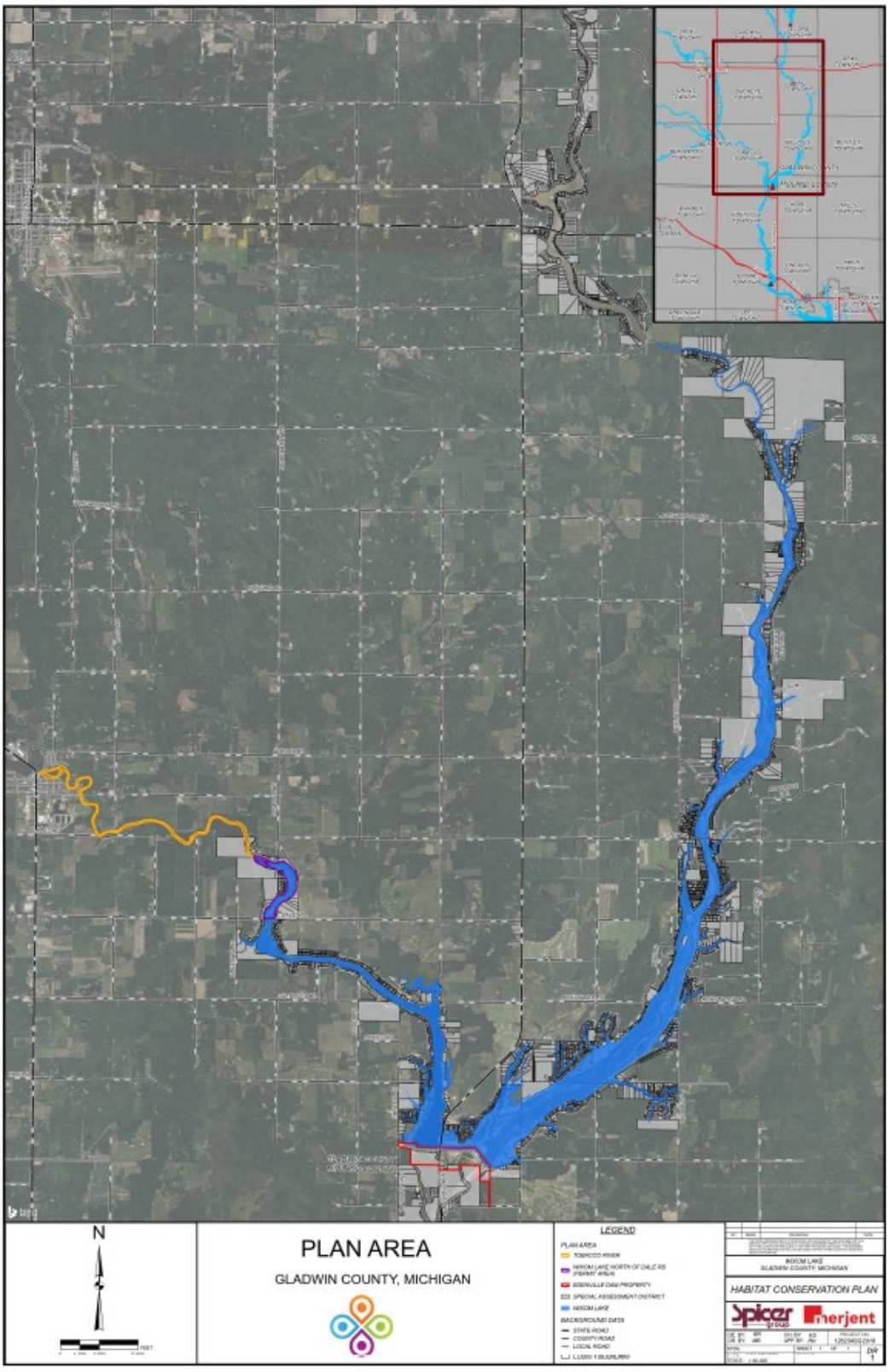

Figure 3. Plan Area

2.3 PERMITTEE

The project proponent is that which is planning to engage in Covered Activities (as defined in Section 6) within the Plan Area. The project proponent may be eligible for a Permit if specific conservation measures identified in the HCP are being or will be implemented. Those measures include minimization and mitigation measures for snuffbox mussel (see Section 9). Following issuance of a Permit, the project proponent is referred to as the Permittee. The project proponent is FLTF.

2.4 TERM OF INCIDENTAL TAKE PERMIT

FLTF is seeking a 30-year ITP from USFWS (Permit Term). Prior to permit expiration, FLTF may choose to apply to renew or amend the HCP and the associated ITP to extend their terms in accordance with USFWS regulations.

2.5 REGULATORY FRAMEWORK

FLTF, as the applicant seeking an ITP, must comply with all applicable federal, state, and local laws and statutes. In addition, the USFWS, as the agency issuing the ITP, must also comply with certain regulations under NEPA.

2.5.1 FEDERAL LAWS

2.5.1.1 Endangered Species Act

Under Title 50 CFR 17, the ESA of 1973, as amended, authorizes the Secretary of the Interior to identify species of wildlife and plants determined to be endangered or threatened with extinction under Section 4(a) of the ESA. Actions which are reasonably certain to cause incidental take of federally listed species require authorization from the USFWS under either ESA Section 7 or 10.

Under ESA Section 7 (“Interagency Cooperation”) federal agencies must ensure that any action funded, permitted, authorized, or carried out by said agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat.[14] If a Project does not have a federal nexus but the non-federal proponent believes Project activities are reasonably certain to cause incidental take of ESA-listed species that would otherwise be prohibited under Section 9 of the ESA, Section 10 of the ESA allows non-federal applicants to apply for incidental take coverage. Development of an HCP is necessary to provide the USFWS with an in-depth effects analysis and is the document by which a non-federal entity applies for an incidental take permit for otherwise lawful activities that are reasonably certain to cause take of federally listed species.

2.5.1.2 Migratory Bird Treaty Act

Migratory birds are protected under the MBTA[15], which prohibits the taking of any migratory bird, or a part, nest, or eggs of any such bird, except under the terms of a valid permit issued pursuant to federal regulations. The law implements the various treaties the United States has entered into with Japan, the Soviet Union, Canada, and Mexico. These treaties were agreements meant to ensure the continued success of migratory bird populations and were in response to the extinction

[14] United States Code, 16 USC § 1536 (a)(2)
[15] United States Code, 16 USC 703-711

or near-extinction of a number of bird species, primarily due to overharvest. While there are no migratory birds covered by this HCP, compliance with the MBTA is still required, and the conservation and mitigation measures developed here cannot result in take of migratory birds.

2.5.1.3 Bald and Golden Eagle Protection Act

The BGEPA prohibits the take; possession; sale; purchase; barter; offer to sell, purchase, or barter; transport; export; or import of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit.[16] "Take" under this statute is defined as to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb.[17] "Disturb," in turn, is defined as to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle; (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Suitable bald eagle nesting habitat is present throughout the Project area. While bald and golden eagles are not covered by this HCP, compliance with the BGEPA is still required, and the conservation and mitigation measures developed here cannot result in take of eagles.

2.5.1.4 National Environmental Policy Act

NEPA requires federal agencies to consider the potential environmental impacts of their proposed actions and to involve the public in the decision-making process. NEPA applies to a wide range of activities carried out or supported by federal agencies, including construction of highways, bridges, airports, and other transportation infrastructure projects, development of energy facilities such as power plants, oil and gas pipelines, and renewable energy projects, and federal grant programs and funding allocations that may directly or indirectly support projects with environmental impacts.

In the case of an HCP, the issuance of an ITP by the USFWS is a federal action which is subject to compliance under NEPA. The USFWS analysis can take the form of either an Environmental Assessment (EA) or Environmental Impact Statement (EIS), depending on whether or not the action will significantly affect the human environment. The USFWS NEPA review will review and analyze the direct, indirect, and cumulative effects of the take they are authorizing through the ITP, as well as the direct, indirect, and cumulative effects associated with the implementation of mitigation and minimization measures described in the HCP.

2.5.1.5 National Historic Preservation Act

Section 106 of the NHPA requires federal agencies to evaluate the effect of actions they carry out, license, approve, or fund on historic properties.[18] Agencies identify historic properties that may be impacted by the action and assess the potential of the action to affect these resources. Alternatives to avoid, minimize, or mitigate any adverse effects must be considered and documented. Agencies are required to engage stakeholders such as State Historic Preservation Officers (SHPOs), Tribal Historic Preservation Officers (THPOs), Indian tribes, Native Hawaiian organizations, and others in the process, as well as provide opportunities for public input. The USFWS will conduct this effects analysis as part of the NEPA process required for the issuance

[16] United States Code, 16 USC 668(a)
[17] Code of Federal Regulations, 50 CFR 22.3
[18] Code of Federal Regulations, 36 CFR Part 800

of the ITP. In addition, FLTF has conducted a Phase I archaeological survey and architectural history review of the dam property and its structural components in 2021. Three archaeological sites were identified which included historic trash scatter, a historic camp and trash scatter, and historic bridge abutments. All three sites were recommended as Not Eligible for listing in the National Register of Historic Places and no further archaeological work would be necessary. Based on this provided information, the Michigan SHPO concurred with this recommendation on November 23, 2021.[19]

2.5.2 STATE AND LOCAL LAWS

2.5.2.1 Michigan Endangered and Protected Species Regulations

Michigan regulates the protection of Threatened and Endangered Species within the state under Part 365 of Michigan's Natural Resources and Environmental Protection Act, Public Act 451 of 1994, as amended (NREPA). The MDNR is the agency within Michigan responsible for the protection of state endangered and threatened species under NREPA. Known occurrences of past recorded plant and animal species that are protected under Part 365 can be obtained from the Michigan Natural Features Inventory (MNFI, a division of the MDNR). Typically, a site-specific investigation is required to determine the presence or absence of a species. If the species is determined to be present and proposed construction activities cannot avoid the species, a "take" permit is required from the MDNR and mitigation measures may be required.

2.5.2.2 Michigan Natural Resources and Environmental Protection Act

Michigan regulates the environment and natural resources of the state under NREPA. This act regulates the use of certain lands, waters, and other natural resources of the State.

2.5.2.3 Michigan Department of Environment, Great Lakes, and Energy

Water Resources Protection, Part 31 of NREPA

Michigan regulates floodplains in the State under Part 31 of NREPA. Floodplains are designated by FEMA. If the watercourse in question does not have a FEMA mapped floodplain, then any activity proposed within a watercourse with drainage area greater than two square miles upstream of the proposed activity will also be considered to have regulated floodplain. Any construction activities (e.g., new structures, excavation, filling, paving, dredging, grading) within the floodplain or within the floodway will require a permit from EGLE. Structures proposed for placement within the floodway will require an analysis of the Hydrologic Engineering Center's River Analysis System to prove there is no harmful interference by the installation of the structure.

National Pollutant Discharge Elimination System, Part 31 of NREPA

The regulation of the discharge of pollutants to surface waters in Michigan is governed by the National Pollutant Discharge Elimination System (NPDES) permit. This is a federal program administered by the State through a Certificate of Coverage. For stormwater discharges from construction sites, the NPDES coverage is automatic for sites between one and five acres of total earth disturbance, however a soil erosion and sedimentation control (SESC) permit must be issued from the local enforcing agency or county enforcing agent. For earth disturbances greater than five acres in size, the applicant must submit a Notice of Coverage to EGLE. For wastewater

[19] Michigan State Historic Preservation Office, 2021

discharges, sand and gravel mining, hydrostatic pressure test water, and industrial stormwater discharges, a general or individual permit must be submitted to EGLE depending upon the type of activity.

Soil Erosion and Sedimentation, Part 91 of NREPA

The regulation of earth disturbance on construction sites in Michigan is governed by Part 91 of NREPA. Any earth disturbance within 500 feet of a river, stream, lake, or wetland or greater than one acre of total earth disturbance requires a permit from EGLE under Part 91 of NREPA. The SESC permit is administered by local or county governments within Michigan. Most large cities have a local enforcing agent, otherwise, the program is administered by county enforcing agents. In Gladwin County, the soil erosion agency is the Gladwin County Conservation District, and in Midland County, the soil erosion agency is Midland County Drain Commission.

Inland Lakes and Streams, Part 301 of NREPA

Michigan regulates watercourses and waterbodies in the State under Part 301 of NREPA. A stream, river, or drain is defined in the State of Michigan as any watercourse with a bed, banks, and evidence of flow or continued occurrence of water. Ponds are defined as waterbodies between one and five acres in size and lakes are defined as waterbodies greater than five acres in size. Construction activities proposed below the Ordinary High Water Mark (OHWM) of a watercourse or waterbody requires a permit from EGLE under Part 301 of NREPA.

Wetland Protection, Part 303 of NREPA

Wetlands in Michigan are regulated under Part 303 of NREPA. Wetlands are regulated by EGLE if they meet one of the following criteria: 1) the location of the wetland is within 500 feet of the OHWM of a river, stream, lake, or pond; or within 1,000 feet of the OHWM of one of Great Lakes; 2) the wetland has a surface water connection to a river, stream, lake, or pond; or 3) the wetland is greater than five acres in size. Construction activities proposed within the limits of a regulated wetland requires a permit from EGLE under Part 303 of NREPA.

United States Environmental Protection Agency Oversight of NREPA

Michigan assumed jurisdiction of wetlands and waterways from the Federal Government and runs its own regulatory program outside of the Federal Clean Water Act. The United States Environmental Protection Agency (USEPA) is the federal agency who oversees the wetland and waterways program established in Michigan. In the Memorandum of Agreement between EGLE and the USEPA, USEPA provides oversight on large project applications, or Major Projects[20], which are as follows:

- Dredging of 10,000 cubic yards or more (wetlands excepted)
- New dredging or upland boat basin excavation in suspected contamination areas
- Seawalls, bulkheads, or revetments of 500 feet or more in length
- Filling or draining of one acre or more of contiguous coastal or inland wetland
- New commercial docks or wharves of 300 feet or more in length
- Stream enclosures of 100 feet or more in length
- Stream relocations of 500 feet or more in length
- Subdivisions, condominiums, or new golf courses

[20] EGLE, Permit Categories

- Filling of 10,000 cubic yards or more (wetlands included)
- Shore projection that extends 150 feet or more into a lake or stream

These projects are considered to be "red files" by EGLE and require EGLE to submit the administratively complete application to USEPA for their review. USEPA has 90 days to review the application and provide their decision to EGLE of whether to approve or deny the application.

2.6 ALTERNATIVES TO THE TAKING

FLTF published, in May of 2021, a Plan for the Restoration of the Four Lakes: Feasibility Study and Plan[21], which included the development of an alternatives analysis for the repair and restoration of all four dams and report, including Edenville Dam and Wixom Lake. On June 30, 2021, EGLE issued a letter[22] that recognized the ownership of the dams, their status under Part 307 and Part 315 as high hazard dams, and their statement for Edenville Dam included a reference to the acceptable alternatives for permitting:

> *…FLTF should continue to pursue these efforts according to the Feasibility Study and apply for permits according to local, state, and federal laws. However, if FLTF determines that reconstruction of Edenville Dam isn't feasible in a reasonable timeframe, a plan to address remaining concerns with long-term dam safety and stability and ongoing natural resource impacts will need to be developed and implemented. The plan would need to consider such alternatives as additional stabilization and restoration measures or removal of the dam and restoration of impacted reaches of the river channel* (EGLE, 2021).

These responsibilities included the requirement for FLTF to complete emergency work, as well as to either apply for permits to reconstruct the dam, or if reconstruction of the dam was not feasible, to prepare a plan that would address remaining concerns with long-term dam safety, stability, and ongoing natural resources impacts.

The alternatives analysis from the May 2021 feasibility study was further developed and is being submitted to EGLE as a part of permit applications associated with the restoration of Edenville Dam and the return of Wixom Lake to its normal (legal) lake level. FLTF considered three alternatives:

1. Leave Edenville Dam in its Interim Stabilized Condition ("No Action Alternative")

2. Removal of the Edenville Dam

3. Restoration of the Edenville Dam and the return of Wixom Lake to its Normal (Legal) Lake Level

The preferred alternative is for FLTF, as the delegated authority of Midland and Gladwin counties, to fulfill their legal obligation under Part 307 to return Wixom Lake to its legally defined lake level. The current condition of Wixom Lake is not satisfactory to EGLE, the counties, or the lake communities, nor is the current condition economically sustainable.

[21] FLTF, 2021b
[22] EGLE, 2021

Further discussion on the three alternatives analyzed is provided in the subsections below. Each alternative is additionally summarized in Table 1, below.

TABLE 1

Least Environmentally Damaging Practicable Alternative Analysis

Practicability Category	Alternative 1 – Leave Edenville Dam in its Interim Stabilized Condition ("No Action Alternative")	Alternative 2 – Removal of the Edenville Dam	Alternative 3 – Restoring the Edenville Dam and return of Wixom Lake to its Normal (Legal) Lake Level
Direct Environmental Impacts (impacts from project construction)	No direct impacts, interim stabilization work at the dam properties is completed.	Impacts from removal of dam infrastructure (i.e., concrete, embankment, spillway) and the impact from the final stabilized design, removal footprint greater than restoration footprint and grade stabilization needed to address sediment transport	Impacts from reconstruction include temporary and permanent lake, stream and wetland impacts to be permitted by EGLE.
Secondary Environmental Impacts	Ongoing environmental degradation (e.g., ongoing erosion, uncontrolled vegetation growth, invasive species proliferation [plants and aquatic], etc.) until the system naturally stabilizes, loss of historic wetlands, disconnected streams via perched culverts, head cutting of streams, ongoing sediment transport downstream	Restoration of free-flowing river conditions (TBW, TBO, and tributaries), loss of historic wetlands, disconnected streams via perched culverts, invasive species migration upstream, and increased sediment transport downstream from structure removal.	Flooding of bottomland wetlands, tributary streams, and the TBW and TBO as a result of the lake level restoration. Restoration of hydrology to historic wetlands and reconnection of disconnected streams.
Cumulative Environmental Impacts	Ongoing environmental degradation until the system naturally stabilizes, loss of historic wetlands, loss of historic habitat, ongoing sediment transport downstream, loss of lake ecosystem, natural resources habitat and streams.	Extensive environmental restoration needed to restore riverine system benefits, loss of surrounding wetlands, loss of historic habitat, increased sediment transport downstream.	Mitigation for loss of benefits as a direct result of the failure; ecosystem anticipated to be restored with lake level restoration.
Community Benefits	Diminished benefits of access to recreation and natural resources, loss of navigation, significant impact to local government tax base and property values.	Reduced recreational opportunities for property owners and community members. Significant impact to local government tax base and property values.	Restoration of lake-based recreation and restored local economic benefits and growth associated with the lake.
Safety	Significant investment with no viable dam safety program, limited flood storage capacity.	Neutral for downstream public relative to historic floods.	Safe for public, sound engineering practices and Federal guidelines to Inflow Design Flood applied to reconstruction.
Funding	No financial mechanism has been identified to support assessments for long-term maintenance.	No local financial mechanism to obtain funds for full removal and environmental stabilization.	SAD set up to fund long-term operation and maintenance and have proven cost to be affordable.
Legal Obligation	No legal framework to support dam structures remaining in lowered lake level state. Not practical to maintain high hazard dams that add no value.	Uncertain legal framework to support Sanford Dam removal and environmental restoration for lakes with a legally established lake level.	Midland and Gladwin counties are legally obligated to maintain the normal (legal) lake level.
Level of Take on Snuffbox Mussel	No take to existing snuffbox mussels within the Permit Area; however, potential failure of interim dam stabilization measures could result in take of species.	Take of snuffbox mussel is possible within the SER upstream of Dale Road where channel stabilization efforts would need to occur. Following channel stabilization efforts, the TBO channel would become viable habitat for snuffbox mussel and host species over time.	Take of snuffbox mussel is possible within the SER upstream of Dale Road where lotic environments would be changed to lentic habitats and increases in sedimentation would reduce quality heterogenous substrates.

2.6.1 Alternative 1 – Leave Edenville Dam in its Interim Stabilized Condition (No Action Alternative)

No further action, meaning leaving the Edenville Dam in its post failure interim stabilized condition, is the "do-nothing" option. This is not a practicable option and is not the least environmentally damaging option. This option could not be administered under Part 307, thus, there is currently no clear regulatory or legal framework to support this approach. To be administered under Part 307, the Edenville Dam would need to maintain State of Michigan Part 307 Legal Lake Levels or provide other values such as power or sustainable flood protection. If the legal lake level is not maintained, there would be no clear understanding of who would own the dams, who would operate the dams, and who would fund the maintenance of the dams. Additionally, no party would be responsible for issues related to the dam failures, including system instability, environmental degradation, and long-term economic damage.

The "No Action Alternative" would be the least impactful alternative to the snuffbox mussel based on a variety of existing and long-term factors; however, if the interim stabilization condition were to fail, the potential effects to snuffbox could be significant. As discussed in Section 2.2.1, the SER from the Dale Road bridge upstream to the Wixom Lake normal (legal) lake level currently supports a diverse mussel community, including the endangered snuffbox mussel and habitat such as heterogenous substrates, riffle bed form features and gradually sloped/stable shoreline habitats. Additionally, the TBO from the upstream extent of Wixom Lake to the Beaverton Dam supports an even more significant and high-quality mussel community. Current conditions within the SER and upstream to Beaverton Dam provide adequate dissolved oxygen concentrations, water temperature, diverse bed form features and quality riparian areas. It is assumed the TBO channel from the upstream extent of Wixom Lake, downstream to the Edenville Dam, is still in a process of equalizing to a stable pattern, profile and dimension from the drastic drawdown in water lever. The river has created a natural riffle-pool pattern and associated geometry, but without human intervention the timeline to stabilize the channel is unknown. As the TBO channel becomes stable the range of suitable habitat for snuffbox mussel will expand from the current areas noted. The naturalized stream channel will become suitable for all life stages of snuffbox adult, juvenile and host fish species habitation. Maintaining a natural lotic environment will also help reduce the abundance of zebra mussels within the TBO, compared to greater abundance associated with lentic environments that would result if Wixom Lake was returned to its prior level. The "No Action Alternative" approach will result in no take of snuffbox mussels within the Plan Area.

2.6.2 Alternative 2 – Removal of the Edenville Dam

Removal of the Edenville Dam has a legal and financial impact. Part 307 does not specifically provide a process for abandoning or rescinding the normal level of an inland lake once established, or for the rescinding of the SAD once approved by the county circuit court. However, because the county circuit court has continuing jurisdiction and, under the Michigan court rules governing civil procedure, courts have the authority to modify orders and, therefore, anything affecting the lake levels, including departures from the normal levels, would likely require a petition or motion requesting the court to abandon or rescind the lake level order and the SAD. The same would be the case for the partial recission of a lake level order that affects more than one lake, as in the case of the Four Lakes system.

Special assessments are based on the benefits derived, and if properties within the SAD do not derive a benefit, the properties cannot be assessed. The benefit envisioned for properties in the SAD comes from restoring the water elevation in Wixom Lake to the level in the 2019 Lake Level

Order[3] and removal of the dam would not deliver that benefit. Thus, for example, if it is determined that it is not financially feasible to restore the stabilized Edenville Dam and Wixom Lake, the counties through their delegated authority, or the state of Michigan could petition the circuit court for modifications of the lake level order to remove or eliminate the court-ordered lake level for Wixom Lake. Elimination of the court-ordered lake level would likely also eliminate FLTF's status as the Delegated Authority of the counties and eliminate the SAD. Properties that would otherwise have benefitted from the maintenance of the normal levels of Wixom Lake would not receive a benefit, and either would not be assessed, or would receive an assessment showing a "$0.00" assessment, even though the properties could remain in the lake level assessment district.

Based on the computation of costs for 2022-2024 Operations and Maintenance, the operations of all four dams in stable condition, is estimated to be $1.4 Million per year by 2024 when the dams are stabilized. It would be expected that the Edenville Dam as the largest dam in the system accounts for a significant portion of the total. If the dam is to be removed the property owners cannot be assessed for cost as they do not benefit. Furthermore, there is no current knowledge of any private entity or local government that could or would desire to administer, finance, or maintain this option.

Significant restoration work would be necessary to stabilize the miles of river and stream channel that will be permanently exposed by loss of the impoundment/removal of the dam. In some cases, this could include a complete rebuild of the stream channel at new elevations, with excavation and stabilization of the surrounding floodplain. Based upon the detailed plan submitted for permitting, construction may require land acquisition and will require substantial engineering and stream restoration expert oversight. Any contaminated sediment that might be mobilized as a result of the proposed project will need to be dealt with, through dredging and disposal in an approved landfill.

Wetland mitigation will be required for all permanent impacts to existing wetlands. Typical mitigation ratios are a minimum of 1.5 acres of wetland mitigation for each acre of impact but are generally higher (2:1) for forested systems. Based on desktop and field analyses (see Section 4.1.6), nearly 2,000 acres of wetlands are expected to be impacted by the loss of hydrology in and surrounding Wixom and Sanford lakes. Wixom and Sanford lakes were drained as a result of the May 2020 disaster and will likely not require wetland mitigation for the wetlands that were impacted by loss of hydrology. However, the loss of the wetlands around the lake will have a significant negative impact on the local ecosystem given the numerous benefits they provide.

Dam removal is typically associated with ecological restoration and restoring aquatic connectivity. It is expected that the composition of the fishery would change significantly with conversion from a lentic to lotic system. Project designs should pay attention to fish species such as lake sturgeon (*Acipenser fulvescens*), walleye (*Sander vitreus*), and suckers (Catostomidae) that could benefit from a free-flowing system. The decommissioning of the dam would reduce boat fishing and introduce more open land surrounding the TBW and TBO rivers and their tributaries for trails and shoreline fishing.

A plan would be required to address the potential for spread of invasive species. Monitoring and management of riparian lands and the initially exposed lake beds may be necessary to ensure proliferation of native plant species. Close coordination with state and federal agencies (particularly the Great Lakes Fisheries Commission) will be required to design and implement plans to control sea lamprey.

Removal of the Edenville Dam would result in the permanent loss of Wixom Lake. This would in turn cause permanent loss of the economic activity that Wixom Lake previously created in the local economy, such as sales of and employment in boat fuel, marine services, fishing tackle and bait, party supplies and groceries, plus loss of income for marinas and campgrounds and loss of property tax revenue from devaluation of what were once many hundreds of waterfront properties. Gladwin County is already in an unfavorable economic condition and the loss of this economic activity and property tax revenue would exacerbate the problem.

Removal of the Edenville Dam would result in potential take of the snuffbox mussel due to channel stabilization efforts that would likely need to take place within the SER upstream of the Dale Road bridge. Currently, the elevation of present-day Wixom Lake (the TBO) above the Tobacco Spillway of the Edenville Dam is 648 feet, while the downstream elevation at the Tobacco Spillway is at the Sanford normal (legal) lake level (currently being restored as a part of a separate Project) of 630.2 feet. Upon removal of the Edenville Dam and its components, construction work to stabilize the existing channel would be required and involve earthwork (cutting and filling) that would result in areas of direct disturbance within the stream channel and therefore cause potential take of snuffbox. Available habitat for snuffbox would be lost from the onset of construction within the stream channel until the channel has stabilized. Once construction is complete and the channel profile and dimension is stable, the restored channel would become suitable habitat for all life stages of snuffbox and host fish species. Assuming the removal of the Edenville Dam would require stabilization of the entire TBO channel from the Edenville Dam to the upstream extent of Wixom Lake, the potential of mussel colonization to areas within the entire length of the stabilized channel is possible. This would result in a net increase in available snuffbox habitat overall.

The timeframe for colonization of snuffbox within the stabilized TBO channel would depend on the success and integrity of installed channel design elements and suitable substrate conditions to develop. For example, within constructed riffles there would likely need to be some deposition of smaller materials such as small gravel and sand within larger cobble substrates to create suitable heterogenous substrate conditions for mussel habitation. Abiotic factors such as dissolved oxygen and temperature would be supportive of snuffbox and host fish species within the stabilized TBO channel and should be similar to those currently supporting mussels upstream of the Wixom Lake normal (legal) lake level. Removal of the Edenville Dam and required stabilization of the TBO channel will ultimately result in the preservation of the TBO channel upstream of the former Wixom Lake area where a diverse and abundant mussel community currently exists. Additionally, the removal of the Edenville Dam would increase connectivity of fish communities upstream and downstream of the dam which could be beneficial for snuffbox mussels host species. Zebra mussel abundance would be reduced in a restored natural lotic environment compared to a lentic environment which would be created from the establishment of Wixom Lake.

2.6.3 Alternative 3 – Restoration of the Edenville Dam and the return of Wixom Lake to its Normal (Legal) Level

The alternative of restoring the Part 307 Legal Lake Level is feasible, practicable, and the least impactful to the environment. It begins the process of restoring the environment to what existed prior to the dam failure. There is a regulatory framework (Part 307), a means to finance the restoration, and a means to finance the long-term operations and maintenance of the Edenville Dam. Restoring the Legal Lake Level is the most expeditious and viable option to mitigate environmental damage, restore the function of tributary streams, and restore hydrology and ground water for quality adjacent wetlands. Based on EGLE's input and the findings of FLTF's

feasibility study, restoration of Edenville Dam and Wixom Lake is the only viable alternative and is the least environmentally damaging practicable alternative.

Wixom Lake has a total of 1,775 parcels that abut the waterfront. Of those parcels, over 80 percent of the residential parcels around Wixom Lake are private, primary homesteads. An overwhelming majority of landowners are willing to pay for and support the restoration. In a recent Public Sector Survey of Four Lakes Communities[6] of Wixom Lake residences who responded:

- 86 percent agreed that a lake was important to them, with 5 percent disagreeing.
- 80 percent agreed that the dams should be rebuilt.
- 72 percent agreed that environmental restoration was important to them.

Other studies indicate positive impact to the community, including fishing, hunting, and recreation prior to the Edenville Dam's failure.

- 20,000 angler boat trips per year
- Over $250 million in property value

Since Edenville Dam's failure, over $14 Million (sum of all spending to date) will have been spent to recover and stabilize the Wixom Lake system. This includes:

- The recovery effort at Edenville Dam is complete, and included constructing the stabilization improvements outlined in the post-failure EGLE Emergency Order and permit.

- Edenville Dam interim stabilization on the TBO and TBW River sides of the Edenville Dam.

- FLTF and the USDA-NRCS have identified numerous debris removal and shoreline stabilization projects that were eligible for USDA-NRCS Emergency Watershed Protection Program funding to protect residential homes and critical infrastructure from damage related to active erosion following the rapid drawdown of Wixom Lake. Construction efforts commenced in 2021 and were completed at the start of 2023.

As further discussed below, the reconstruction of Edenville Dam and the return of Wixom Lake to the normal lake level with proposed "run-of-the-river" operations will have a positive impact on the recovery of the thriving lake ecosystem present prior to the dam failure.

FLTF is committed to ensuring that the restoration of the dam also results in the restoration of the surrounding lake ecosystem. Restoration of surface water hydrology to the normal (legal) lake level is anticipated to have a positive impact on the tributaries entering Wixom Lake that can support lake adapted aquatic species such as macroinvertebrates, fish, and amphibians. Recovery of the lake ecosystem will take time, as it developed over a century and will not return immediately following restoration of the normal (legal) lake level. FLTF has brought on stream and wetland specialists to help understand the changes in the wetlands and streams surrounding Wixom Lake. FLTF and their specialists have consulted with EGLE on monitoring plan methodology for these water resources and studies have been implemented. These studies are briefly summarized below; see Section 4.1.6 for additional detail related to these ongoing studies.

The dam failure and resulting draining of the impoundment resulted in the loss or degradation of existing wetlands around Wixom Lake and the development of new early successional wetlands on Wixom Lakes' bottomlands. The *Wixom and Sanford Lakes Post-Disaster Created Wetlands Investigation Report*[23] and *Pre-Disaster Wetland Impact (Wetland Rehydration) Monitoring Report*[24] provide details on the methodology and results of wetland studies initiated in 2022. In summary, approximately 447 acres of wetlands have formed on the Wixom Lake bottomland, none of which are anticipated to develop into high-quality systems. These wetlands will be lost when the lake level is restored. However, with the restoration of the lake level, EGLE believes that at least 6705 acres of wetlands historically supported by elevated water levels will be restored. These wetlands would not be restored immediately as the lake refills, therefore requiring a temporal Impact offset that is accounted for by the wetland hydration acreage provided at a 1.5 to 1 ratio.

After the failure of Edenville Dam and the draining of its impoundment, approximately 10.9 miles of the TBW River and 5.1 miles of the TBO River, have returned to a free-flowing condition for the first time in nearly 100 years. In addition, many tributaries enter the TBW and TBO rivers in the former Wixom Lake impoundment. In summary, 22 streams totaling 80,638 feet of stream length, will be converted from a lotic to a lentic environment by refilling Wixom Lake to the legally established summer elevation. In their current state, none of these streams are functioning properly in terms of hydrology, hydraulics, morphology, and physiochemical parameters of biology.

Restoration of Wixom Lake to the normal (legal) lake level will restore water elevations and will prevent the river and streams from further cutting new channels and moving bottomland sediment. Given the reduced velocity of the flow through Wixom Lake compared to the current conditions, the system will be able to begin stabilization and result in a reduction of sediment loads downstream. Conversely, this would also alter the natural sediment transport, given that the system would return to an impounded state. The restoration of lake levels will also restore hydrologic connections to adjacent stream tributaries and wetlands that are currently interrupted due to the decreased elevations of the local water table and lack of surface water connections.

FLTF, as the Delegated Authority, and the SAD have extremely limited powers to directly influence land use changes within the impacted watershed, change or promulgate rules/regulations governing land use, or expand funds outside of its jurisdiction. Thus, FLTF plans to promote, partner, and assist stakeholders with education and activities that embody low-impact development principles with a purpose of improving water quality throughout the Plan Area. As such, FLTF will support necessary policies and programs, including outreach, which incentivize these actions. FLTF will evaluate seeking funding from EGLE to develop a nine-element watershed management plan, which would allow stakeholders to apply for and receive grant funding to conduct on-the-ground water quality improvement projects.

Restoration of Wixom Lake to the normal (legal) lake level may result in the take of snuffbox mussels within the SER from the Dale Road bridge to the upstream extent of Wixom Lake due to abiotic factors which would change within the river reach. Specifically, the establishment of a lentic environment will remove established riffle bed forms within the existing channel which is a preferred habitat for snuffbox mussel and their host species. Sediment transport dynamics would also change within a lentic environment and result in increased deposition of fine sediments and overtime result in reduced heterogenous substrates. Dissolved oxygen and temperature changes

[23] Merjent, 2022
[24] Merjent, 2023

resulting from the restoration of Wixom Lake are not suggested as limiting factors to snuffbox and host fish habitation within the SER upstream of Dale Road Bridge based off historical dissolved oxygen and temperature profiles measured near the Edenville Dam. The bathymetric conditions within the SER from Dale Road Bridge to the Wixom Lake normal (legal) lake level would likely not support dissolved oxygen concentration below 5 milligrams per liter (mg/L) and temperature changes will be minimal within the water column, such that it would not limit the biological community. Mussel surveys from 2022[12] indicate a diverse mussel community was present within the upstream extent of Wixom Lake north of the Dale Road bridge. At this location, an abundance of mussel individuals and composition of species were sampled. Therefore, while the conditions which would result in the restoration of Wixom Lake are not ideal for snuffbox mussels, there is evidence to support further survival of the species within the SER upstream of Dale Road within Wixom Lake. The point at which snuffbox habitation is not possible is certain to occur at a minimum downstream of the Dale Road bridge. Operational processes associated with the restoration of Wixom Lake, including winter drawdown procedures, are not expected to impact the snuffbox mussel and host species. Currently, areas which would become dewatered in the winter are not within the current wetted channel area of the TBO and therefore contain no snuffbox mussels at this time. If Wixom Lake normal (legal) lake level were restored, those area would become wetted. However, because they are dewatered annually, they are not considered viable habitat for colonization. The change from a lotic to lentic environment would support the establishment of a larger zebra mussel community and therefore could result in take of snuffbox mussel within the SER due to fouling of zebra mussels on snuffbox. The restoration of Wixom Lake and continued maintenance of the Edenville Dam would assist to preserve the existing high quality mussel community upstream of Wixom Lake, due to stable water levels.

2.6.4 Review of Edenville Dam Restoration Alternatives

After the agreement with EGLE that the reconstruction of the Edenville Dam is the least damaging environmental practical alternative, three alternatives for dam design were reviewed by GEI Consultants (GEI) as part of the design process. FLTF, Spicer Group, Inc., and GEI held a workshop on March 24, 2022, to evaluate the information developed and select the preferred alternatives for advancing the 60 percent design. During the workshop, each alternative was assessed against weighted evaluation criteria and rated as being Positive, Moderate, or Negative using a value and relative scoring system. The selected alternative, presented in the EGLE permit application, scored highest with discussions on how to minimize direct impacts from construction being a part of the evaluation of alternatives.

3.0 SPECIES COVERED BY THIS PERMIT

The snuffbox mussel (*Epioblasma triquetra*) is the only species included in this HCP. The snuffbox mussel is listed as federally endangered under the ESA and endangered by the State of Michigan. FLTF has determined that Covered Activities are reasonably certain to cause incidental take of this species, and an ITP is necessary to remain in compliance with the ESA. This species is discussed in detail in Section 7 of this HCP.

FLTF evaluated the potential for other species protected by federal regulations (e.g., federally listed species, candidate species, species proposed for Federal listing, eagles, and migratory birds) within the HCP Plan Area.

3.1 SPECIES NOT COVERED BY THIS PERMIT

FLTF reviewed a list of federally endangered, threatened, proposed, and candidate species under the ESA that may occur within the Plan Area (see Table 2 below). This list was developed using the USFWS Information for Planning and Consultation project planning tool (IpaC).[25] Species accounts and discussion of suitable habitats are provided below. The Plan Area does not intersect designated critical habitat for any federally listed species.

FLTF conducted an effects analysis of the Covered Activities to determine their possible impacts to federally listed species. This analysis found that incidental take of the species listed in Table 2 is not reasonably certain to occur. As such, FLTF does not require an ITP for these species, and they are not covered in this HCP. A brief discussion of the results of the effects analysis and any avoidance and minimization measures (AMMs) necessary to ensure Covered Activities will not result in unauthorized take can be found in the subsections below for each of the species listed in Table 2.

TABLE 2

Species Not Covered by the FLTF HCP

Common Name	Scientific Name	Status
Northern long-eared bat	*Myotis septentrionalis*	Endangered
Tricolored bat	*Perimyotis subflavus*	Proposed Endangered
Rufa red knot	*Calidris canutus rufa*	Threatened
Eastern massasauga	*Sistrurus catenatus*	Threatened
Monarch butterfly	*Danaus plexippus*	Candidate

3.1.1 NORTHERN LONG-EARED BAT

The northern long-eared bat spends a portion of each year in hibernation, typically between October 1st and April 1st. The species overwinters in small crevices or cracks in hibernacula, such as caves and mines. In April, the species emerges from its hibernacula and migrates to summer roosting habitat. During the summer, reproductive females form maternity colonies that are variable in size, ranging from a few individuals to as many as 60 adults[26], while males and non-reproductive females typically roost in different summer roosting habitat and may roost alone.[27] The pup season generally occurs between June 1st and July 31st. Roost tree fidelity appears to

[25] USFWS, 2022a
[26] Caceres and Barclay, 2000
[27] Lacki and Schwierjohann, 2001

be low and female northern long-eared bats may move among roosts as often as every two days.[28]

The primary threat to the northern long-eared bat is the spread of white-nose syndrome; in the absence of this disease, it is unlikely the species would be suffering the dramatic population declines seen across its range. Populations of the northern long-eared bat have declined substantially in the Midwest, with an estimated 99 percent decline in certain populations, and it is considered to be one of the species most impacted by the disease.[29] Although species declines from white-nose syndrome are much more significant, impacts to the species from removal of hibernacula, loss or degradation of summer habitat and wind farm operations pose significant threats to the species.[30]

To ensure that tree clearing associated with construction activities will not result in take of northern long-eared bats, tree clearing will be conducted when the species is in hibernation and not using summer roosting habitat, between October 1st and March 31st.

3.1.2 TRICOLORED BAT

The tricolored bat spends a portion of each year in hibernation. In Michigan, the species is among the first to enter hibernation starting as early as late-July to October and the last to emerge in April.[31] The species overwinters in caves and mines where available. However, throughout much of its range in the southern United States, roadside culverts, tree cavities, and abandoned water wells serve as suitable overwintering habitat.[32] The species are known to exhibit high site fidelity with many individuals returning year after year to the same hibernacula.[32]

During the active season (generally, April 1st to October 31st), the species may be found roosting among leaf clusters (live and dead) on living or recently dead deciduous hardwood trees. Roost choice may also vary by region: the species uses Spanish moss in the southern portion of its range and “bony beard” lichen plants (*Usnea trichodea*) in the north. The species has also been observed roosting in eastern red cedar trees and pine needles as well as within manmade structures such as barns and bridges.[32] Females will form maternity roost colonies and similar to overwintering habitat will return to the same roosting locations year after year, while males roost individually.[32]

The primary threat to the tricolored bat is the spread of white-nose syndrome; in the absence of this disease, it is unlikely the species would be suffering the dramatic population declines seen across its range. Populations of the tricolored bat have declined 90 percent to 100 percent at winter colony sites impacted by the disease.[32]

To ensure that tree clearing associated with construction activities will not jeopardize the existence of the tricolored bat, tree clearing will be conducted when the species is in hibernation and not using summer roosting habitat, between October 1st and March 31st.

[28] Foster and Kurta, 1999
[29] USFWS, 2015a
[30] USFWS, 2015b
[31] MNFI, 2022a
[32] USFWS, 2022b

3.1.3 RUFA RED KNOT

The red knot is a large sandpiper measuring 9 to 10 inches in length and noted for its long-distance migration between breeding grounds in the Arctic and wintering areas in high latitudes of the Southern Hemisphere.[33] Threats to the rufa red knot include habitat destruction, habitat modification, or curtailment of red knot habitat and other natural and anthropogenic factors. Many of the threats are related to climate change, wetland quality and availability, oil spills, leaks, and environmental contaminants, and wind energy development.

Red knot habitat preferences vary widely during the three main phases of their annual cycle:

- **Breeding** – Red knots nest on dry, sunny, elevated, wind-swept ridges or slopes in the Arctic tundra. Nests are typically located near shallow sedge meadows or sparsely vegetated lake edges, which provide foraging habitat to chicks and fledglings.[34]

- **Migration** – While migrating, red knots prefer sandy coastal habitats where they forage on a variety of invertebrates. For coastal migrants, a crucial stopover site on the northward journey is Delaware Bay, where they feed mainly on the eggs of horseshoe crabs (*Limulus polyphemus*).[34]

- **Non-breeding** – Preferred wintering habitats in the southern United States include sandy beaches, peat banks, salt marshes, brackish lagoons, tidal mudflats, and mangroves.[34]

The following species-specific AMMs will be implemented if construction takes place during the species' migratory window from May 1st to September 30th:

> If a rufa red knot is sighted by FLTF's contractor within one mile of the construction workspace during construction, or if the USFWS notifies FLTF of a rufa red knot sighting within one mile of the construction workspace, construction activities will cease until the individual(s) have left the area. Any sightings by FLTF's contractor within the construction workspace will be immediately reported to the USFWS and MDNR.

3.1.4 EASTERN MASSASAUGA

The Eastern Massasauga Rattlesnake (EMR) is primarily associated with wetland habitats with adjacent uplands, these include bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, and floodplain forests with semi-open areas to provide cover from predators and thermoregulation (basking) sites.[35] They will shift the habitats they use, depending on the season. Generally, they use wetlands in the spring, fall, and winter. In summer, snakes migrate to higher, drier upland sites, ranging from forest openings to old fields, agricultural lands, and prairies.[36]

[33] Baker et al., 2013
[34] Niles et al., 2008
[35] Prior, 1991 and MNFI, 2022b
[36] Kingsbury, 2002

The species overwinters between October to March in crayfish burrows but may also be found under logs and tree roots or in small mammal burrows.[37] Individuals emerge from winter dormancy as spring floods begin in March and April.[35]

The primary threat to the Eastern Massasauga is habitat loss and habitat fragmentation. The key contributions include development of habitat; vegetative succession; road mortality; natural and artificial hydrologic alterations (i.e., drought and flooding); illegal collection; and, adverse habitat management from post hibernation prescribed fires and mowing activities.[38]

Ground-disturbing activities could have adverse impacts on the species if conducted during the species active period (i.e., conducted April 15th to October 15th). To avoid and minimize impacts to the species, it is recommended that all work be conducted during the species' inactive period (October 16th through April 14th). If this is not feasible, then the following AMMs should be implemented:

1. Watch MDNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake (EMR)" video, review the EMR factsheet, or call 517-351-2555 to increase human safety and awareness of EMR.

2. All personnel on site are required to report any EMR observations to the Service within 24 hours.

3. Use wildlife safe materials for SESC devices and site restoration and eliminate the use of erosion control products containing plastic mesh netting or other similar material that could ensnare snakes:
   - Use natural fiber netting or no netting
   - Materials should be 100 percent biodegradable
   - Use loose weave, non-welded, movable jointed netting (leno or gauze)
   - Rectangle (elongated) mesh is better than square
   - Stake erosion blankets and mats to the ground so that all edges are secured with wooden stakes
   - Bury edges of blankets and mats
   - Remove SESC BMPs as soon as they are no longer needed
   - Hydraulically applied SESC BMPs

When no longer required, temporary SESC products should be promptly removed, usually as soon as vegetation establishes in the soil.

3.1.5 MONARCH BUTTERFLY

The monarch butterfly is found throughout the 48 contiguous states in the United States and parts of Canada and Mexico. Suitable habitat for monarch migration, foraging, and reproduction is comprised of milkweed and nectar-producing flowering plants. Monarch butterflies lay their eggs exclusively on milkweed plant leaves and therefore their continued existence is dependent on milkweeds. The larvae/caterpillars then use the milkweed for food until they reach adulthood. Nectar-producing flowering plants are used by the adult monarchs for food where they move

[37] Szymanski et al., 2016
[38] USFWS, 2016b

pollen between flowering plants. Monarchs east and west of the Rocky Mountains winter in Mexico and California, respectively.[39]

The monarch butterfly is affected by a variety of threats; however, the most critical are habitat-related.[40] Other threats to the species include incompatible management of overwintering areas, tree thinning and logging at overwintering areas, drought, urban development, insecticides, climate change, and low population numbers, which are more susceptible to catastrophic events.[41]

Ground-disturbing activities could have adverse impacts on monarch butterflies if conducted in suitable foraging and egg-laying habitat (i.e., milkweed) during the species active period (i.e., conducted May 1st to October 1st). Fugitive dust and noxious weeds could have impacts on monarch butterflies by reducing the productivity and quality of the vegetation that comprise suitable habitat areas. Dust in high concentrations could have a detrimental effect on caterpillar development or potentially affect the growth and survival of vegetation. To avoid and minimize impacts to the species, the following measures should be implemented in areas of suitable habitat:

- Conduct all work in suitable habitat during the species' inactive period (October 2nd through April 30th).
- Apply speed limits on all vehicles in construction workspace to reduce collision and crushing risk.
- In areas requiring vegetation maintenance, but which contain suitable foraging and/or egg-laying habitat:
    - mow/brush no more than one-half of the open, non-forested foraging habitat within the management area per year, if possible; leave patches of unmowed habitat for the entire year; and/or
    - create a mosaic of structurally different habitat patches or ensure that the extent of the area mowed is not likely to affect more than one-third of the foraging habitat that is available on site or within the larger landscape.
- Apply herbicides using spot treatment methods (no broadcast application with boom or aerial sprayers)
- Reseed areas with nectaring plants and milkweed to the maximum extent practicable.

Fugitive dust and noxious weeds could have impacts on monarch butterflies by reducing the productivity and quality of the vegetation that comprise suitable habitat areas. Dust in high concentrations could have a detrimental effect on caterpillar development or potentially affect the growth and survival of vegetation. To ameliorate fugitive dust as a stressor, FLTF has committed to a dust abatement program throughout the entire workspace. Dust suppression measures will be employed as necessary to control fugitive dust emissions.

[39] Cardno, 2020
[40] Thogmartin et al., 2017
[41] USFWS, 2020a

4.0 ENVIRONMENTAL SETTING

Gladwin and Midland counties are located at the tension zone that divides the lower and upper portions of Michigan's lower peninsula near Michigan's eastern Bay Region. Gladwin County is approximately 516 square miles and Midland County is approximately 528 square miles. Within these counties, the Townships of Edenville, Hope, Tobacco, Billings, and Hay surround Wixom Lake. These townships are primarily rural, with an average population of 1,978 that is centered around Wixom Lake. More specifically, the SAD community that surrounds the Four Lakes system consists of more than 8,400 properties, with an average home value of approximately $117,909.

Wixom Lake is wholly situated in the TBW Watershed District. The TBW Watershed is a hydrologic constituent within the Saginaw Basin, Southwestern Lake Huron-Lake Huron Subregion, of the Great Lakes Region watershed network. Prior to the dam failure, Wixom Lake typically had a surface area of 1,908 acres, a shoreline of more than 84 miles, and a maximum depth of 40 feet. Currently, Wixom Lake is drawn down to a normal water elevation of 649 +/- (TBO) and 641 +/- (TBW).

Wixom Lake, which is impounded by the Edenville Dam, is located within Michigan's Gladwin and Midland counties. Townships, ranges, and sections intersected by Wixom Lake are provided in Table 3 below.

TABLE 3

Location of Wixom Lake

Township	Range	Section	Township Name
18N	01E	14-15, 23-25, 35-36	Hay Township
17N	01E	1-2, 11-14, 23, 26, 27, 33-35	Billings Township
17N	01W	15-16, 21-26, 35-36	Tobacco Township
16N	01E	3-4	Hope Township
16N	01W	1	Edenville Township

This section discusses the local economic demographic, climate, topography, geology, soils, surface waters, wetlands, vegetation, land use, public lands, and species occurring in the region of Wixom Lake and the Edenville Dam.

4.1.1 ECONOMY AND DEMOGRAPHIC

The failure of the Edenville Dam and loss of Wixom Lake has had a significant economic impact on the community. Boating, water sports, and angling supported the local economy through tourism and increased home values and annual property tax revenues. FLTF completed an analysis that estimated a loss of $3.4 million in economic dollars to the area annually as a result of the loss of Wixom Lake. The results of Public Sector Consultant's FLTF Demographic Assessment[42] are provided in Table 4 below.

[42] Public Sector Consultants, 2021

TABLE 4

Economic Demographics

Demographic	Gladwin	Midland	Michigan
Population	25,279	83,355	9,965,265
Unemployment Rate	5.9%	5.2%	5.9%
Labor Force Participation Rate	45.0%	59.6%	61.5%
Total Housing Units	17,923	36,973	4,596,198
Median Home Value	$110,000	$141,700	$154,900
Housing Units with a Mortgage	51.4%	57.3%	60.1%
Income Range <$10,000	8.7%	5.1%	6.6%
Income Range $10,000 to $14,999	5.4%	3.8%	4.4%
Income Range $15,000 to $24,999	13.5%	9.5%	9.6%
Income Range $25,000 to $34,999	10.8%	8.6%	9.8%
Income Range $35,000 to $49,999	17.4%	12.7%	13.5%
Income Range $50,000 to $74,999	19.9%	19.3%	18.3%
Income Range $75,000 to $99,999	11.0%	14.0%	12.7%
Income Range $100,000 to $149,000	8.3%	14.1%	14.2%
Income Range $150,000 to $199,999	3.2%	5.8%	5.6%
Income Range ≥$200,000	1.6%	7.3%	5.2%
Median Household Income	$44,619	$62,625	$57,144

4.1.2 CLIMATE

The USDA-NRCS climatic data[43], which has been recorded since 1892 at the Gladwin weather station, was reviewed to discuss current and historic climate trends that may affect the Wixom Lake area. Over the past century, temperatures have become warmer and increased precipitation has occurred in the region. A summary of values reviewed is provided in Table 5 below.

TABLE 5

Climatic Data

Data	1923 – 2002 Historic Average	2003 – 2023 Recent Average
Frost Data		
Last Freezing Temperature in Spring (1 Yr. in 10 Later than) 32ºF or Lower	May 31	May 22
Last Freezing Temperature in Spring (2 Yr. in 10 Later than) 32ºF or Lower	May 26	May 18
Last Freezing Temperature in Spring (5 Yr. in 10 Later than) 32ºF or Lower	May 18	May 11
First Freezing Temperature in Fall (1 Yr. in 10 Earlier than) 32ºF or Lower	September 11	September 27
First Freezing Temperature in Fall (2 Yr. in 10 Earlier than) 32ºF or Lower	September 15	October 2
First Freezing Temperature in Fall (5 Yr. in 10 Earlier than) 32ºF or Lower	September 25	October 10
Growing Season Days		
Daily minimum Temperature >32ºF (2 Yr. in 10)	111	134
Daily minimum Temperature >32ºF (5 Yr. in 10)	117	140
Daily minimum Temperature >32ºF (8 Yr. in 10)	130	153
Beginning and End of Growing Season Dates (5 Yr. in 10) 32ºF or Higher	5/18 – 9/25	5/11 – 10/11
Beginning and End of Growing Season Dates (7 Yr. in 10) 32ºF or Higher	5/14 – 9/29	5/8 – 10/15
Precipitation		
Annual Precipitation in Inches	31.70	34.32
Average Days with >0.10 Inches of Precipitation	68	75

[43] USDA-NRCS, NRCS Field Office Technical Guide, Climate Data for Gladwin County, MI

TABLE 5

Climatic Data

Data	1923 – 2002 Historic Average	2003 – 2023 Recent Average
Snowfall		
Annual Snowfall in Inches	48.5	50.4
Snow Depth in Inches	16	11
Temperature		
Average Temperature ºF	45.2	46.2

4.1.3 TOPOGRAPHY

The topography of the region surrounding Wixom Lake gradually decreases in elevation from its northern extents to the Edenville Dam, with a more abrupt decrease in elevation south of the Edenville Dam, where water passes the TBO and TBW spillways to a lower elevation. The low areas on the landscape appear to be occupied by waterbodies and streams with associated wetlands and floodplains. The highest elevations appear to occur within the northwest section of Beaverton Township. Topographic differences are consistent with the mapped watershed for the aquatic system. A map depicting the Light Detection and Ranging (LiDAR) contours surrounding Wixom Lake is included as Figure 4 below.[44]

4.1.4 GEOLOGY

The TBW Watershed is seated in the Tawas Lake Plain and Saginaw Lake Plain ecoregions. While there are some clay and silt-based soils, the majority of the underlying substrate matrices as composed of excessively drained to poorly drained sands with minor components of sandy loams, clay loams, and mucky sands.

The USGS State Geologic Map[45] geodatabase was used to review the mapped geology of Gladwin and Midland counties. This database identifies the age and type of bedrock present within the region. The primary bedrock consists of sandstone with a secondary component of shale that dates to the Pennsylvanian period (see Table 6 below).

TABLE 6

Geologic Data

County	Age	Bedrock Type	Percent Area by County
Gladwin	Pennsylvanian	Sandstone, Shale	91%
Gladwin	Jurassic	Shale	8%
Gladwin	Mississippian	Shale, Black Shale	1%
Midland	Pennsylvanian	Sandstone, Shale	77%
Midland	Jurassic	Shale	23%

[44] Michigan Department of Technology, Management & Budget, Michigan Statewide Authoritative Imagery & LiDAR Program

[45] USGS, 2017

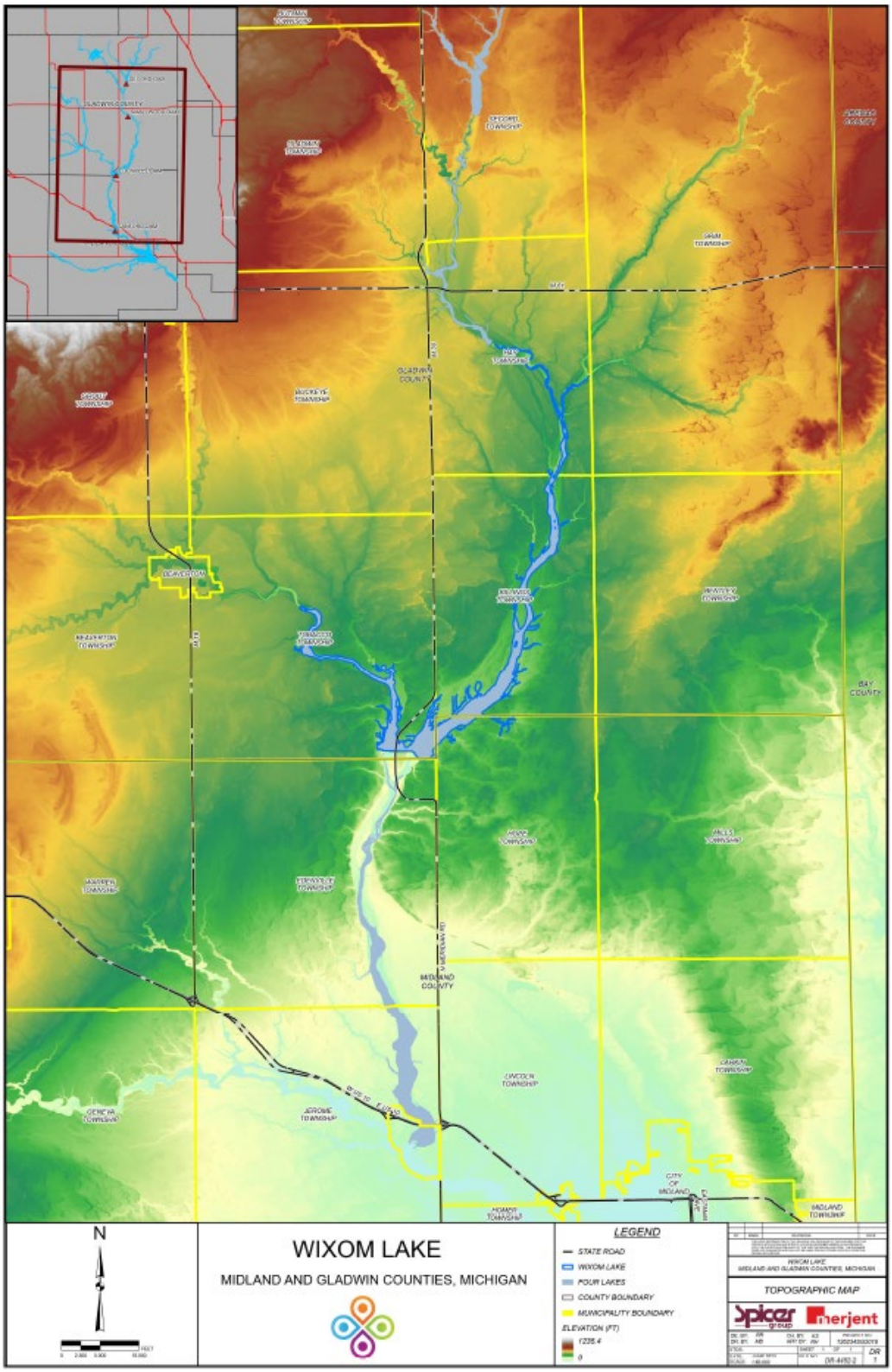

Figure 4. Light Detection and Ranging (LiDAR) Topographic Contours

4.1.5 SOILS

The USDA-NRCS's Soil Survey Geographic Database[46] was reviewed to identify predominant soil types within Gladwin and Midland counties. The primary soil types within these counties consist of sands and loams (Table 7).

TABLE 7

Mapped Soil Units

County	Dominant Soil Texture	Acreage	Percent Area by County
Gladwin	Sands, Loams	310,749	96%
Gladwin	Clayey	2,748	1%
Gladwin	Mucks	9,633	4%
Midland	Sands, Loams	309,112	94%
Midland	Clayey	18,034	5%
Midland	Mucks	2,250	1%

4.1.6 WETLANDS AND SURFACE WATERS

Wixom Lake is wholly situated in the TBW Watershed District. The TBW Watershed is a hydrologic constituent within the Saginaw Basin, Southwestern Lake Huron-Lake Huron Subregion, of the Great Lakes Region watershed network. The watershed covers approximately 1,800 square miles surrounded predominantly by agricultural and urban land use. The TBW is the main waterway within the watershed. Its hydrology is primarily influenced by winter snowmelt from winter snowpack. The watershed has been impacted by agricultural and urban runoff which has led to elevated levels of nutrients and sediment. The largest bodies of water within the watershed are associated with Wixom and Sanford lakes. Prior to the dam failure, Wixom Lake typically had a surface area of 1,908 acres, a shoreline of more than 84 miles, and a maximum depth of 40 feet. Currently, Wixom Lake is drawn down to a normal water elevation of 649 +/- (TBO) and 641 +/- (TBW).

Surrounding the perimeter of Wixom Lake were a variety of wetlands and wetland complexes supported by the natural hydrology of the TBO and TBW. While much of the shoreline has been developed, there are also areas of undeveloped land that included wetlands along the lakes and rivers as well as wetlands that were disconnected from direct shoreline contact but still hydrologically supplied by the lake. Historic wetland areas have been mostly ditched and tiled to drain the saturated soil environment.

Wetland habitats serve a variety of purposes and have both human and ecological impacts. Ecologically, they filter water, mitigate flooding, and provide habitat for a variety of animals. For humans, they support wildlife for recreational purposes like birding and hunting. They trap and slowly release surface water, reducing the inputs and movement of water through the floodplain, erosion, and flood height.

[46] USDA-NRCS, Soil Survey Geographic Database

4.1.6.1 Wetlands

Since 2021, desktop and field studies[24] have been initiated to analyze the effect that the Wixom Lake impoundment draining had on wetlands. This includes analysis of the impact that the impoundment draining had on wetlands that were previously supported by the artificially high water level of Wixom Lake, as well as an analysis of the extent of new wetland created on the exposed bottomland of Wixom Lake following the impoundment's draining.

Impact on Previously Supported Wetlands:

Merjent, Inc. (Merjent) completed a detailed desktop analysis of areas located within one mile of Wixom Lake in March 2021 to determine the locations of wetlands, as they existed, prior to the disaster that may be influenced by the hydrology of the historic lake[47]. This is important to consider as the drawdown of Wixom Lake and the associated water table may have impacted adjacent wetlands. Refilling of Wixom Lake (this Project) may provide beneficial impact to these adjacent offsite wetlands as their hydrology will be restored; re-protecting their integrity.

This study reviewed a variety of data resources including LiDAR derivatives, drone imagery, historic imagery, color infrared imagery, watershed connectivity modeling, and previous wetland mapping to estimate pre- and post-disaster wetland limits in relation to pre- and post-disaster water surface limits. Due to lack of available data at the time of this study, the upstream reaches of the TBO portion of Wixom Lake were not included in this study.

In total, it was estimated that between 1,904 and 2,929 acres of wetlands were negatively impacted to some degree as a result of the dewatering of Wixom Lake. This includes significant acreages of established forested wetland, between 1,549 and 2,562 acres. A summary of these results is displayed on Figure 5 and provided in Table 8 below. Created wetlands within the bottomlands were estimated at this time strictly based on elevation from existing surface water elevations.

TABLE 8

Wetland Resources Impacted by the Dam Failure

Feature	Pre-Disaster Acres	Post-Disaster Acres	Δ
Non-Forested Wetlands	1,269	1,122 to 1,134	-134 to -147
Forested Wetlands	6,688	4,126 to 5,139	-1,549 to -2,562
Submergent Wetlands	220	0	-220

In coordination with EGLE, a study was launched by Merjent in 2022 with the goal of identifying the level of impact the impoundment draining at Wixom Lake had on wetlands that were present prior to the disaster. EGLE conducted a groundwater modelling analysis of wetlands identified surrounding the Wixom Lake basin using wetland data provided from Merjent's desktop study. Adjacent wetlands were ranked from high to low priority for field monitoring based on their estimated depth to the historic groundwater table. This study focused on those wetlands that had a mapped 35 groundwater table, at least partially, within 0 to 6.5 feet below the ground surface.

[47] Merjent, 2021

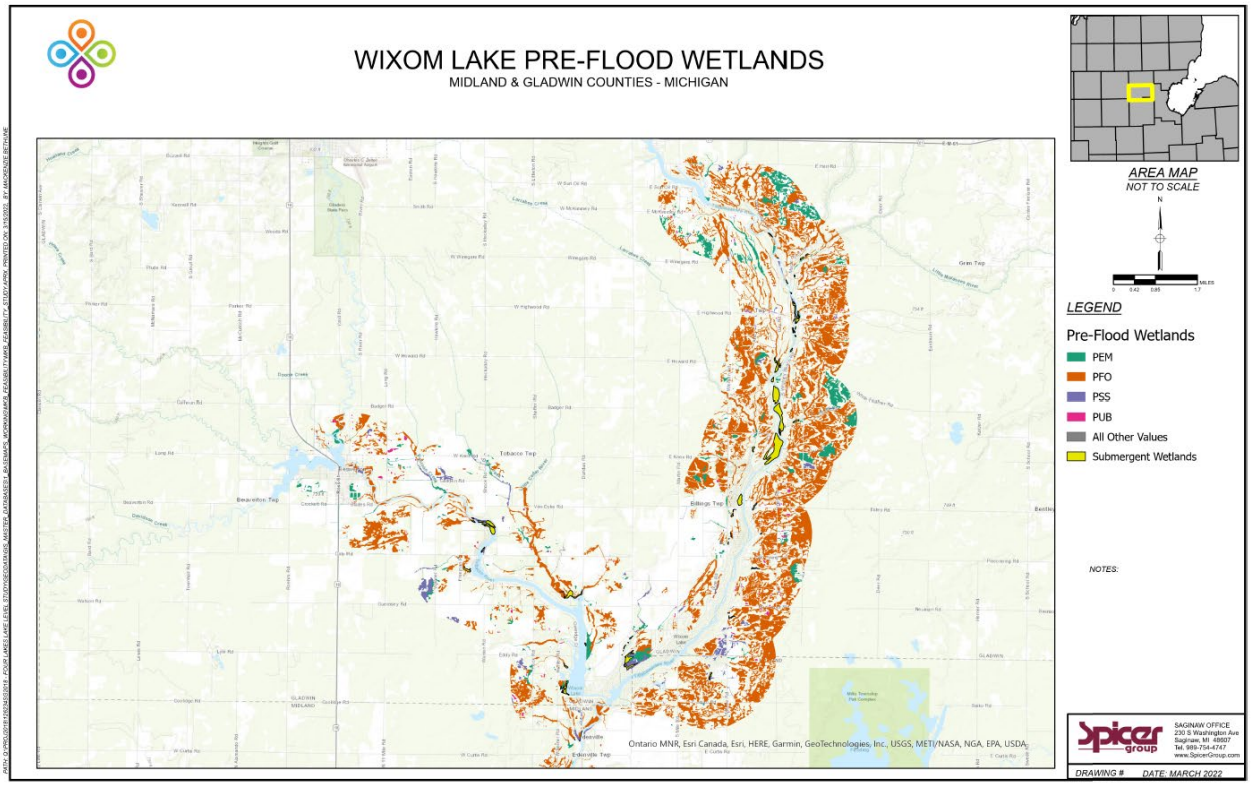

Figure 5. Wixom Lake Pre-Flood Wetlands

On May 9, 2022, Merjent implemented a monitoring study that involved the installation of long-term shallow groundwater monitoring wells in high priority wetlands surrounding Wixom Lake. In addition to year-long water table monitoring, vegetation monitoring is being completed at these locations to determine how vegetation is reacting to the change in hydrological conditions. Control wells for use in comparing impoundment-affected wetland conditions were installed in the Kawkawlin Flooding Area, a neighboring watershed that is controlled by a dam structure. Monitoring is proposed to be continued through the return of Wixom Lake to its normal (legal) lake levels. Ultimate duration of monitoring is dependent on EGLE permit conditions which have yet to be determined.

Of the seven shallow groundwater monitoring wells installed surrounding Wixom Lake, two recorded a groundwater table within 12 inches of the soil surface for a period of 14 consecutive days or more and for at least 15 percent of the growing season. The remaining five wells did not meet these criteria. Both shallow groundwater monitoring wells located on the Kawkawlin exhibited wetland hydrology according to these criteria. EGLE reviewed this data and agreed with FLTF that there is a compelling argument that adjacent wetlands are being impacted (or lost) due to the loss of Wixom Lake and associated hydrology. At this time, it is estimated that 1,483 acres of wetland surrounding Wixom Lake have been impacted or lost as a result of the Edenville Dam failure. This includes 120 acres of emergent wetland, 93 acres of shrub-carr wetland, 1,263 acres of forested wetland, and eight acres of unconsolidated bottom wetland. The complete results are reported within the Pre-Disaster Wetland Impact (Wetland Rehydration) Monitoring Report[24].

Creation of New Bottomland Wetlands:

The existing conditions of the drained Wixom Lake bottomlands were investigated in 2022 by Merjent and Streamside. The bottomlands, historically inundated by water because of the Edenville Dam impoundment, are currently exhibiting rapid changes in hydrology and vegetation community composition. The study was completed using a combination of desktop and field methods. The goal of this study was to identify the extent of wetlands and vegetation community types that are on the present-day bottomlands. An evaluation of streams and tributaries is ongoing to understand the stream function within the ecosystem and the changes because of the lake level restoration. FLTF has developed a summary of tributary stream functions pre- and post-disaster. Field survey has gathered information on habitat, macroinvertebrate and fish community, and erosion assessments of these features. Special attention is being given to locations with perched culverts as this prevents the movement of aquatic species upstream.

High-resolution drone imagery was collected across the Wixom Lake bottomlands in 2021. This imagery included color infrared collection. Merjent's geospatial analysts used geospatial tools to classify neighboring pixels together based on their similarity to create colored classifications based on signatures of like type. Differences in pixel coloration may be attributed to hydrologic and vegetation community composition differences. In total, 30 classified signatures were identified on the bottomlands.

Using the preliminary desktop analysis results, Merjent implemented a field study in July 2022 to further evaluate, refine, and define the extent of wetlands located on Wixom Lake's present-day exposed bottomlands. The field study included wetland determination data form plot sampling at 123 predetermined monitoring point locations. Field study locations were partly dependent on ability to navigate the bottomlands due to access constraints and safety concerns.

Areas were determined to be wetland based on the locations ability to display dominance of hydrophytic vegetation and show evidence of wetland hydrology. Soils were not considered, as they are significantly disturbed and naturally problematic as a result of being historically lakebed soils. This information was used to draw broad conclusions on the remaining areas of the lake bottomlands where detailed field assessment was not completed.

In total, 447 acres of wetland communities are estimated to exist within Wixom Lake's bottomlands (see Table 9 below). These results are depicted on Figure 6 below. The complete results are reported within the Wixom and Sanford Lakes Post-Disaster Created Wetlands Investigation Report[23].

TABLE 9

Wetlands on Present Day Wixom Lake Bottomlands

Wetland Community Type	Acreage	Percent Study Area
Shrub-Carr Wetland	282	13.3%
Emergent Wetland	165	7.8%
Total Wetland	**447**	**21.1%**

Wetland Summary:

In summary, a total of approximately 447 wetland acres are estimated to occur on the present day Wixom Lake bottomlands. Preliminary shallow groundwater monitoring well data suggests

that approximately 1,483 acres of high priority wetlands (as defined by EGLE) have displayed evidence of degradation to some degree. The majority of these wetlands are forested wetlands within close proximity to the normal (legal) lake level of Wixom Lake. It is expected that these degraded wetlands will recover following the return of Wixom Lake to its legally established lake levels. Therefore, it is estimated that refilling of Wixom Lake will provide a net benefit to the wetland resources in the area.

4.1.6.2 Surface Waters

Subsequent to the failure of the Edenville Dam and draining of its impoundment, approximately 10.9 miles of the TBW River and 5.1 miles of the TBO River have returned to a free-flowing condition for the first time in nearly 100 years. In addition, many tributaries enter the TBW and TBO rivers in the former Wixom Lake impoundment.

LiDAR and historic imagery were reviewed to estimate pre- and post-disaster water surface limits. Due to lack of available data at the time of this study, the upstream reaches of the TBO portion of Wixom Lake were not included in this study. Based on the data available in early 2021, it was estimated that approximately 1,510 acres of surface water were lost from Wixom Lake. Additional surface water has since been lost since this initial study with the lowering of the TBO arm of Wixom Lake related to emergency stabilization efforts at the TBO and TBW embankments and spillways, including putting of the TBW back on its original course. These projects were completed in 2022.

Streamside Ecological Services (Streamside) completed a desktop and field evaluation of surface water stream features associated with Wixom Lake. In August 2022 and February 2023, the entire perimeter of the Wixom Lake shoreline was assessed via aerial photography and on-the-ground inspection. Each stream was walked and assessed for stream function from the approximate location of the full pool elevation of Wixom Lake downstream to the TBW and TBO rivers. Upstream areas were also assessed at available road crossings.

Site assessments were based on professional judgement; looking at indicators that determine stream function such as volume and rate of flow, biological use including accessibility for fish, stream connectivity, functional floodplain, riparian areas, bank and bed erosion, soil stability, and sediment transport, length and area of proposed impact were calculated based on site observations and review of high-resolution aerial photography. Pertinent photographs were taken, and notes and observations were recorded. Because these streams will be converted to a different aquatic environment, each was assessed for general functional values in an effort to compare existing conditions to proposed conditions, and to determine what might be done to offset any impacts.

The elevation of culvert inverts and streambeds were also obtained upstream of the Wixom Lake normal (legal) lake level elevation to determine what positive (or negative) impacts could be reasonably identified after the lake is refilled. Most elevations were obtained at the next upstream road crossing. The overall intent was to identify the approximate length of stream that could reasonably be assumed to see benefits from increased soil saturation and ground water input. LiDAR was also used to identify elevations in upper reaches where access to survey was not possible. The limits of upstream benefit identified did not reach beyond four feet above the summer lake level elevation.

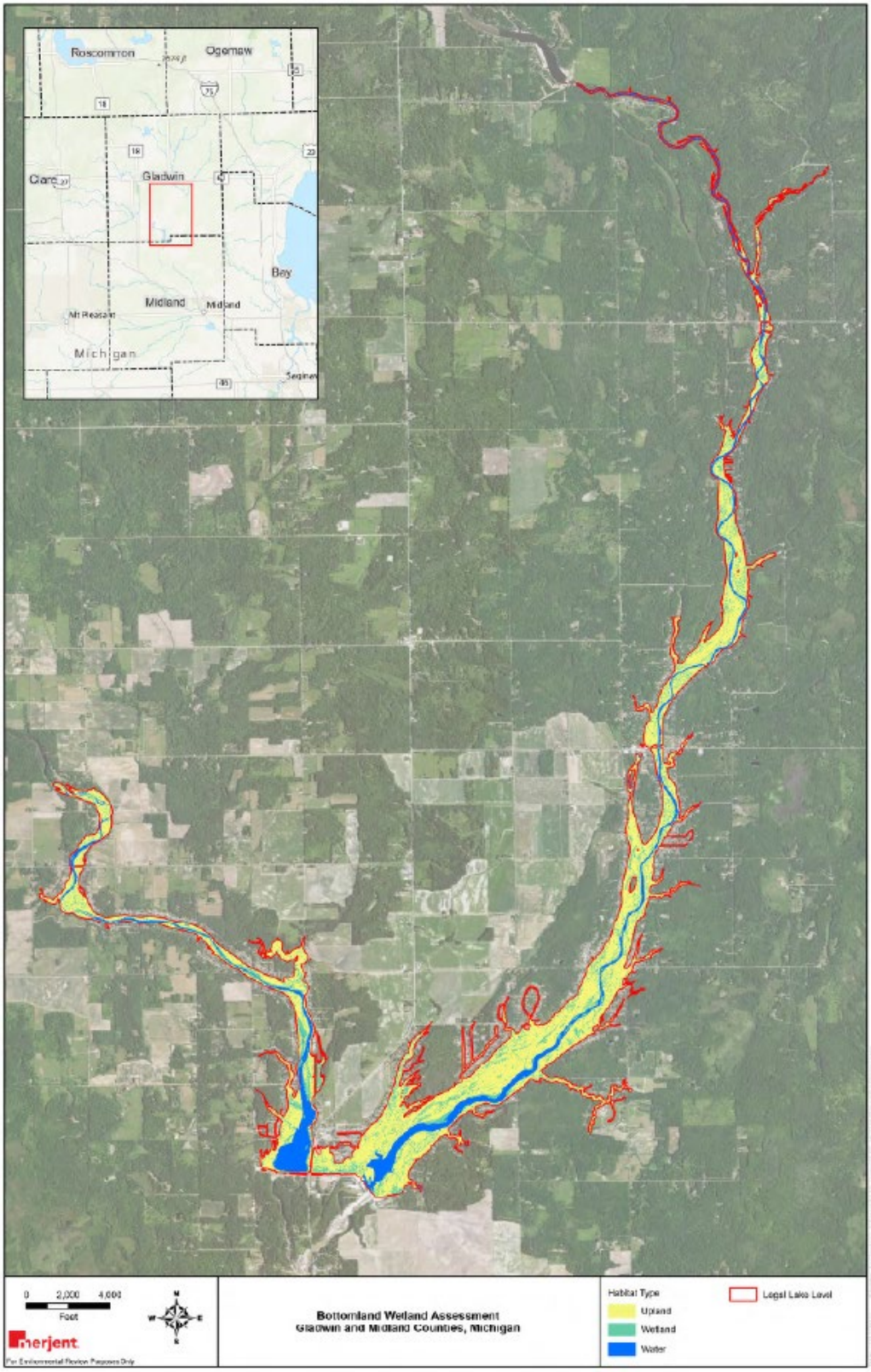

Figure 6. Wixom Lake Bottomland Wetland Assessment

In total, 22 defined streams were identified based on the criteria set forth in Part 301 which states, in pertinent part, "…may or may not be serving as a drain as defined by the Drain Code of 1956, 1956 PA 40, MCL 280.1 to 280.630; or any other body of water that has definite banks, a bed, and visible evidence of a continued flow or continued occurrence of water, …". For the most part, these sites can be described under three categories:

- A defined channel with flowing water
- A defined channel with pockets of standing water, or
- A defined channel with a completely dry bed.

Of these sites, five contain what would be considered a perennial stream with flowing water during the entire year. The remaining 17 streams are currently intermittent and may only flow during heavy precipitation or runoff events. Several of the channels only exist due to concentrated runoff that sculpted the erosion-prone lakebed following dam failure while other sites have indicators of being perennial but appear to have lost permanent flow due to the dam failure and loss of groundwater input. At all these sites, erosion of the streambanks and streambed is common, and the substrates are still mostly unstable. All these streams are small, averaging only a few feet in width and several inches in depth when water is present. The aquatic habitat for fish, macroinvertebrates, amphibians, or reptiles is severely limited.

In summary, 22 streams totaling 80,638 feet of stream length, will be converted from a lotic to lentic environment by refilling Wixom Lake to the legally established summer elevation. In their current state, none of these streams are functioning properly in terms of hydrology, hydraulics, morphology, and physiochemical parameters of biology.

4.1.7 VEGETATION

The TBW Watershed is seated in the Tawas Lake Plain and Saginaw Lake Plain ecoregions. Pre-settlement vegetation within these ecoregions consisted of beach ridge forest communities dominated by hemlock, beech, sugar maple, red oak, red pine, and white pine populations. Poorly drained areas within the region influenced diverse wetland habitats. The region contained vast areas of swamps, coastal marshes, wet prairies and depressional wetlands. Today, the region supports cut-over areas of aspen, black cherry, tamarack, paper birch and red maple.

As a part of the Wixom and Sanford Lake Post-Disaster Created Wetlands Investigation Report[23], Merjent implemented a field study to further evaluate, refine, and define the types and extent of vegetation communities present on the present-day exposed Wixom Lake bottomlands. Following the field study, trends in dominant vegetation, community composition, and floristic quality were used to refine the initial 30 classified signatures into eight distinct community types (and water) based on similarities. A description of these community types is provided below (see Table 10).

Vegetation within the Wixom Lake bottomlands is considered both significantly disturbed and naturally problematic for all parameters that are used when determining wetland extent. The plant communities onsite have been affected by significant natural disturbance and aftermath of the May 2020 flood event. They are also naturally problematic due to the presence of perennial hydrophytic plants persisting in dry, sandy locations as well as communities that are dominated by aggressive advantageous species, interfering with calculating an accurate hydrophytic status of the vegetative community. A thorough review of available literature was completed, and it appears that this is a novel study of the effects of a large-scale failure of a dam and its associated

exposed bottomlands. Merjent believes the results provided are accurate to the best extent possible with the resources available.

TABLE 10

Wixom Lake Bottomland Vegetation Community Types

Community Type, Wetness	Description
Dense Shrubland, Mesic	A mesic shrub dominated community that contains both wetland and upland portions. Vegetation differences between upland and wetland community types are difficult to interpret. Dominant shrubs include several types of willows (*Salix* spp.) and poplars (*Populus* spp.). Herbaceous vegetation that persists below thick shrubland canopy cover is often sparse. Soils typically are sand underlain by a loamy/clayey layer. The water table is either located within the upper 24 inches of the soil profile or not observed at all. The water table depth appears dependent on soil structure, where the water table is likely to be present where loamy/clayey layers are at or near the soil surface. Soil saturation on aerial imagery is present in some locations.
Dense Shrubland, Upland	An upland shrub dominated community that is dominated by several types of willows and poplars. Closely related to the Dense Shrubland, Mesic community type, soils are typically a mixture of sand and loamy/clay. However, the water table was not observed and indicators of wetland hydrology, such as saturation visible on aerial imagery, are not present.
Herbaceous, Sand, Upland	An upland, very dry herbaceous community dominated by a variety of adventive species including red clover (*Trifolium pratense*), lambs-quarters (*Chenopodium album*), nodding smartweed (*Persicaria lapathifolia*), and horseweed (*Conyza canadensis*). Few remnants, very stressed native herbaceous species are present. Sandy soils with no water table observed or any evidence of wetland hydrology indicators.
Herbaceous, Upland	An upland, herbaceous community dominated by a mixture of upland and wetland vegetation. Dominant herbaceous vegetation includes very wet species such as rice cut grass (*Leersia oryzoides*) and blue vervain (*Verbena hastata*), at times, but is primarily dominated by upland, advantageous species including several types of nut rushes (*Cyperus* spp.), clovers (*Trifolium* and *Melilotus* spp.), tall fescue (*Schedonorus arundinaceus*), and smartweeds (*Persicaria* spp.). Sandbar willow (*Salix exigua*) and eastern cottonwood (*Populus deltoides*) observed invading the herbaceous layer. Soils typically sandy, sometimes with a loamy/clayey component. The water table is not present or rarely observed. Hydrology indicators other than passing of the FAC-Neutral Test, are rarely present.
Herbaceous, Wetland	A wetland, herbaceous community dominated by primarily wetland vegetation. Dominant herbaceous vegetation primarily consists of early-successional and weedy species (sometimes upland species) including sow-thistle (*Sonchus arvensis*), reed canary grass (*Phalaris arundinacea*), cattails (*Typha* spp.), barnyard grass (*Echinochloa crus-gallii*), willow-herbs (*Epilobium* spp.), smartweeds and purple loosestrife (*Lythrum salicaria*). At times, eastern cottonwood saplings dominate the herbaceous layer. Soils typically loamy/clayey. The water table is typically observed in the upper three feet of the soil profile, sometimes near surface.
Scattered Shrubland, Upland	An upland community with scattered shrubs at <50% cover. Dominant shrubby vegetation includes several types of willows and poplars. Dominant herbaceous vegetation includes a mixture of wetland and upland vegetation, from hydrophytic species including soft-stemmed rush (*Juncus effusus*), purple loosestrife (*Lythrum salicaria*), and fox sedge (*Carex vulpinoidea*), to upland species including clovers, sow-thistle , nodding smartweed, and crab grasses (*Digitaria* spp.). Soils typically sandy or sand underlain by gravel or loamy/clayey material. The water table is not present or rarely observed. Hydrology indicators other than passing of the FAC-Neutral Test, are not present.
Shrub-Carr, Wetland	A wetland, shrub dominated community that primarily consists of wetland vegetation. Dominant shrubs include a variety of willow and poplar species. Herbaceous vegetation dominating the understory includes purple loosestrife, soft-stemmed rush, reed canary grass, water horehound (*Lycopus americanus*), willow-herbs, and fox sedge. Soils are typically loamy/clayey underlain by a sandy material. The water table is typically within two to three feet, sometimes nearer the soil surface.

4.1.8 LAND USE

The USGS National Land Cover Database[48] was used to estimate the land uses of Gladwin County and Midland County (see Table 11 below). Land use data for the areas surrounding Wixom Lake is depicted on Figure 7 below.

TABLE 11

Land Use Land Cover Data

Definition	Gladwin Acres	Midland Acres
Open Water–- All areas of open water, generally with less than 25% cover or vegetation or soil	5,998	4,679
Developed, Open Space–- Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	10,948	14,447
Developed, Low Intensity -Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.	10,311	14,007
Developed, Medium Intensity–- Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.	2,176	6,049
Developed, High Intensity–- Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.	419	2,990
Barren Land (Rock/Sand/Clay)–- Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.	62	109
Deciduous Forest–- Areas dominated by trees generally greater than five meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.	59,740	51,899
Evergreen Forest–- Areas dominated by trees generally greater than five meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.	9,528	2,171
Mixed Forest–- Areas dominated by trees generally greater than five meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.	19,498	7,334
Shrub/Scrub–- Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.	2,781	1,601
Grassland/Herbaceous–- Areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling but can be utilized for grazing.	9,085	4,644
Pasture/Hay–- Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.	10,201	4,989
Cultivated Crops–- Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.	53,976	78,892
Woody Wetlands–- Areas where forest or shrub land vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	131,239	140,296
Emergent Herbaceous Wetlands–- Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	4,651	3,835
Total Acres	**330,614**	**337,941**

[48] USGS, 2019

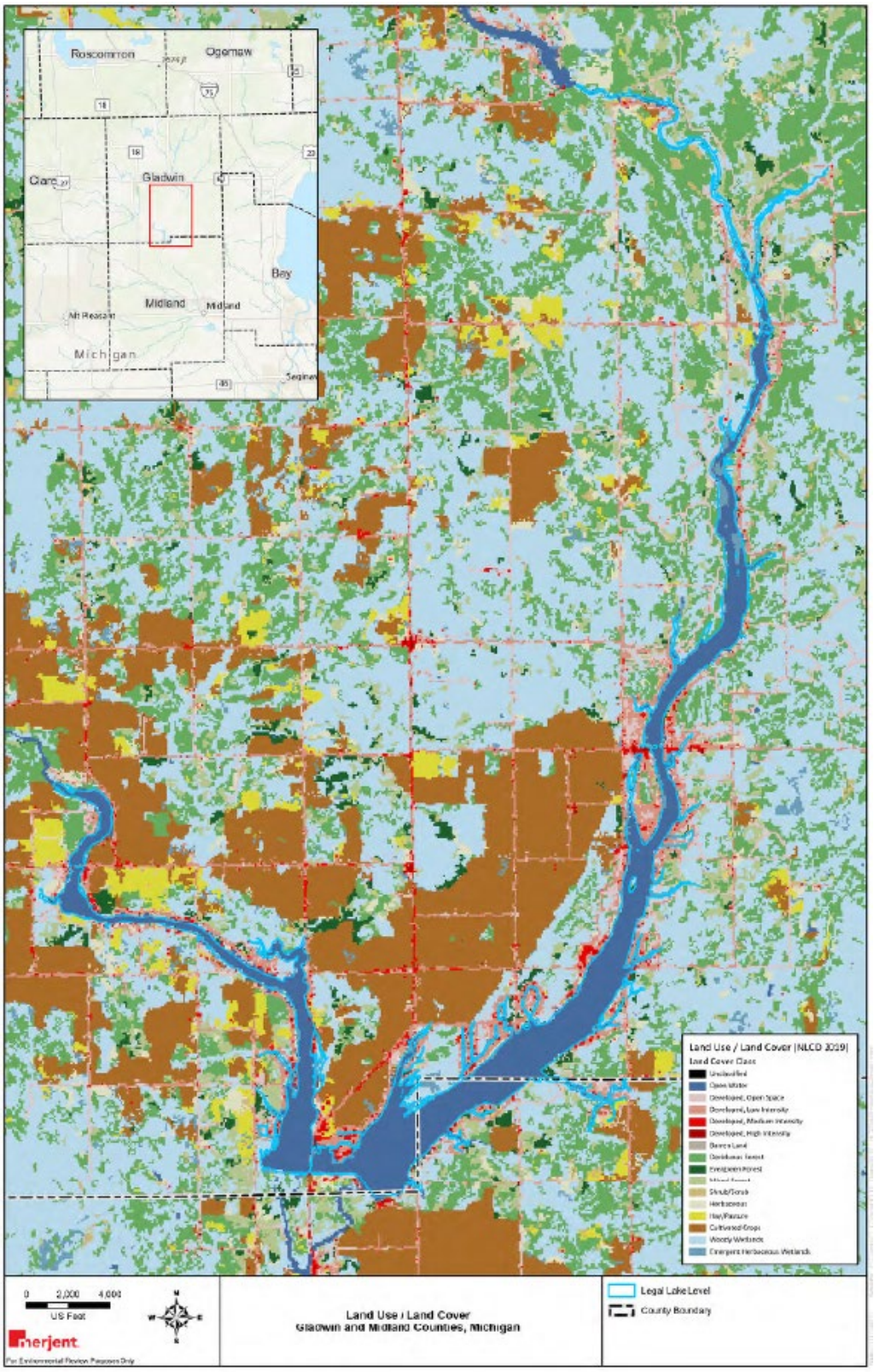

Figure 7. Land Use Land Cover Data

4.1.9 PUBLIC LANDS

The USGS Gap Analysis Project Protected Areas Database[49] of the United States was reviewed to identify public and private lands that are designated for use by the public. In Gladwin County, 95,206 acres of public use land are present. In Midland County, 52,305 acres of public use land are present. A summary of those lands that are greater than 100 acres in size is provided below. This information includes county, ownership type, local owner, unit name, and acreage(see Table 12 and Figure 8 below). Some private lands have an unknown local owner.

TABLE 12

Public Lands

County	Ownership Type	Local Owner	Unit Name	Acres
Gladwin	State	MDNR	Gladwin State Forest Area	73244
Gladwin	State	MDNR	Gladwin Game Unit and Field Trial Area of State Forest	4737
Gladwin	State	MDNR	Molasses River Flooding No.1 State Wildlife Management Area	3151
Gladwin	State	MDNR	Molasses River Flooding No.3 State Wildlife Management Area	1851
Gladwin	State	MDNR	Molasses River Flooding No.3 State Wildlife Management Area	1851
Gladwin	State	MDNR	Molasses River Flooding No.5 State Wildlife Management Area	1459
Gladwin	State	MDNR	Bentley Marsh Flooding State Wildlife Management Area	1437
Gladwin	Private	Unknown	Buckeye Hunting Club	657
Gladwin	Private	Unknown	Timbertrails Conservation Club	592
Gladwin	Private	Unknown	Evergreen Club	385
Gladwin	State	MDNR	Gladwin State Game Area	368
Gladwin	Private	Educational Forest	Beaverton Rural Schools	345
Gladwin	Private	Private	Little Forks Conservancy Easement # MI-113567	281
Gladwin	Private	Private	Little Forks Conservancy Easement # MI-238667	264
Gladwin	Private	Unknown	Tee Creek Hunt Club	238
Gladwin	Private	Educational Forest	Gladwin Community Schools	208
Gladwin	Private	Unknown	Sugar Springs Hunting Preserve	202
Gladwin	Private	Private	Little Forks Conservancy Easement # MI-238669	186
Gladwin	Private	Private	Gladwin Heights Golf Course	183
Gladwin	Local	City of Gladwin	City of Gladwin Park	179
Gladwin	Private	Unknown	Good News Camp	172
Gladwin	Private	Unknown	Lucky Eight Hunting Club	163
Gladwin	Local	County of Gladwin	Local Forest	162
Gladwin	Private	Unknown	Eddy End Club	159
Gladwin	Private	Private	Little Forks Conservancy Easement # MI-238663	157
Gladwin	Private	Private	GRP, Gladwin, Michigan	156
Gladwin	Private	Unknown	Wolverine Hunting Club	155
Gladwin	Local	Township of Buckeye	Buckeye Township Land	154
Gladwin	Private	Unknown	Wildlife Reserve	153
Gladwin	Private	Consumers Energy	Utility Corridor	152
Gladwin	Local	Township of Beaverton	Beaverton Township Game Refuge	146
Gladwin	Private	Wolverine Power Co	Smallwood Lake Dam	144
Gladwin	Private	Private	Little Forks Conservancy Easement # MI-238656	118
Midland	State	MDNR	Gladwin State Forest Area	38654
Midland	State	MDNR	Kawkawlin Creek Flooding State Wildlife Management Area	2927

[49] USGS, 2020

TABLE 12

Public Lands

County	Ownership Type	Local Owner	Unit Name	Acres
Midland	Private	Chippewa Nature Center	Chippewa Nature Center	1249
Midland	State	MDNR	Bluff Creek/US-10/M-18 Floodings State Wildlife Management Area	869
Midland	Private	Consumers Energy	Utility Corridor	592
Midland	Local	County of Midland	Local Forest	590
Midland	Local	City of Midland	Midland City Forest	554
Midland	Private	Private	Currie Municipal Golf Course	421
Midland	Local	Township of Ingersoll	Township of Ingersoll Park	344
Midland	State	MDNR	Gladwin State Forest Area	328
Midland	Local	County of Midland	Pine Haven Recreational Area	328
Midland	Local	City of Midland	City of Midland Park	315
Midland	Private	Private	05-56-0037	315
Midland	Local	City of Midland	City of Midland Park	239
Midland	NGO	Little Forks Conservancy	Riverview Natural Area	227
Midland	NGO	Little Forks Conservancy	Riverview Natural Area	197
Midland	Local	Township of Mills	Mills Township Park	162
Midland	Local	County of Midland	County of Midland Park	161
Midland	Local	Township of Mt. Haley	Township of Mt. Haley Park	151
Midland	Private	Unknown	Wild 70	148
Midland	Local	County of Midland	Manitou	144
Midland	Local	County of Midland	Veterans Memorial Park	133
Midland	Private	Unknown	Midland County Sportsman Club	121
Midland	Private	Unknown	Deerless Acres Club	119
Midland	Private	Private	08-56-0009	115
Midland	Private	Private	Midland Country Club	115

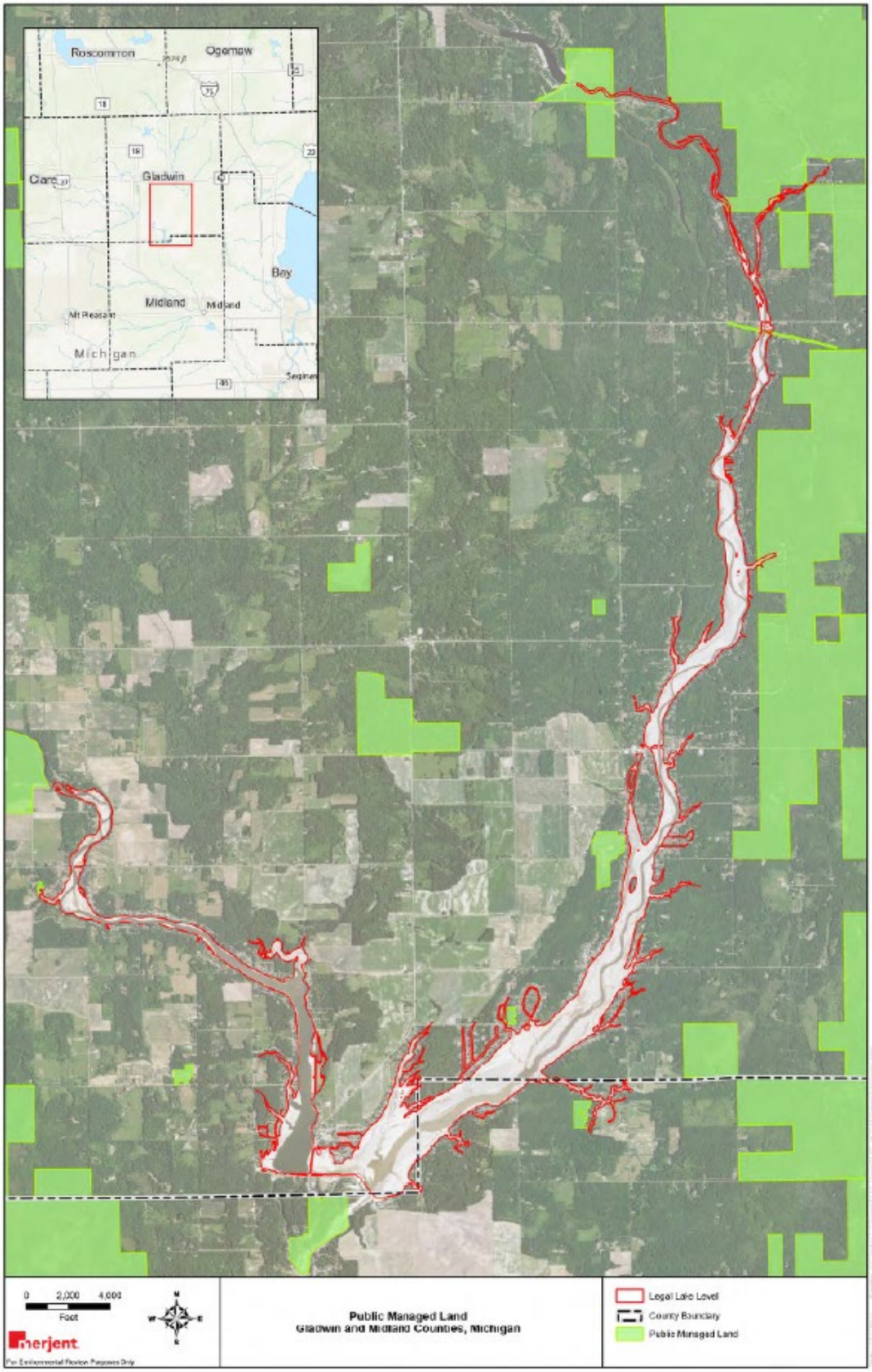

Figure 8. Public Lands

4.1.10 FISH COMMUNITY

A Wixom Lake Restoration Fishery Scoping Report[50], included as an Appendix to the Plan for the Restoration of the Four Lakes: Feasibility Study and Plan[21] was completed by Streamside. The proposed restoration of Wixom Lake will result in the restoration of aquatic conditions that are similar to those from pre-failure conditions. Therefore, a restoration target of fish communities like those present before May 2020 appears logical. While it is anticipated that all species naturally present before dam failure will repopulate Wixom Lake at some point in time, strategies for a more controlled repopulation may be considered. Ultimately, the Fisheries Division of MDNR is the agency charged with overseeing the management of the fishery resources in the TBW watershed, including Wixom Lake. Any management activities such as fish stocking or habitat improvement would be led and endorsed by the MDNR Fisheries Division.

Fish species type and diversity is important for freshwater mussel communities. The snuffbox, like other freshwater mussels, reproduces by parasitizing the gills of host fish with microscopic larvae (i.e., glochidia). Within the TBW watershed, logperch (*Percina caprodes*) and blackside darter (*Percina maculata*) are the assumed host fish species for snuffbox.[51] While these species were not reported during previous studies, they are likely present within the system due to their widespread distribution within Michigan waters and due to the identification of a reproducing snuffbox mussel population within the Permit Area and the immediately upstream TBO portion of the Plan Area. Understanding fish species known to exist within the watershed, and their expectation to return following the refill of the Wixom Lake impoundment, is critical to understanding mussel community health.

The TBW Assessment[52] describes the fish community of the Wixom Lake impoundment as dominated by cool- to warm-water fishes that are indicative of lake rather than riverine environments. Sunfishes, including black (*Pomoxis nigromaculatus*) and white crappie (*Pomoxis annularis*), bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), green sunfish (*Lepomis cyanellus*) and rock bass (*Ambloplites rupestris*) dominated the fish community and fishery prior to May 2020. Top predators in these systems were black bass [largemouth bass, (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*)], northern pike (*Esox Lucius*), muskellunge (*Esox masquinongy*), walleye and channel catfish (*Ictalurus punctatus*). Additionally, the impoundment also had sizable populations of a variety of redhorse sucker species (*Moxostoma spp.*), white sucker (*Catostomus commersonii*), common carp (*Cyprinus carpio*), and black bullhead (*Ameiurus melas*), brown bullhead (*Ameiurus nebulosus*), and yellow bullhead (*Ameiurus natalis*). The pre-flood fish community in Wixom Lake supported excellent fishing opportunities for black bass, northern pike, muskellunge, walleye, channel catfish, bluegill, black and white crappie, and other sunfish. Age distributions for the predator species were balanced with good survival to older ages, resulting in desirable numbers of large individuals to attract fishing activity. Periodic stocking of walleye and muskellunge by MDNR supported the fisheries for those predatory species.

The fish community of Wixom Lake has likely been changed dramatically by the draining of the impoundment. As the Edenville Dam was constructed in 1925, no historical fisheries or macroinvertebrate data for the TBW and TBO in the vicinity of the former impoundment exists. Although no local riverine fishery survey data exists, the TBW system downstream of Edenville dam has maintained components of predominantly warmwater and coolwater fisheries, along with

[50] Streamside Ecological Services, 2020.
[51] Watters et al., 2009.
[52] Schrouder et al., 2009

seasonal migratory potadromous species.[52] Lake sturgeon, longnose gar (*Lepisosteus osseus*), bowfin (*Amia calva*), longnose sucker (*Catostomus catostomus*), white sucker, silver redhorse (*Moxostoma anisurum*), golden redhorse (*Moxostoma erythrurum*), shorthead redhorse (*Moxostoma macrolepidotum*), yellow bullhead, brown bullhead, channel catfish, northern pike, lake trout (*Salvelinus namaycush*), white bass (*Morone chrysops*), rock bass, smallmouth bass, largemouth bass, yellow perch (*Perca flavescens*), walleye, and freshwater drum (*Aplodinotus grunniens*) have been identified within the downstream portion of the TBW. These species were described as having access to the TBW watershed and likely used the main stem and its tributaries to complete a portion of their lifecycle.[52] Although the remnants of the failed Edenville Dam may create physical barriers to upstream migration, many of the species identified in the TBW Assessment were also previously identified in Sandford Lake during periodic fisheries assessments.[53]

4.1.11 MUSSEL COMMUNITY

With the ever-increasing human impacts on biodiversity, one group of organisms most impacted by human disturbances are native freshwater mussels (unionids). When declines in native mussel populations are detected, they are often considered 'canaries in the coalmine' for freshwater ecosystems, giving the advanced warning of other ecosystem concerns to follow. Currently, 72 percent of the approximately 300 species of freshwater mussels native to North America are considered endangered, threatened, or need protection predominately due to human actions[54]. With over 300 species of freshwater mussels in North America and 43 species in Michigan, they are very diverse with variable host use, brood time, and habitat use. Native mussels can be found in a variety of habitats from rivers, lakes, impoundments, and backwaters. Of the 43 species of freshwater mussels in Michigan, 31 of these species are listed as species of conservation concern (endangered, threatened, or special concern)[55] and of those 31, six species are federally listed as either threatened or endangered.[56] The threats to imperiled mussels include habitat destruction, fragmentation, channel modification, water quality degradation, and introduction of non-endemic mollusks.[54] In the Great Lakes watersheds, the non-native mollusks that are highlighted as causing extreme declines of native freshwater mussels are the dreissenids (Zebra and Quagga Mussels).

Historic data on native freshwater mussel distribution is often lacking in many parts of North America including in the Great Lakes region[57]. However, prior to studies implemented by FLTF as a part of the proposed Four Lakes projects, several studies have been completed within the Four Lakes region. A summary of each historical study and surveys implemented for the Four Lakes projects are described in the following text and reported in Table 13.

The first comprehensive mussel survey within the Upper TBW watershed was completed from 1979 to 1981, in which 50 sites were sampled and 28 sites yielded live individuals, fresh dead shells or weathered shells.[58] Sampling methodology involved visual searches within shallow water portions of sites. Thirteen live species and one species only collected as a weathered shell were identified during the study (see Table 13).

[53] Schrouder, 2007
[54] Downing et al., 2010
[55] Michigan Administrative Code, R 299.1021 et seq.
[56] USFWS, 2022c
[57] Freshwater Mollusk Conservation Society, 2016
[58] Hoeh and Trdan, 1984

In December 2019, the MDNR conducted quantitative and semi-quantitative survey efforts for mussels associated with a water drawdown of Wixom Lake, at a point located approximately 0.40 miles downstream of the normal (legal) lake level extent of Wixom Lake within the TBO.[59] This survey identified six live species and seven species only represented by weathered shells (see Table 13). The survey identified one articulated snuffbox mussel (*Epioblasma triquetra*) and one valve, indicating that live snuffbox may be present in the area. Further evaluation was completed in the vicinity of these findings in December 2019, searching specifically for snuffbox shells, and resulted in the identification of 6.5 fresh snuffbox shells (i.e., fresh nacre, periostracum, or hinge attached); two of which were articulated and nine valves.

As part of the Four Lakes projects, FLTF initiated a mussel survey within Smallwood Lake, Secord Lake, upstream and downstream of existing dams and select nearby tributary sites.[60] A total of 59 sites were surveyed for mussels and used semi-quantitative search methods. A total of six live species and seven species only represented by weathered shells were collected during the study (see Table 13). One live species was found in Secord Lake and six live species were collected from Smallwood Lake.

In 2022, FLTF initiated a mussel survey within Wixom Lake, Sanford Lake, and downstream of the Sanford Dam.[11] A total of 87 sites were surveyed and used semi-quantitative search methods. A total of 17 live species were collected and an additional six species were detected only by weathered shells (see Table 13). Survey efforts did collect one live snuffbox individual at the upstream extent of the TBO arm of Wixom Lake within the Permit Area.

A total of 23 mussel species have been documented within the Four Lakes Region through a variety of survey efforts since 1979. Of those, 21 have been collected live while two have only been documented by weathered shells. A review of the MNFI for Gladwin and Midland Counties also includes a record for Deertoe mussel (*Truncilla truncata*) within Midland County in 2020 (see Table 13 below). The diversity of mussel species collected within the Four Lakes Region is indicative of a variety of suitable mussel habitat present within the region.

TABLE 13

Mussel Survey Records Within the Four Lakes Region

Scientific Name	Common Name	Status (*Federal and State)	1984 Upper TBW	2019 Wixom Lake	2021 Smallwood Lake/Secord Lake	2022 Wixom Lake/Sanford Lake	2023 Gladwin Co	2023 Midland Co
Actinonaias ligamentina	Mucket	None				P		
Alasmidona marginata	Elktoe	Special Concern	P	P	P*	P	1981	2020
Alasmidonta viridis	Slippershell	Threatened	P		P*	P*	1981	2020
Anodontoides ferussacianus	Cylindrical Papershell	None	P		P*	P*		
Camrarunio (formally Villosa) iris	Rainbow	Special Concern		P		P	1926	2020
Eurynia dilatata	Spike	None	P	P	P*	P		
Epioblamsa triquetra	Snuffbox	Endangered		P*		P		2020

[59] MDNR unpublished data, 2019
[60] Woolnough et al., 2021

TABLE 13

Mussel Survey Records Within the Four Lakes Region

Scientific Name	Common Name	Status (*Federal and State)	1984 Upper TBW	2019 Wixom Lake	2021 Smallwood Lake/Secord Lake	2022 Wixom Lake/Sanford Lake	2023 Gladwin Co	2023 Midland Co
Fusconaia flava	Wabash Pigtoe	None	P	P		P		
Lampsilis cardium	Plain Pocketbook	None	P	P	P	P		
Lampsilis siliquoidea	Fatmucket	None	P	P	P	P		
Lasmigona complanata	White Heelsplitter	None	P	P	P*	P		
Lasmigona compressa	Creek Heelsplitter	Special Concern	P		P*	P*	1926	2011
Lasmigona costata	Flutedshell	Special Concern		P	P	P		2020
Leptodea fragilis	Fragile Papershell	None				P		
Ligumia recta	Black Sandshell	Endangered				P		2020
Potamilus alatus	Pink Heelsplitter	Special Concern				P		2015
Pleurobema sintoxia	Round Pigtoe	Special Concern				P*		2020
Ptychobranchus fasciolaris	Kidneyshell	Special Concern	P*	P		P	2020	2020
Pyganodon grandis	Giant Floater	None	P	P	P	P		
Strophitus undulatus	Creeper	None	P	P	P*	P		
Taxolasma parvum	Lilliput	Endangered				P*		
Truncilla truncata	Deertoe	Special Concern						2020
Utterbackia imbecillis	Paper Pondshell	Special Concern	P		P	P*		
Venustaconcha ellipsiformis	Ellipse	Special Concern	P	P	P	P	1981	2015
TOTAL SPECIES IN SUMMARY			**14**	**13**	**13**	**23**	**6**	**12**

Reference	Focus of Research
Hoeh and Trdan 1984[58]	Entire Community (50 sites Upper TBW Watershed)
MDNR Unpublished[59]	Mussel Salvage data for drawdown activities
Woolnough et al. 2021[60]	Entire Community (59 sites)
Laszlo, et al. 2022[12]	Entire Community (87 sites)
MNFI 2023[61]	Listed Species (Year last detected)
MNFI 2023[61]	Listed Species (Year last detected)

*** Only shells found, no live individuals**

[61] MNFI, 2023

4.1.12 WATER QUALITY

4.1.12.1 FERC Reports for Wixom Lake at Edenville Dam

Water quality monitoring was completed at the Edenville Dam as a part of their FERC requirements by the previous dam owner. Reports from 2012 to 2019 were made available for review and describe assessments for a variety of parameters including water temperature and dissolved oxygen, nutrients (nitrate and phosphorous), flow release cycling/triggers and weed abatement effects. Sampling locations included annual monitoring in the tailrace of the TBO and TBW tailraces and periodic sampling within Wixom Lake immediately upstream of the Edenville Dam within Wixom Lake in the TBO. Exact locations of water quality monitoring are unknown. The most recent year that reported on the Edenville Dam and associated Wixom Lake was 2018[62]. Table 14 summarizes the data collected from the Edenville Dam's tailrace for a period occurring from June 6, 2018, through September 19, 2018. Dissolved oxygen levels were at their lowest, and temperatures were at their highest, during July and August.

TABLE 14

Wixom Lake Water Quality Data (FERC Reporting, June 2018)[62]

Water Temp. (ºC)	**June**	**July**	**August**	**September**
High	24.51	27.86	27.35	24.36
Low	20.64	23.25	22.53	18.30
Average	22.59	25.78	24.89	21.86
Dissolved Oxygen (mg/L)	**June**	**July**	**August**	**September**
High	8.91	8.14	8.54	9.84
Low	6.23	4.88	4.96	6.63
Average	7.56	7.08	7.08	8.38

Dissolved oxygen and temperature profiles were collected within Wixom Lake in 2012[63], 2013[64], 2014[65] and 2016[66], in close proximity upstream of the Edenville Dam powerhouse on the TBW. Dissolved oxygen and temperature profile measurement frequency varied by year as shown in Table 15 below. The review of dissolved oxygen and temperature profiles suggests Wixom Lake does not significantly thermally stratify as shown by the temperature readings in Table 15. The maximum profile temperature change from surface to bottom was 4.45 degrees Celsius (°C), and most commonly only varied by 1 to 2 °C. Dissolved oxygen concentrations show a larger range in variation from surface to bottom concentrations indicating increased biological oxygen demand at lower water depths and reduced oxygen saturation from phytoplankton in the photic zone of the water column. Dissolved oxygen concentrations in Table 15 show anoxic conditions were only present in two of the 21 profiles recorded. However, dissolved oxygen concentrations did fall below the 5 mg/L surface water standard set by Michigan Administrative Code Part 4 Water Quality Standards, Rule 323.1064 within eight of the 21 profiles measured. Mostly commonly, when dissolved oxygen concentrations fell below 5 mg/L, it did not occur until the 20- or 30-foot sampling location.

62 Boyce Hydro, LLC., Water Quality Report, 2018
63 Boyce Hydro, LLC., Water Quality Report, 2012
64 Boyce Hydro, LLC., Water Quality Report, 2013
65 Boyce Hydro, LLC., Water Quality Report, 2014
66 Boyce Hydro, LLC., Water Quality Report, 2016

TABLE 15. **Wixom Lake Dissolved Oxygen and Temperature Profile Data (FERC Reporting, 2012, 2013, 2014 and 2016)**[63,64,65,66]

Dissolved Oxygen Concentrations (mg/L or ppm)																					
Depth (ft)	8/7/12	8/15/12	6/12/13	7/2/20113	7/10/13	7/24/13	7/31/13	8/7/13	8/14/13	8/21/13	8/29/13	9/4/13	9/11/13	9/18/13	9/30/13	6/10/14	7/14/14	8/20/14	9/16/14	10/8/14	8/9/16
1.	-	-	8.76	7.97	7.77	8.19	8.31	6.4	8.07	8.35	9.5	7.6	8.64	8.88	8.52	9.36	9.64	7.76	7.16	8.61	10.
5	11.9	7.87	7.68	7.94	7.06	8.27	7.36	6.9	7.93	8.56	8.34	7.2	7.31	8.35	8.33	9.13	9.22	5.6	7.1	8.57	9.9
10	7.98	6.66	8.71	7.88	6.03	7.72	6.75	6.7	7.84	8.4	7.6	6.4	7.25	8.06	8.41	8.58	8.67	5.72	7.01	8.51	9.6
15	7.63	6.87	8.34	7.8	3.67	7.43	6.1	6.0	7.79	5.8	6.56	6.2	7.36	8.03	8.37	8.38	8.17	6.18	6.97	8.44	8.6
20	7.58	6.63	6.7	7.55	2.89	7.11	5.82	6.1	7.91	4.91	4.23	6.2	7.02	7.9	7.94	7.5	4	5.4	7.13	8.24	2.5
25	-	-	5.12	7.18	2.21	6.48	6.55	5.5	7.93	4.56	0.33	6.1	5.82	7.82	7.51	5.29	3.32	4.79	7.25	8.09	0.6
30	-	-	4.35	6.61	1.14	4.05	5.19	5.6	7.96	3.65	0.33	5.9	5.29	7.2	7.22	4.71	2.19	4.14	7.21	8.1	-
Temperature (°C)																					
Depth (ft)	8/7/12	8/15/12	6/12/13	7/2/20113	7/10/13	7/24/13	7/31/13	8/7/13	8/14/13	8/21/13	8/29/13	9/4/13	9/11/13	9/18/13	9/30/13	6/10/14	7/14/14	8/20/14	9/16/14	10/8/14	8/9/16
1.	-	-	21.8	23.7	25.1	26.4	23.8	23.	21.5	23.5	25.1	23.	23.4	20.4	18.8	24.4	24.6	23.1	19	14.4	-
5	18.8	21.7	20.7	23.7	24.7	26	23.5	22.	21.9	23	24.6	23.	22.7	20	18.7	24.2	24.3	22.2	18.8	14.5	-
10	24.7	21.8	20.6	23.7	24.2	25.3	23.2	22.	22	22.8	24.4	23.	22.6	19.7	18.6	24	24.0	21.9	18.5	14.5	-
15	24.7	21.4	20.4	23.2	23	25.1	22.8	22.	21.9	21.9	24	22.	22.5	19.6	18.5	23.5	23.9	21.8	18.2	14.5	-
20	24.7	21.7	19.5	22.9	22.6	24.9	22.7	22.	21.7	21.7	23.2	22.	22.3	19.6	18.2	22.6	23.0	21.6	18	14.3	-
25	-	-	18.8	22.7	22.3	24.6	22.6	22.	21.6	21.7	21.8	22.	22.1	19.6	18.2	20.5	22.8	21.5	17.9	14.3	-
30	-	-	18.1	22.4	21.9	23.8	22.4	22.	21.6	21.4	21.8	22.	21.9	19.2	18.1	20	22.4	21.4	17.9	14.3	-

4.1.12.2 TBO Water Quality Monitoring Data

The TBO at its intersection with Glidden Road near Beaverton, Michigan, was monitored for physical and chemical properties by the USGS on August 10, 1967[67]. Additionally, the TBO at Maison Road was monitored for temperature and dissolved oxygen as part of annual FERC water quality monitoring in 2013.[64] No additional information on water quality parameters is available for the TBO portion of the Plan Area prior to the Edenville Dam failure. USGS water quality measures are provided in Table 16 and 2013 FERC monitoring data is in Table 17 below.

TABLE 16

TBO River Water Quality Data (USGS, August 10, 1967)[67]

Parameter	Value
Water Temperature	21 ºC
Mean Stream Flow	220 ft^3/s
pH	8.1
Specific Conductance	405 uS/cm

TABLE 17

TBO at Maison Road Water Quality Data (FERC Reporting, 2013)[64]

Date	Water Temperature (°C)	Dissolved Oxygen (ppm)
6/18/2013	22.1	9.35
7/16/2013	26.6	8.1
9/4/2013	19.6	7.54
9/25/2013	15.0	9.78

Mussel surveys were completed within the SER from June 1 through August 10, 2022. During these assessments, Central Michigan University divers collected water quality measurements,

67 USGS, 1967

generally characterized the aquatic habitat, and collected percentages of substrate types. This information is presented in Table 18, and on Figure 9 below.

TABLE 18

Wixom Lake Snuffbox Evidence Reach Water Quality Data[11]

Parameter	June	July	August
Water Temperature	22.68 ºC	21 ºC	23.8 ºC
Degree of Silt	Medium – Heavy	Heavy	Heavy
Total Dissolved Sediments	326 ppm	330 ppm	332 ppm
Aquatic Macrophytes	Absent – Low	Medium	Absent – Low
Algal Growth	None – Medium	None	Slight

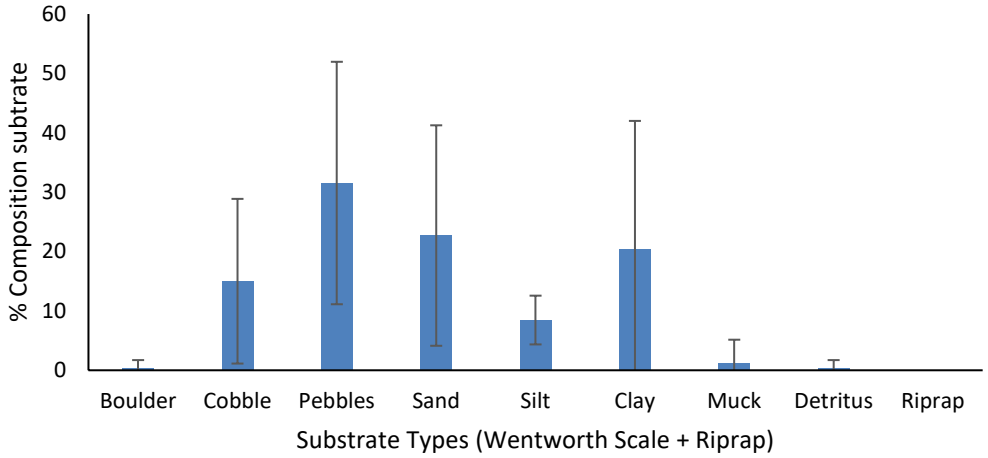

Figure 9. Mean Substrate Types within the Snuffbox Evidence Reach[11]

The most recent water quality data available from the TBO portion of the SER and surrounding Plan Area was collected in May 2023 by the USFWS Sea Lamprey Control Program[68]. Program staff sampled various sites within the TBO and select tributaries from the Beaverton Dam to below the Edenville Dam to assessment water quality characteristics associated with potential sea lamprey control applications (see Figure 10). Table 19 provides a summary of the collected parameters at TBO sites and are organized from upstream to downstream. Additional water quality information was collected from Nestor Drain, Bear Creek, Little Cedar River and Venison Creek; however, those results are not reported in this document. Water temperature over the two-day sampling period ranged from 15 to 20°C and dissolved oxygen ranged from 7.5-11.7 mg/L. Within a given sampling day the range of water temperatures varied by 2°C, and therefore are not suggested to change significantly from upstream to downstream (see Table 19). Dissolved oxygen also showed limited change from upstream to downstream sites with a range of 3.3 mg/L and 2.7 mg/L on sampling days (see Table 19 below). Alkalinity and pH were similar between sampling sites and showed no significant change from upstream to downstream. Overall, sampled water quality parameters were within Michigan surface water standards.

TABLE 19

TBO Sea Lamprey Control Program Water Quality Data[68]

[68] USFWS, 2023a.

Site	Sample Date	Temperature °C	DO (mg/L)	pH	Alkalinity (mg/L)
Tobacco River at Beaverton Dam spillway	5/11/2023	17.0	7.5	8.38	200
Tobacco River (Powerhouse Channel) at Beaverton Dam Powerhouse	5/10/2023	18.0	11.6	8.39	199
Tobacco River (Powerhouse Channel) at Beaverton Dam Powerhouse	5/11/2023	16.0	10.2	8.41	202
Tobacco River below Beaverton Dam spillway	5/10/2023	20.0	8.4	8.39	200
Tobacco River at Glidden Road	5/10/2023	18.4	10.2	8.41	199
Tobacco River at Glidden Road	5/11/2023	16.0	9.5	8.39	202
Tobacco River at Dale Road	5/10/2023	20.0	10.2	8.63	202
Tobacco River at Dale Road	5/11/2023	15.0	8.5	8.26	201
Tobacco River at Public Access Site	5/10/2023	19.4	11.7	8.65	197
Tobacco River at Public Access Site	5/11/2023	15.0	8.2	8.23	197
Tobacco River at Edenville Dam	5/10/2023	19.6	10.3	8.54	194
Tobacco River below Edenville Dam	5/11/2023	16.0	9.3	8.38	197

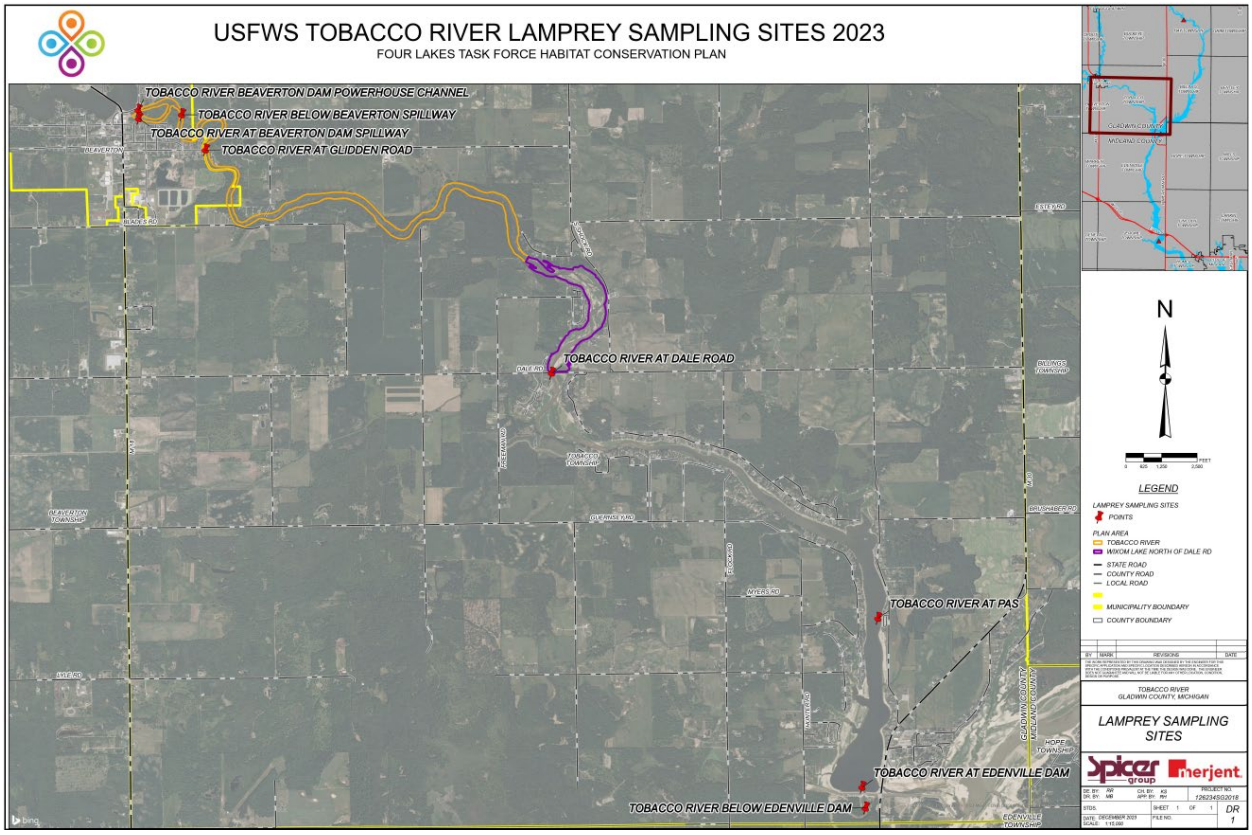

Figure 10. USFWS Tobacco River Lamprey Sampling Sites (2023)[68]

4.1.13 WATER DEPTH AND WETTED AREAS

Wixom Lake's bathymetric map from prior to the impoundment draining[69] displays a water depth ranging from 0 to 10 feet within the Permit Area. Furthermore, LiDAR data collected post-flood reveals the true bathymetry or contours of the exposed Wixom Lake bottomlands within the Permit Area following the flood disaster and substrate deposition that resulted from the event. Within the

69 i-Boating: Free Marine Navigation, n.d.

Permit Area, LiDAR topographic contours display similar elevation ranges to that of the prior Wixom Lake impoundment. As the Project proposes to restore the water levels of Wixom Lake to prior conditions, it is assumed that the maximum water depth within the Permit Area will be 10 feet. Details on depth profile by location of the SER are provided in Table 20 below. Comparing historical dissolved oxygen and temperature profile data to the bathymetric data suggests the vast majority of the Permit Area maintains dissolved oxygen concentrations above 5 mg/L and has limited thermal stratification.

TABLE 20

Bathymetry of Wixom Lake
Snuffbox Evidence Reach

Location	Maximum Depth
Wixom Lake North of Dale Road	5 ft
Wixom Lake South of Dale Road	10 ft

Within the Permit Area, the present day TBO has a wetted surface area of 18.17 acres. This 18.17 acres is not influenced by the downstream Edenville Dam in its current status. This water level may fluctuate depending on climatic conditions but is not influenced by downstream impoundments. Upon refill of the impoundment as a part of the Project, this area is anticipated to increase to a total wetted lake surface of 69.21 acres. At this point, the wetted surface area would be impacted by the downstream Edenville Dam during yearly winter drawdowns. The winter drawdown would decrease the total wetted area from 69.21 acres to 50.64 acres. Current wetted areas versus the proposed wetted areas are displayed on Figure 11 below.

The Permit Area is also influenced by the upstream Beaverton Dam. The Beaverton Dam acts as a hydroelectric and lake level control dam, in a series of other upstream dams located within the TBO watershed. The Beaverton Dam is not owned or operated by FLTF. To evaluate the impact that the Beaverton Dam has on the Permit Area, the USGS TBO at Glidden Road water gage was reviewed[70]. This gage records water height from 2018 to present day. In reviewing these records, a percentage occurrence of flowrate (in cfs) and flow duration curve were calculated to determine the likelihood and rate at which water is held back and released at the Beaverton Dam spillway downstream to the Permit Area (see Table 21 and Figure 12 below).

[70] USGS, 2023a

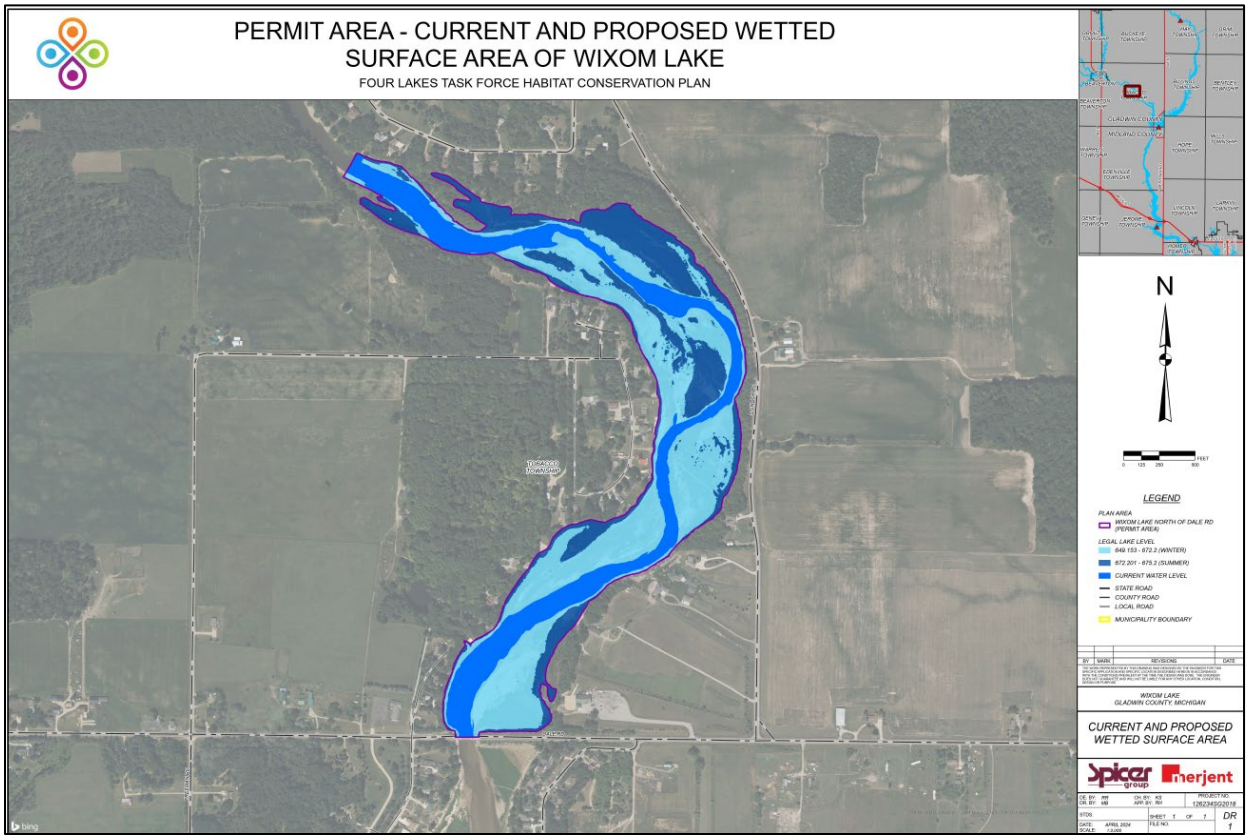

Figure 11. Permit Area – Current and Proposed Wetted Surface Area of Wixom Lake

TABLE 21

Beaverton Dam Flowrate Occurrence Summary (USGS Tobacco River at Glidden Road Gage)[70]

Flowrate (cfs)	Percentage Occurrence	Flowrate (cfs)	Quartile
1,800	1%	4	Minimum
1,190	5%	238	1st Quartile
665	20%	325	Median
512	30%	459	3rd Quartile
403	40%	8,480	Maximum
318	50%		
249	60%		
191	70%		
140	80%		
95	90%		
75	95%		

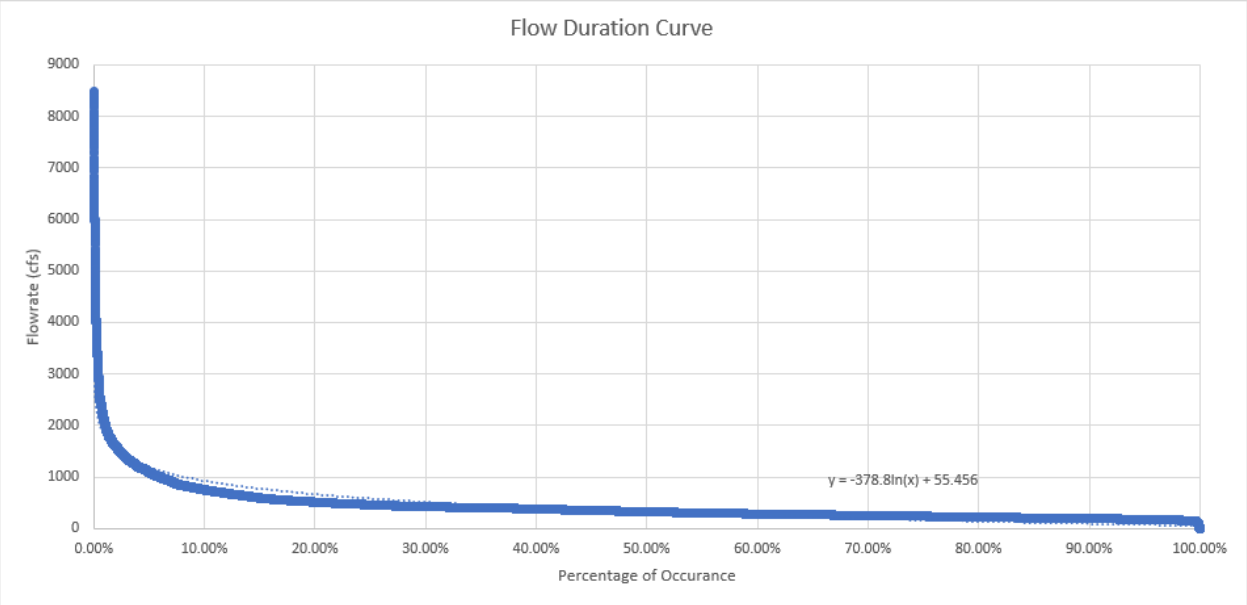

Figure 12. Beaverton Dam Flow Duration Curve

4.1.14 OTHER WATER QUALITY CONSIDERATIONS

In addition to specific water quality and water depth measures, FERC reports from prior years[62,63,64,65,66] noted several factors to consider when evaluating dissolved oxygen concentrations within the Four Lakes system. This is important to consider as prior to 2017, the Four Lakes had issues exceeding the required 5 mg/L dissolved oxygen threshold as required by FERC during the summer months. This information was collected within the area monitored for the FERC reports immediately upstream and downstream of the Edenville Dam. This information may not ultimately play a factor on water quality parameters within the Permit Area. Locations of previous water treatments performed by lake management boards and weed control districts is unknown. This information is provided for discussion purposes to support potential conservation strategies of this HCP as it is believed that traditional lake management protocols may influence water quality parameters negatively. Factors noted within the FERC reports include:

- Certain locations within the canal areas of Wixom Lake contribute high levels of anthropogenic land-borne nitrogen into Wixom Lake.
- High levels of nitrogen exist at the Edenville Dam impoundment and are reducing dissolved oxygen concentrations which create conditions for the excessive growth of aquatic vegetation and algal blooms.
- Phosphorus concentrations may be an additional stressor on the water quality within Wixom Lake, especially during the spring and summer months when anthropogenic activities along the shoreline have increased.
- Small amounts of copper-containing algaecide *Cutrine* significantly reduces dissolved oxygen concentrations, suggesting that algaecides applied to Wixom Lake by the lake improvement boards were a significant component of reduced dissolved oxygen concentrations.

- Copper-containing algaecides are recognized to be toxic to fish and aquatic invertebrates and can result in oxygen loss from decomposition of dead algae and weeds. This can lead to fish and invertebrate suffocation and has a potential for runoff for several months or more after the application.

- Water quality profiles taken within the Wixom Lake impoundment (immediately upstream of the Edenville Dam) showed that dissolved oxygen concentrations drop-off quickly with depth, much more so than as seen at other hydroelectric project impoundments in Michigan. It is likely that this problem is seen within Wixom Lake due to the respective amount of shoreline and watershed development.

- Aeriation systems that were installed to help increase dissolved oxygen displayed mixed results without significant increases in dissolved oxygen.

- Small (approximately one inch) openings in the spill-gates, and an associated protocol to open the spill gates as such during the summer months, significantly increased dissolved oxygen.

5.0 PROPOSED ACTION

FLTF proposes to refill the Wixom Lake impoundment to the normal (legal) lake level. This will begin to occur upon completion of spillway construction following the commissioning of the dam embankments and spillway structures. This is anticipated to occur in 2026 or 2027. At this time, the TBO portion of the Wixom Lake impoundment is anticipated to rise under normal flows to the normal (legal) lake level elevation of 675.2 (summer). The impoundment will be refilled slowly until summer normal (legal) lake level elevations are achieved. It is expected that the refilling of Wixom Lake will be conditioned by EGLE to not occur until a complete inspection, operation, and maintenance manual and refilling plan are submitted and approved by the agency. This refill plan will receive input from the USFWS, MDNR, and EGLE and will contain parameters that govern the process. It is anticipated that Wixom Lake will be filled at a maximum of 1 foot per day or as flows allow. The minimum required passing flow rate, which will be determined and conditioned as a part of the EGLE Dam Safety permit, will be maintained through the spillways during refilling. Thus, refill to the normal (legal) lake level may occur over several days, weeks, or months depending on water inputs to the upstream system.

6.0 COVERED ACTIVITIES

This section describes the covered activities within the Plan Area for which FLTF is seeking incidental take coverage. The Covered Activities include a variety of actions related to refilling of Wixom Lake and the ongoing operations and maintenance of the Edenville Dam that would affect Wixom Lake's water levels. To be eligible for incidental take authorization, covered activities must be: (1) otherwise lawful, (2) non-Federal, and (3) under the direct control of the permittee. The permit also authorizes take that may result from the HCP's required conservation and monitoring measures.

6.1 WIXOM LAKE REFILL

Wixom Lake's boundaries are defined by its summer normal (legal) lake level of elevation 675.2 (North American Vertical Datum of 1988 [NAVD88]). During winter drawdown operations, the normal (legal) lake level drops temporarily by three feet to 672.2 (NAVD88). Prior to the dam failure, Wixom Lake typically had a surface area of 1,908 acres, a shoreline of more than 84 miles, and a maximum depth of 40 feet. Currently, Wixom Lake is drawn down to a normal water elevation of 649 +/- (TBO) and 641 +/- (TBW). The extent of the Wixom Lake refill, including summer and winter lake levels, is discussed below, and depicted on Figure 13.

The Project proposes to refill Wixom Lake to the normal (legal) lake level and conduct seasonal drawdowns and refills to maintain the summer and winter elevations. Seasonal drawdowns are discussed under Section 6.2, Operations and Maintenance. The Edenville Dam will be operated as a "run-of-the-river" facility, wherein the dam gates are operated to maintain the normal (legal) lake level, such that the outflow from the dam is equal to the water flowing into it for drought, normal, and flood flows. Whenever possible, FLTF will match system outflows with system inflows when there is an excess of water in the system. During droughty conditions, FLTF proposes to maintain the lake level prior to passing flows for run-of-the-river. This is consistent with the prior FERC license that required FLTF to comply with Part 307, which includes reservoir water elevations as ordered in 2019, where the normal (legal) lake level is to be maintained as a prioritization versus tailrace water quality.[71] As such, there is no foreseeable scenario where water levels would fluctuate beyond the legally established lake levels.

The re-impoundment of Wixom Lake is a dam restoration project where FLTF will return water levels to their required elevations as previously agreed upon by federal and state agencies during the prior FERC licensing process. Impact on the reservoir will be no greater than that which was in place prior to the May 2020 flood event that resulted in the draining of the impoundment. The impoundment will not be used for water supply, flood control, or electric power generation. The primary use of Wixom Lake will be for recreation. There is no obligation for FLTF to pass water to downstream communities. FLTF is required to maintain the normal (legal) lake levels as defined by Court Order and Part 307.[72] Therefore, fluctuations in water elevation are not to occur.

Additionally, Wixom Lake would be returned to an impounded lake that is located within a highly managed river system where water is controlled throughout the watershed. Multiple dam operations and associated impounded lakes exist up and downstream of the Edenville Dam that are not owned and operated by FLTF. Inflows to the system are partly dependent on upstream

[71] 2017 Water Quality Monitoring Status Report

[72] Michigan NREPA Part 307 Sec. 30708(1): After the court determines the normal level of an inland lake in a proceeding initiated by the county, the delegated authority of any county or counties in which the inland lake is located shall provide for and maintain that normal level.

dam owners, including the Beaverton Dam immediately upstream of the Plan Area and additional dams further upstream from the Beaverton Dam.

The legal lake level Court Order[3] allows for a maximum change in legal lake levels within a 24-hour period to be a maximum of 0.7 feet. This may have historically been a part of normal operations of the Edenville Dam when it was used for electrical power generation. FLTF operations of the Edenville Dam will not store additional water in Wixom Lake; therefore, the lake levels will not have these minor fluctuations throughout the year, as they did when the dams previously produced power. The Edenville Dam is being designed so that when the LLO reaches a max discharge the spillway crest gates will open. When the crest gates are at max discharge the auxiliary spillway will be used. This auxiliary spillway is designed for significant flood events. Therefore, as designed, the water levels will not exceed the normal (legal) lake level unless there is a significant rainfall event that leads to catastrophic flooding of the region. Downstream of the dam, the rivers will be a natural flow, within minimum outputs being maintained and outflows equality inflows during normal conditions. Operating as run-of-the-river will have fewer negative impacts on the shoreline due to decreased fluctuations of water levels than with historical operations.

At the conclusion of construction, reservoir refilling will be accomplished by raising the crest gates and restricting discharge through the LLO to raise the reservoir level. The refilling of the reservoir will be conducted at a controlled rate to allow monitoring of the dam and embankments and to evaluate the structures to ensure they are responding appropriately to the rising water level. In the event adverse behavior is observed, the reservoir refilling will be stopped or reversed as needed. If the spillway is not operated as intended, storm events may result in a rapid rise in the reservoir level.

The objective of the refilling plan is to refill the reservoir in a controlled manner, allowing time for the project structures and instrumentation to react and reach some degree of equilibrium before continuing, and allowing time to observe and interpret dam and instrument behavior. The primary goal of the refilling is to limit the refilling rate to allow verification of dam safety performance as the reservoir rises.

A final refill plan must be in place prior to refill operations as a condition of other required permits and will be developed to govern the process. This Plan can be modified to accommodate environmental needs. Wixom Lake will be filled at a maximum of 1 foot per day, or as flows allow. Minimum flow will be maintained through the LLOs during refilling. Care will be taken to monitor weather forecasts regularly and compare to the publicly available rainfall depth-duration curves and peak discharge values estimated for the basins using the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation frequency tool online[73] and the EGLE Flood Discharge Database.[74]

To limit refill to 1 foot per day, the crest gates will be operated to pass flows. Note, as the reservoir level rises above the sill elevation of the gated spillway, there is increasingly more ability to limit the refilling rate in the event of flooding. To account for the differing degrees of exposure, project outflow control will be exercised to the extent possible to achieve a targeted reservoir refilling rate of less than 1 foot per day, while maintaining the following permit minimum flow discharges:

[73] NOAA, https://hdsc.nws.noaa.gov/pfds/
[74] EGLE, 2023

- TBW – The LLO system will be constructed to pass base flows (900 cfs) or greater in accordance with the highest 50 percent exceedance base flows estimated by the State of Michigan EGLE Flood discharge database.

- TBO – The LLO system will be constructed to pass base flows (600 cfs) or greater in accordance with the highest 50 percent exceedance base flows estimated by the State of Michigan EGLE Flood discharge database.

The reservoir refilling will be accomplished with natural inflow into Wixom Lake reservoir. The minimum flow release will be maintained, as possible, throughout the reservoir refilling process. Table 22 below provides the monthly flow exceedance values for the TBO river at its Edenville Dam spillway. A monthly flow exceedance curve looks at the flowrate of the river during different frequencies that it exceeds a certain amount of flow. For example, a 100-year storm event is considered a 1 percent exceedance event, which is why as you go down in the exceedance percentage, it is less likely that flowrate will occur. The 95 percent occurrence interval is considered to occur under extremely dry conditions, in which the river flow rate would be low. Data provided for the TBO[67] displays typical flowrates during the February through June months to be higher due to spring snowmelt as well as the frequency of spring storms that can cause higher than normal flowrates on a river. The 50 percent exceedance values are representative of monthly mean inflow to the reservoir. The storage-elevation curve for the reservoir is provided in Figure 14. This is a diagram that shows the volume in each lake basin (TBO and TBW) as it compares to the elevation of the lake level. As the elevation of the water levels of the impoundment increase, the total volume of water held by the impoundment increases.

TABLE 22. **Monthly Flow Exceedance Curve Data (cfs) for the TBO at Edenville Dam[75]**

Monthly Flow Exceedance Curve Data (cfs)
Tobacco River at Edenville Dam

Exceedance	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5%	820	1190	2230	2160	1160	860	550	460	510	570	710	790
10%	520	780	1690	1640	870	620	390	340	400	460	530	590
15%	430	560	1370	1280	730	490	340	290	330	400	470	490
20%	390	440	1130	1090	640	410	310	270	300	370	430	450
25%	360	400	970	950	560	380	290	260	280	340	400	420
30%	340	370	850	870	510	350	270	240	270	320	380	380
35%	320	350	790	800	480	330	260	230	250	300	350	360
40%	310	330	690	730	450	310	250	230	240	290	340	340
45%	300	310	610	680	420	300	240	220	240	280	320	330
50%	280	290	550	620	400	290	230	210	230	270	310	310
55%	280	280	500	580	380	280	220	200	220	260	300	300
60%	270	280	460	550	360	260	210	200	220	250	280	290
65%	260	270	420	520	340	250	200	190	210	240	280	280
70%	250	260	390	490	330	240	190	190	200	230	260	270
75%	240	250	350	470	310	230	190	180	190	220	260	260
80%	240	240	320	430	290	220	180	170	190	210	250	250
85%	230	230	300	400	270	210	170	170	180	200	230	240
90%	220	230	260	370	250	190	160	160	170	190	220	220
95%	190	200	230	330	220	160	150	140	150	170	190	200

Note:
1. Flows estimated by the State of Michigan and referenced from the EGLE Flood Discharge Database. Tobacco data accessed from: https://www.egle.state.mi.us/flow/lflow.asp?FileNumber=10420

When installing a dam, it is common for the impoundment to result in an increase in water temperature and decrease in water quality. The current condition of the impoundment has resulted in poor water quality because of system instability and increased sediment loading resulting in high turbidity. The reconstruction of the Edenville Dam will improve water quality be reducing turbidity and allowing for the monitoring and control of water temperatures and dissolved oxygen within the system. Supervisory Control and Data Acquisition (SCADA) units are to be installed at the Edenville Dam structure that continuously monitor specific water quality parameters such as dissolved oxygen and temperature. These SCADA units are not proposed outside of areas immediately upstream and downstream of the dam consistent with previous FERC monitoring requirements. The final operations documents for the dams will outline what steps to take in the event of readings outside of the normal ranges to ensure the dam is not negatively impacting water quality. FLTF will be implementing run-of-the-river operations and will implement all reasonable and prudent measures to comply with applicable water quality standards, including temperature, per the May 28, 2019, Court Order.[3] This includes the maximum monthly average temperatures downstream from the project shown in Table 23.

Primary outflow control is provided at the two spillways by the following means:

- TBW LLO: A 6-foot-wide by 8-foot-high primary gate with an upstream 6-foot-wide by 10-foot-high guard gate. Sill elevation of 642.0 feet.
- TBW Crest Gates: Three, 21-foot-10.75-inch-wide by 16.5-foot-high gates. Sill elevation of 659.2 feet.
- TBO LLO: A 4.67-foot-wide by 7-foot-high primary gate with an upstream 4.67-foot-wide by 9-foot-high guard gate. Sill elevation of 647.0 feet.
- TBO Crest Gates: Three, 27-foot-wide by 16.5-foot-high gates. Sill elevation of 659.2 feet.

If the capacity of the LLOs and Crest Gates are exceeded, the reservoir will begin to rise and would eventually overtop the Auxiliary Spillway, which provides additional spillway capacity up to the design flood. A spillway discharge curve for the TBO spillway is included below as Figure 15 below.[75] This diagram shows how much water can be passed overtop of the Edenville Dam at the TBO spillway with the proposed infrastructure at the lake level that is shown in elevation. These charts are used to determine and understand how you should set the gates and structures to maintain a set lake level or a set flowrate downstream.

[75] GEI, 2023

TABLE 23

Monthly Average Temperatures Downstream from the Project Not to Exceed[3]

Month	Temperature (°F)
January	42
February	41
March	53
April	67
May	78
June	85
July, August	86
September	80
October	69
November	56
December	44

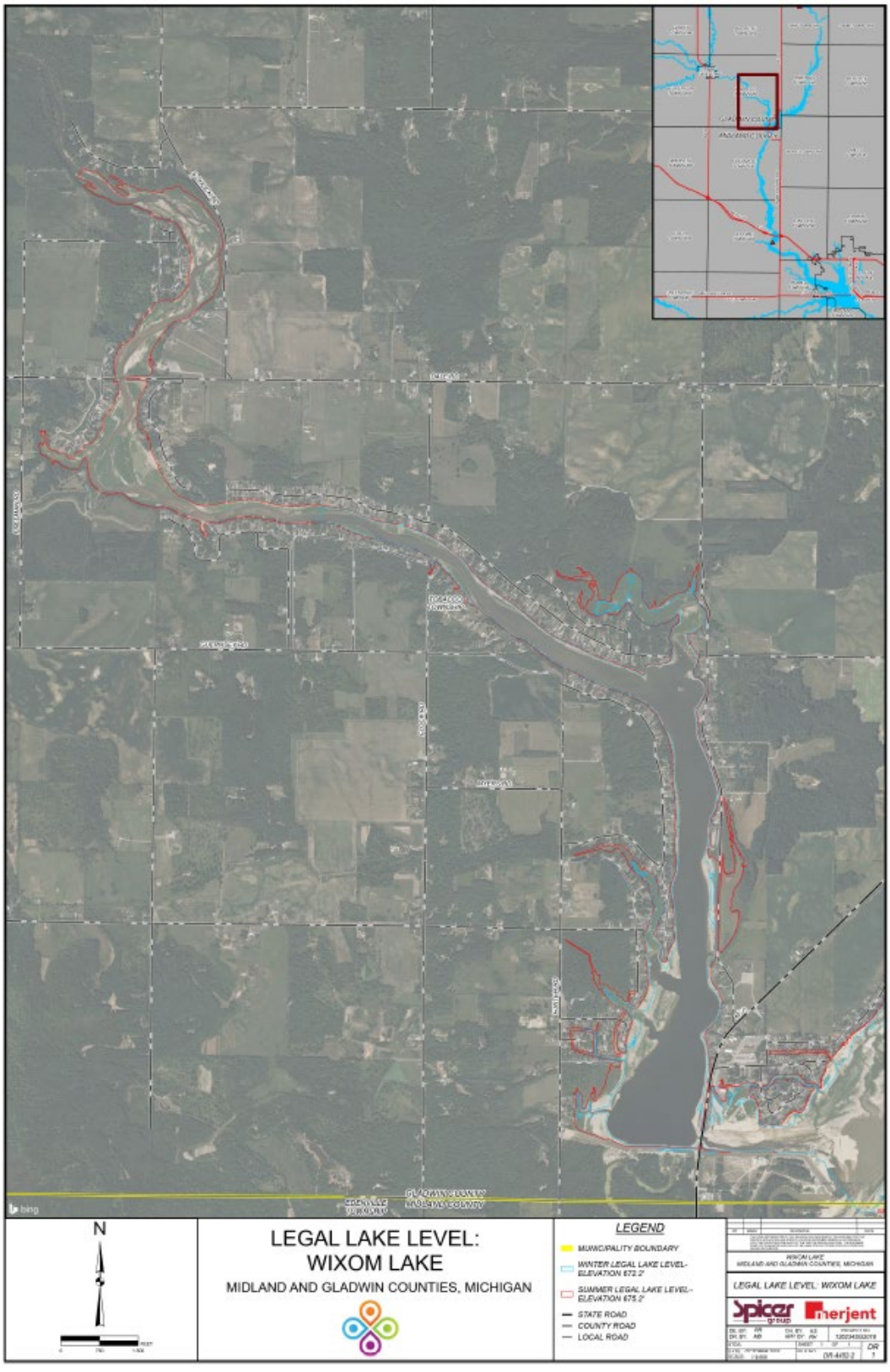

Figure 13. Wixom Lake Refill and Maintained Elevations

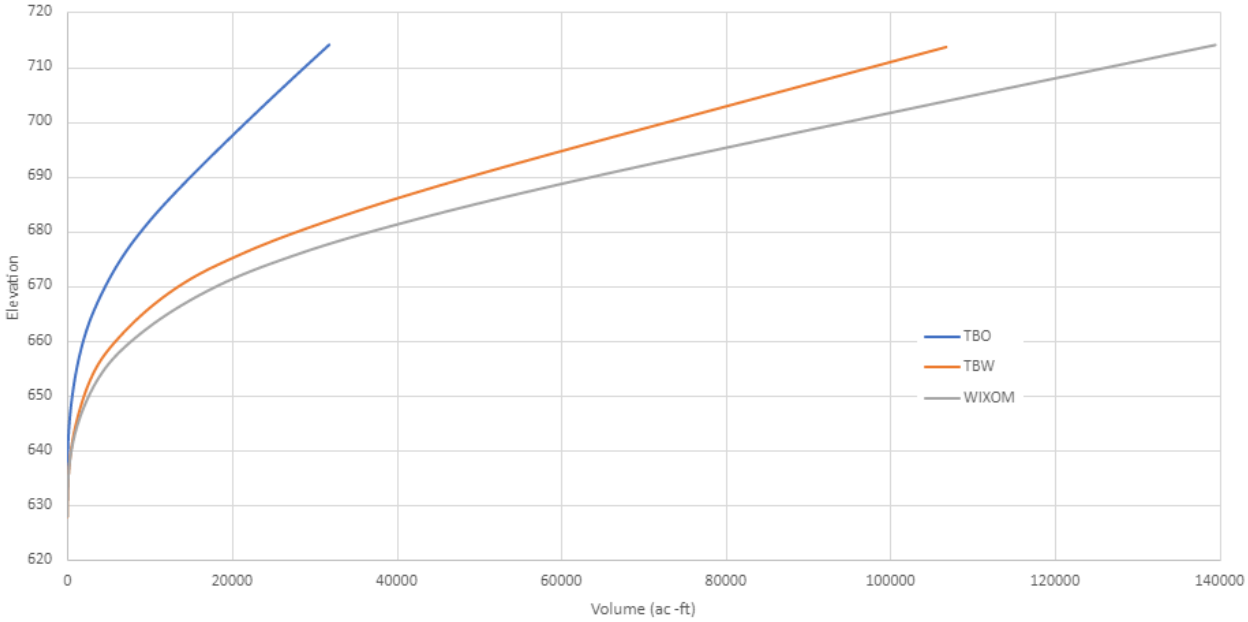

Figure 14. Edenville Elevation and Storage Curve[75]

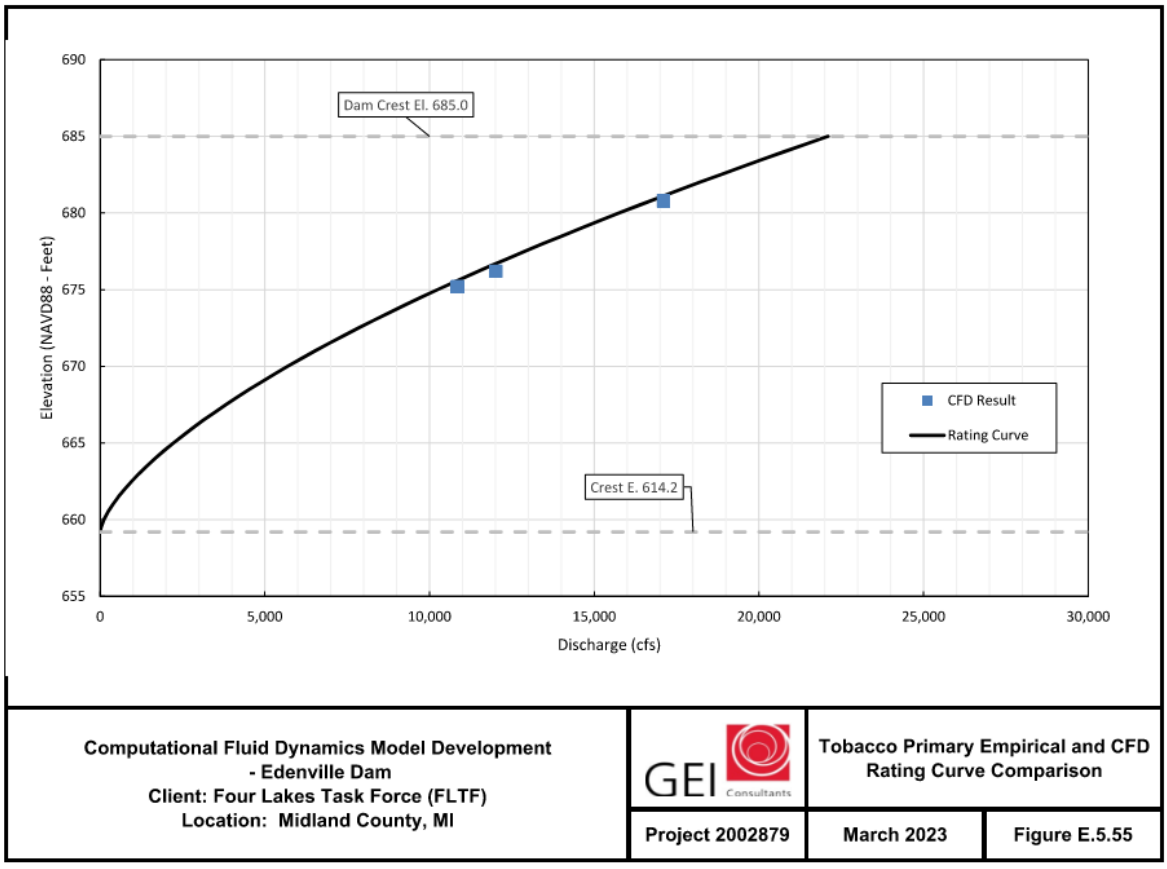

Figure 15. Spillway Discharge Curve for the TBO Spillway[75]

FLTF personnel will be responsible for the monitoring of reservoir levels, forecasting inflows, and operation of outflow control. The primary outflow control during the reservoir refilling will be the LLOs. The crest gate spillway will not be capable of discharging flow until the reservoir level exceeds the crest gate sill elevation of 659.2 feet. The crest gate spillway is useful for control of extreme floods and will remain in service, but crest gate adjustments will be more challenging for adjustment during low flows.

GEI evaluated the refill rates[75] by month start date, given the following conditions.

- Refill Starting Lake Level on the TBO Side 661.8 feet.
- Refill Starting Lake Level on the TBW Side 663.2 feet.
- Winter Normal Pool Level = 672.2 feet.
- Summer Normal Pool Level = 675.2 feet.
- Elevation and Storage volume per analysis provided within this section.
- Target maximum refill rate = 1 foot per day.
- Minimum refill duration at 1 foot per day = 10 days (winter) and 13 days (summer)
- Range of 50 percent to 75 percent Flow Exceedance assumed as lake inflow.
- TBO LLO operated to achieve TBO River permit requirements of 40 cfs October 1st to March 31st and 60 cfs April 1st to September 30th.
- TBW LLO operated to achieve an estimated minimum flow of 125 cfs.

Table 24 below provides a summary of the total refill days required if refill is started in that given month assuming a 50 percent Flow Exceedance.[75] As an example of potential refilling rates, the 50 percent flow exceedance in October is about 410 cfs. With 165 cfs being released downstream, approximately 245 cfs is available to fill the reservoir, equal to slightly over 485 acre-feet per day. The reservoir storage volume increases from 10,300 acre-feet at the starting elevations to 26,800 acre-feet at summer normal pool, so that the available average inflow could raise the reservoir at an average rate of about 0.4 feet per day or 33 days to Summer Normal Pool, which is below to the refill limitation of 1 foot per day. Inflows higher than the median inflow and the refill limitation of 1 foot per day will need to be discharged during the refilling period.

TABLE 24

Total Refill Days at 50% Flow Exceedance[75]

Month	1/1	2/1	3/1	4/1	5/1	6/1	7/1	8/1	9/1	10/1	11/1	12/1
50% flow Exceedance (cfs)	460	480	1040	1250	750	470	350	320	350	410	480	500
Minimum Total Discharge (cfs)	165	165	165	185	185	185	185	185	185	165	165	165
Remainder (cfs)	295	315	875*	1065*	565	285	165	135	165	245	315	335
Pool Target (feet)	672.2	672.2	672.2	672.2	675.2	675.2	675.2	675.2	675.2	675.2	672.2	672.2
Total Refill (days)	**19**	**18**	**10***	**10***	**15**	**29**	**55**	**58**	**44**	**33**	**18**	**17**

* *Mean refill rates exceed maximum 1-ft per day, FLTF to manage outflow as to not exceed daily max rise in reservoir level.*

Table 25 below provides a summary of the total refill days required if refill is started in that given month assuming a 75 percent Flow Exceedance.[75] It is estimated that the refill of Wixom Lake will occur over a range of 10 to 82 days with the above assumptions.

TABLE 25

Total Refill Days at 75% Flow Exceedance[75]

Month	1/1	2/1	3/1	4/1	5/1	6/1	7/1	8/1	9/1	10/1	11/1	12/1
75% flow Exceedance (cfs)	380	400	600	850	540	360	290	280	290	340	400	400
Minimum Total Discharge (cfs)	165	165	165	185	185	185	185	185	185	165	165	165
Remainder (cfs)	215	235	435	665*	355	175	105	95	105	175	235	235
Pool Target (feet)	672.2	672.2	672.2	672.2	675.2	675.2	675.2	675.2	675.2	675.2	672.2	672.2
Total Refill (days)	**26**	**24**	**13**	**10***	**23**	**59**	**82**	**74**	**60**	**43**	**26**	**24**

* *Mean refill rates exceed maximum 1-ft per day, FLTF to manage outflow as to not exceed daily max rise in reservoir level.*

Impounding Wixom Lake would not impact the snuffbox population upstream of the Permit Area where waters are outside of the influence of the legal (normal) lake level. The Edenville Dam would have an impact from its location to the upstream extent of Wixom Lake of the TBO by creating an impounded environment. Upstream of this location, the riffles, mussel community, and suitable habitat that is currently present would not be changed due to this refill. The high-quality mussel community that currently exists in this stretch of the TBO between Beaverton Dam and Wixom Lake was established and existed prior to the draining of the impoundment, was unimpacted by the draining of the impoundment, and would continue to be unaffected by the return of Wixom Lake. As such, the refill of the impoundment would not change the community or the habitat. If host fish species have migrated downstream from the Permit Area due to the lowering of the impoundment, they would be able to migrate back upstream as Wixom Lake is slowly refilled to the normal (legal) lake level.

Within the Permit Area, a live snuffbox mussel and several snuffbox valves were identified, and suitable riverine habitat for snuffbox mussel is currently present. This portion of the Permit Area is 69.21 acres with a current wetted area of 18.17 acres. As proposed, the normal (legal) lake level will return and wet an additional 51.04 acres within the Permit Area.

The refilling of Wixom Lake to its normal (legal) lake level will impact the habitat currently present in the Permit Area. This area is currently characterized by very lotic and diverse substrates, gradually sloping shorelines lined with vegetation, and lack eroded channelized vertical banks created when water retreated following the scouring caused by the flood event that resulted in the draining of the impoundment. This is unlike other areas downstream of the Permit Area. Mussel surveys from 2022 indicate a diverse mussel community was present within the Permit Area. At this location, an abundance of mussel individuals and composition of species were sampled. Therefore, while the conditions which would result in the restoration of Wixom Lake are not ideal for snuffbox mussels there is evidence to support that the species is able to survive within the Permit Area under proposed refill conditions. The point at which snuffbox habitation is not possible is certain to occur at a minimum downstream of the Dale Road bridge, which is located outside of the Permit Area. Snuffbox habitation is not suitable downstream of Dale Road due to steeply eroded banks and substrates compositions with greater amounts of clay, silt and muck. Mussel surveys from 2022 indicate a small population and low diversity of mussel species are present downstream of Dale Road. Refer to Section 7.1.7 for a more detailed description of mussel distribution within the Wixom Lake.

Although snuffbox may be able to survive within the Permit Area, restoration of Wixom Lake to the normal (legal) lake level may result in the take of snuffbox mussels at this location. Take would primarily be related to the destruction of suitable or preferred habitat for the species. Impounding the TBO would result in a shift from a riverine to a more lacustrine system where impact to the flow regime would occur. Several abiotic factors would change within the Permit Area. Specifically, the establishment of a lentic environment will remove established riffle bed forms within the existing channel, which is a preferred habitat for snuffbox mussel and their host species. Sediment transport dynamics would also change within a lentic environment and result in increased deposition of fine sediments and overtime result in reduced heterogenous substrates. Dissolved oxygen and temperature changes resulting from the restoration of Wixom Lake are not suggested as limiting factors to snuffbox and host fish habitation within the Permit Area based off historical dissolved oxygen and temperature profiles measured near the Edenville Dam. The bathymetric conditions within the Permit Area would likely not support dissolved oxygen concentration below 5 mg/L and temperature changes will be minimal within the water column, such that it would not limit the biological community. In addition to these water quality factors, a significant impact to snuffbox would occur as a result of the loss of the present, more diverse, mesohabitat types (riffle, run, pool) distribution within the Permit Area, to one dominated primarily by pool environment. Shallower riffle, run and pool habitats, capable of transporting increased sediment loads, which reduce sedimentation, will be lost with the establishment of an impounded environment. Currently marginal habitat for snuffbox will be degraded due to the transition to an impounded environment. Riffle habitat will be lost and deep pool habitat will be dominant, reducing the habitat variability within the Permit Area. The shift to more homogeneous substrates will reduce habitat suitability for snuffbox and their host fish species. Literature supports that snuffbox are found in substrate mixture of pebbles and sand and not in exclusively sandy regions.[11,76,77,78,79]

As discussed in Section 4.1.11 and Section 7.1.7, mussel surveys completed in 2019, 2021, 2022, and 2023, documented mussels at various locations within the Permit Area.[11,12,59,78,79] A review of the various studies suggest well established mussel communities were present within the Permit Area prior to the dam failure event. Specifically, mussel community density and diversity within the Permit Area had increased numbers of live mussels collected and overall species diversity, compared to downstream sites. Survey data located just upstream of the Wixom Lake's normal (legal) lake level had a similar diversity of mussels and similar habitat characteristics (average water depth, substrate composition) to that present within the Permit Area. Therefore, it is suggested impacts to the existing mussel community, and snuffbox specifically, may be very minimal within the Permit Area where the impoundment refill activities will occur. Additionally, the 2019 MDNR mussel survey had comparative mussel community data to nearby 2022 survey sites. The 2019 MDNR survey identified similar live species composition upstream and downstream of the 2022 mussel survey. A comparison of the 2019 MDNR data and the 2022 data further supports the assumption that the Permit Area contained suitable habitat conditions prior to the dam failure and supported a mussel community. Therefore, the refilling of the Wixom Lake to its normal (legal) lake level may have limited impact on mussels in this area.

6.2 OPERATIONS AND MAINTENANCE

As introduced in Section 6.1 Wixom Lake Refill, the Project proposes to refill Wixom Lake to the normal (legal) lake level and conduct seasonal drawdowns and refills to maintain the summer and winter elevations. The Edenville Dam will be operated as a run-of-the-river facility during both

[76] Woolnough, 2015
[77] Caldwell et al., 2016
[78] LaValley, 2022
[79] Vellequette, 2024

summer and winter elevations. FLTF proposes to maintain the lake level prior to passing flows for run-of-the-river consistent with the prior FERC license that required FLTF to comply with Part 307, which includes reservoir water elevations as ordered in 2019, where the normal (legal) lake level is to be maintained as a prioritization versus tailrace water quality. As such, there is no foreseeable scenario in which water levels would fluctuate beyond the legally established lake levels.

A winter drawdown is required, as ordered by the Court. In response to public comment, FERC required the winter drawdown of the reservoir in early winter to prevent ice damage to shoreline recreation and erosion control structures, allow residents to maintain and repair these structures, and reduce uncontrolled spill events that contribute to flooding. The winter drawdown would begin on December 15 and be completed by January 15. The annual lake level change will affect the wetted surface area of the Permit Area. Similar to the proposed refill operations of Wixom Lake (see Section 6.1), the refill of Wixom Lake to summer elevations will be completed. This includes similar prescribed refill rates. For winter drawdown operations, the same methods are proposed but in reverse. A maximum water elevation change of 1 foot per day is currently suggested.

FLTF will conduct routine maintenance inspections and repairs of Edenville Dam. These inspections and repairs would be conducted during the impoundment's drawdown to the winter normal (legal) lake level, foregoing the need to drawdown the lake outside of its prescribed winter and summer normal (legal) lake level cycle. During the winter normal (legal) lake level drawdowns, FLTF proposes to conduct routine dam maintenance inspections on a 3-year cycle. The purpose of these inspections is to identify required maintenance and repairs. These inspections are completed via visual observations and use of a dive team to evaluate conditions below the water's surface. All inspections would occur within the permitted normal (legal) lake levels.

Maintenance activities may be identified that would require work on portions of the Edenville Dam spillways that control the normal (legal) lake level. To ensure lake level changes do not occur during these maintenance activities, FLTF has designed the Edenville Dam reconstruction to incorporate a stop log system so that a stop log can be placed to maintain the normal (legal) lake level during repairs. This stop log system will be in place for potential maintenance of both the proposed crest gates and LLO.

Maintenance activities may be identified that would require work on portions of the Edenville Dam embankment. To ensure lake level changes do not occur during embankment maintenance activities, FLTF has designed the reconstruction of the Edenville Dam to contain a newly installed cutoff wall through the center of the embankment. This cutoff wall would prevent the lowering of the normal (legal) lake level while work is performed on the embankment. An isolated cofferdam may be installed at the localized repair area to allow for dry working conditions along the embankment.

FLTF does not plan, in the foreseeable future, to ever drop Wixom Lake's water elevation below the defined normal (legal) lake level elevations. Routine operations and maintenance of the Edenville Dam will continue to maintain the established summer and winter normal (legal) lake levels. The reconstruction of the Edenville Dam has been designed, as such, to avoid the need for a future emergency drawdown of Wixom Lake. In the unanticipated and unfortunate event that a dam failure were to occur or an imminent failure were to take place, FLTF would lower the elevations of Wixom Lake to a level ordered by EGLE's Dam Safety Program. At this point, the elevation of Wixom Lake could be lowered to the top elevation of the dam's LLO structure (649 feet) and it would be anticipated that a modification to this HCP would be required.

Within the Permit Area, a live snuffbox mussel and several snuffbox valves were identified, and suitable riverine habitat for snuffbox mussel is currently present. This portion of the Permit Area is 69.21 acres with a current wetted area of 18.17 acres. As proposed, the normal (legal) lake level will return and wet an additional 51.04 acres within the Permit Area. This area would be reduced to a wetted surface of 50.64 acres (reduction of 18.57 acres) during annual winter drawdowns.

Operational processes associated with the restoration of Wixom Lake, including winter drawdown procedures, may impact the snuffbox mussel and host species. Currently, areas which would become dewatered in the winter are not within the current wetted channel area of the TBO and therefore contain no snuffbox mussels at this time; however, if the Wixom Lake normal (legal) lake level was restored those areas would become wetted and become seasonally available areas for habitation. Because these areas are dewatered annually, they are not considered preferred habitat for colonization, but would become available. This is due to the short amount of time within any one season where snuffbox would need to become established in the areas and the marginal mussel habitat that will be present in the areas. Mussels are inherently not highly mobile organisms, with specific movement rates (e.g., feet per year) for snuffbox unknown, so it is reasonable to conclude snuffbox migration laterally and up bed slope to these areas would be limited. The dewatered winter areas at the Wixom Lake normal (legal) lake level will be low mussel habitat quality because they are located along the channel margins, backwater habitats or mid-channel depositional areas, such that reduced water currents and increased deposits of fine sediments (silt and sand) will be present. These areas would not be preferred habitats for snuffbox host species and therefore reduce the potential for larval snuffbox glochidia to be transported to these areas. The direct connection of the water channel during a significant portion of the year however, allows for the potential of snuffbox and host fish species to inhabit these portions of the channel, and therefore are considered potentially a loss of habitat for the species.

The winter drawdown is suggested to have a positive impact on the permanently wetted portion of the Permit Area due to lowering of water levels. The lowering of lake levels reduces the wetted width of Wixom Lake, thereby concentration flow within a more lotic environment, especially within the upstream 4,000 feet of the Permit Area, resulting in increased sediment transport capacity by the channel. The increase in sediment transport is likely to mobilize a portion of fine sediments that may have become deposited within these areas and assist with maintaining suitable substrate conditions for snuffbox habitation. Change from a lotic to lentic environment would support the establishment of a larger zebra mussel community and therefore could result in take of snuffbox mussel within the Permit Area due to fouling of zebra mussels on snuffbox. However, the winter drawdown should assist with reducing the overall abundance of zebra mussels within the Permit Area because dewatered areas will result in the mortality of any zebra mussels established within these areas annually. The restoration of Wixom Lake and continued maintenance of the Edenville Dam would assist in preserving the existing high quality mussel community upstream of Wixom Lake due to stable water levels.

6.3 OTHER PROJECT /LAKE PLAN INITIATIVES

The FLTF, as the Delegated Authority, and the SAD have extremely limited powers to directly influence land use changes within the impacted watershed, to change or promulgate rules/regulations governing land use, or to expend funds outside of its jurisdiction; FLTF will promote, partner, and assist stakeholders with education and activities that embody Low Impact Development (LID) principles and have the primary purpose improving water quality.

Development of a comprehensive lake restoration plan is critical for the community to understand how recreational and natural resource value is being restored. The scope and magnitude of the lake restoration plan will be developed by FLTF with input from EGLE, USFWS, MDNR and other stakeholders in the coming years. The base components of the lake restoration plan will include planning measures for natural resource management, erosion management, debris and sediment management, habitat creation, restoration of hydrology to wetlands, threatened and endangered species management, invasive species management, vegetation management, floodplain management, and lake level management and recreation.

FLTF has reviewed opportunities within Wixom Lake, focusing primarily on properties that were directly impacted by the dam failure and those where FLTF-owned properties and public-owned lands exist, to implement best managements practices (BMPs) and to minimize the impacts resulting from the refilling of Wixom Lake. Consistent with the USEPA's recommendation on the previously submitted permit application for the downstream Sanford Dam, FLTF has identified and evaluated additional opportunities for BMPs, such as providing fish passage through the dam, natural shoreline stabilization, native vegetation buffers, fish habitat, and low-impact-development to the maximum extent practicable to minimize the adverse effects of the re-impoundment.

Public properties surrounding Wixom Lake have been identified and reviewed to determine if any listed BMPs could be implemented. Several properties already have proposed projects to be implemented. It is important to note that most of the lakefront property is privately owned, which limits the options for implementation of specific projects. Currently, no BMPs are proposed within the project's Permit Area.

For BMPs, FLTF agrees that to the extent practical, LID techniques will provide water quality benefits to the restored lakes, as well as provide an offset to adverse impacts associated with the basin refill process and dam reconstruction. The USEPA defines the term LID as "systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat."[80] Stormwater, in a mixed-used watershed such as the one that drains to the lakes, is comprised of a variety of pollutants from agricultural as well as urban land uses. These pollutants range from nutrient loading associated with use of fertilizers, hydrocarbons associated with automobile use, and bacteria loading associated with manure application, failed or poorly functioning onsite wastewater systems, and natural background loads.

Regarding nonpoint source runoff from agricultural land uses, FLTF plans to work with stakeholders, including The Nature Conservancy, to prioritize and implement agricultural BMPs that improve soil health and reduce sediment and nutrient loading. Beneficial practices include vegetated buffer strips, grassed waterways, prairie strips, constructed wetlands, saturated buffers and two-stage ditches, all of which will act to reduce peak flows and filter nutrients and sediments prior to entering the lake systems. Additionally, FLTF will support the necessary policies and programs, including outreach, which incentivize these actions. FLTF will evaluate seeking funding from EGLE to develop a nine-element watershed management plan, which would allow stakeholders to apply for and receive grant funding to conduct water quality improvement projects.

For urban sources of nonpoint source pollution that could practically be addressed by the implementation of on-the-ground LID practices, FLTF will devote a portion of their website as a repository of educational resources on the importance of water quality for the lake restoration project, practical LID BMPs that could be implemented by stakeholders to improve water quality,

[80] USEPA, 2012

and will participate in larger-scale stakeholder discussions on future shoreline and near-shore projects that would be focused on addressing stormwater runoff, preventing shoreline erosion, and maintaining key wetland areas within the footprint of the Project. FLTF will continue to partner with EGLE, NRCS, MDNR, USFWS, and other state and federal agencies on projects that serve to meet LID goals and benefit the overall functions of the restored lake system.

FLTF's support in development of a comprehensive lake restoration plan will have a beneficial impact on the mussel communities of Wixom Lake and the surrounding watershed.

7.0 COVERED SPECIES

7.1 SPECIES INFORMATION

7.1.1 Species Description

The snuffbox mussel (snuffbox) is a medium-sized freshwater mussel endemic to the United States and Canada.[81] Female shell shape is more triangular than the more ovate males. While coloring darkens with age, the species is characterized by a green, yellow, or brown shell interspersed by green rays.

7.1.2 Life History

The species typically occurs in sand and gravel substrates of small- to medium-sized streams and rivers in areas with a moderate to swift current in natural flow regimes. As suspension feeders, adult snuffbox filter suspended particles of algae, freshwater plankton, and dissolved organic material from the water or sediments, while burying themselves partially or entirely in the substrate[76]. When spawning or trying to attract a host fish for reproduction, adult snuffbox will move out of the substrate in order to release or capture sperm and to lure host fish.

Water quality and temperature play a critical role in freshwater mussel habitats; mussel species are generally sensitive to changes in temperatures, dissolved oxygen, and water quality. Data specific to snuffbox parameters is unknown, but mussels generally require water temperatures below 86 degrees Fahrenheit, and dissolved oxygen concentrations above 5 mg/L.

The snuffbox, like other freshwater mussels, reproduces by parasitizing the gills of host fish with microscopic larvae (i.e., glochidia). In the Great Lakes region, logperch (*Percina caprodes*) and blackside darter (*P. maculata*) have been found to host snuffbox. Female snuffbox draw in the host fish using an inflated mantle, then close their shell around the head of the fish, releasing the glochidia.[11,82]

7.1.3 Status

The snuffbox mussel was listed as an endangered species under the ESA on March 14, 2012.[83] Critical habitat has not been designated for this species.

7.1.4 Distribution

The snuffbox is historically known from 213 streams and lakes in 18 states and Ontario, Canada. The species is currently understood to be extant in 85 streams and lakes in 14 states and Ontario.[76] There are known populations of snuffbox in Michigan; the species has been documented in 12 rivers in the central and southern portions of the state.[83,84] Surveys conducted by LaValley in 2021 within the TBO downstream of the Beaverton dam but upstream of Wixom Lake's normal (legal) lake level identified two live snuffbox – one adult male and one subadult – indicating successful reproduction in this reach of the river. However, only one additional snuffbox shell was identified, resulting in a shell-to-live ratio of 36.5 and a catch per unit effort (CPUE) of

[81] USFWS, 2023b
[82] Beaver et al., 2019
[83] USFWS, 2012a
[84] MNFI, 2022c

0.09, indicating low abundance, and leading LaValley to determine that this small population had low viability.[78] The TBO snuffbox population is one of only two remaining populations known in the Lake Huron watershed, with the other population in the AuSable River in Ontario, Canada.[77,11] Additionally, the surveys conducted by LaValley identified an abundance of shells, specifically in the TBO, which suggests that the TBO had a moderate sized snuffbox population and that there has been a decline in population size.

7.1.5 Reasons for Decline

Snuffbox mussel populations have seen declining populations across the species' range due to a variety of factors, including habitat modification, destruction, and degradation; impoundments and channelization of natural streams and rivers; modification of stream flow regimes; overexploitation; pressure from invasive species; and, pollution runoff and sedimentation from developed areas and agricultural production.[81,83]

Dams and impoundments affect unionid species generally, including snuffbox, by altering the flow regime, causing scour of substrates, changing water depths and therefore, water temperatures and dissolved oxygen concentrations. Many mussel species depend on swift currents to oxygenate water and provide foraging opportunities; still or slow-moving water in the more lacustrine environments created by dams do not provide the nutrients and conditions for snuffbox to thrive. In addition, impoundments prevent host fish from moving through a river system by blocking seasonal passage through dam infrastructure. Dams also prevent mussels from moving downstream and ensure that up- and downstream populations remain isolated, both immediately in terms of spatial distribution, but also long-term in terms of genetic flow and variability.[85] Fluctuating water levels caused by dams also impact tailwaters by stranding or otherwise exposing mussels to extreme temperatures, which can result in mass mortalities. High-volume water discharges and instant water stoppages can cause instability of substrate below dams.[51]

Changes to stream morphology (channelization, dredging, and removal of vegetation) reduces available host and mussel habitat, which can alter circulation patterns and substrate composition. Mussels can be caught and destroyed during dredging activities, and sediment turned during dredging may travel downstream to affect mussels outside construction areas. Dredge spoils can re-enter rivers through upland runoff and contaminants may re-enter streams through groundwater. When streams are channelized, it can reduce the overall available mussel habitat, and on a larger scale, can be catastrophic to mussels. The removal of fallen trees and debris (snagging) can also reduce available habitat. Snagging can also increase bank erosion, which creates unstable substrates during stream recovery. Both channelization and snagging can increase flood heights, which could result in additional runoff into streams.[51]

Point and non-point sources of pollution have also contributed to snuffbox population declines. These can be runoff from agricultural sources including cultivated fields, feedlots, poultry and pork production, as well as chemical discharges from factories and industrial facilities, and even runoff from city roads, construction sites, and other sources of untreated stormwater. Pollution can affect mussel populations, including direct mortality due to toxic exposure or a decrease in water quality, or accelerating algal blooms, which may affect both mussels and host fish in a variety of ways. Similarly, sedimentation may also affect water quality, leading to changes in temperature and dissolved oxygen, and potentially smothering mussels and their spawning areas.[85]

[85] USFWS, 2012b

The impacts of invasive mussel species on native mussel populations also cannot be understated. Zebra mussels (*Dreissena polymorpha*) have spread rapidly through the Great Lakes ecosystems as well as large rivers in the Upper Midwest and central United States since their accidental introduction in the 1980s. Zebra mussels compete with native species for food sources, and will also attach to and colonize on the larger native species preventing them from filter feeding, spawning, and dispersing, effectively smothering them.[86,87]

Surveys conducted in 2020 and 2021 by LaValley identified seven streams where snuffbox populations show a declining trend. LaValley recommended that future analyses of water quality, flow and temperature regimes, and algae and food availability may explain the variations in snuffbox populations across Michigan. Additionally, geographic information systems analyses of various streams throughout Michigan were unable to explain whether certain demographic changes and very localized sources such as pollutants, competition from invasive species, or predation may also contribute to the decline of snuffbox mussels.[78]

7.1.6 Threats

Continued threats to snuffbox across its range include habitat modification (i.e., impoundments and stream channelization) and impacts to water quality, including sedimentation and pollution. Invasives species such as zebra and quagga mussels and Asian mystery snails are present in rivers and streams in the Great Lakes region and may impact native mussel populations through biofouling and use of the same food resource as freshwater unionids.[11,81,84]

7.1.7 Covered Species Presence within the Permit Area

A mussel survey funded by FLTF was conducted throughout Wixom Lake during the summer of 2022. This survey identified one live female snuffbox and 21 snuffbox valves within the Permit Area. No additional live individuals or suitable habitat for snuffbox mussel were identified outside of the Permit Area[11] (see Figure 16 below) within the influence of Wixom Lake's normal (legal) lake level.

Two other recent studies are known to have occurred within the Permit Area. These studies resulted in the finding of additional live snuffbox mussel in the TBO downstream of the Beaverton Dam, but upstream of the normal (legal) lake level boundary of Wixom Lake. As mentioned in Section 7.1.4, two live snuffbox were found by Central Michigan University during a 2021 mussel survey.[78] One additional live snuffbox was identified during ongoing surveys conducted by Central Michigan University as a part of a Master's degree research study.[79] These additional studies were not funded by FLTF.

A total of four surveys were conducted at four sites within the Permit Area during the FLTF-funded 2022 mussel survey. Three survey sites were established within the boundaries of Wixom Lake (TT12, TT13, and TT14) and one survey site immediately upstream in the TBO portion of the Permit Area (TT11). The live individual, a non-gravid female, was found at site TT12. Snuffbox valves were found in quantities of 7, 5, and 9 at TT12, T13, and TT14, respectively. Per the guidance on shell condition used by the USFWS and defined in Southwick and Loftus (2003), all snuffbox valves encountered were categorized as weathered or subfossil, with the exception of one live dead valve located at TT12, and a mix of both female and male valves were identified.[11,12] The sex of the valves were roughly 1:1 male and female. Woolnough et al. (2022) calculated

[86] USFWS, 2020b
[87] USGS, 2023b

snuffbox density at site TT12 as 0.00024 individuals per square meter (m^2) and 0.25 per person hour CPUE.

Abundance of live unionids found from the TBO to Wixom Lake transition at the uppermost extent of the Permit Area to the downstream extent of the Permit Area decreases rapidly. A total of 250 live individuals, representing 7 species, were identified at TT11 which was located within the TBO immediately upstream of Wixom Lake's normal (legal) lake level. Within the Permit Area, TT12 recorded a total of 153 live mussels from 9 different species at a density of 0.037 m^2 and 38.25 per person hour CPUE. Survey of TT12 also identified 137 valves from 14 species. Downstream of TT12, site abundance of live mussels decreased to 38 total individuals at TT13 and 25 total individuals at TT14 where Dale Road intersects Wixom Lake and the Permit Area terminates. Downstream of the Permit Area within Wixom Lake live individual abundance dropped to ≤ 3 individuals per survey site (see Figure 17).

Central Michigan University has completed additional mussel surveys in 2023 as a part of a Master's degree research study[79] within the Permit Area. The report and results are pending, but it has been alluded to FLTF that the portion of Wixom Lake downstream of Dale Road has vastly different aquatic habitat that is not suitable for mussel species compared to the suitable habitat located upstream of this location. The furthest two upstream sites of the Permit Area of Wixom Lake (TT11 and TT12) had a very different habitat than the further downstream sites – a very lotic and diverse substrate. Also, TT11 and TT12 had shorelines lined with trees and vegetation unlike most of the surveyed sites in 2022. Both TT11 and TT12 had riffles in parts of the site surveys. Both TT11 and TT12 had gradually sloping shorelines and lacked eroded channelized vertical banks that were present in many of the sites influenced by the dam failures. Suitable habitat features were not present downstream of Dale Road.

A species richness curve and a survey adequacy curve were performed to assist in quantifying confidence in the survey effort. The species richness curve indicated an additional 249 live individual mussels would need to be identified in order to detect one additional species. Similarly, the survey adequacy curve determined that 134 more survey sites would require survey to detect one additional species. These results indicate that the survey effort identified all mussel species present in the SER and subsequent Permit Area.

The 2021, 2022, and 2023 data have identified a small population of snuffbox mussels located within the Permit Area upstream to the Beaverton Dam. Finding juvenile or young snuffbox mussel within this reach suggests that this is a reproducing population. This population has a low density and abundance, and LaValley determined that it is likely the population is in decline[78].

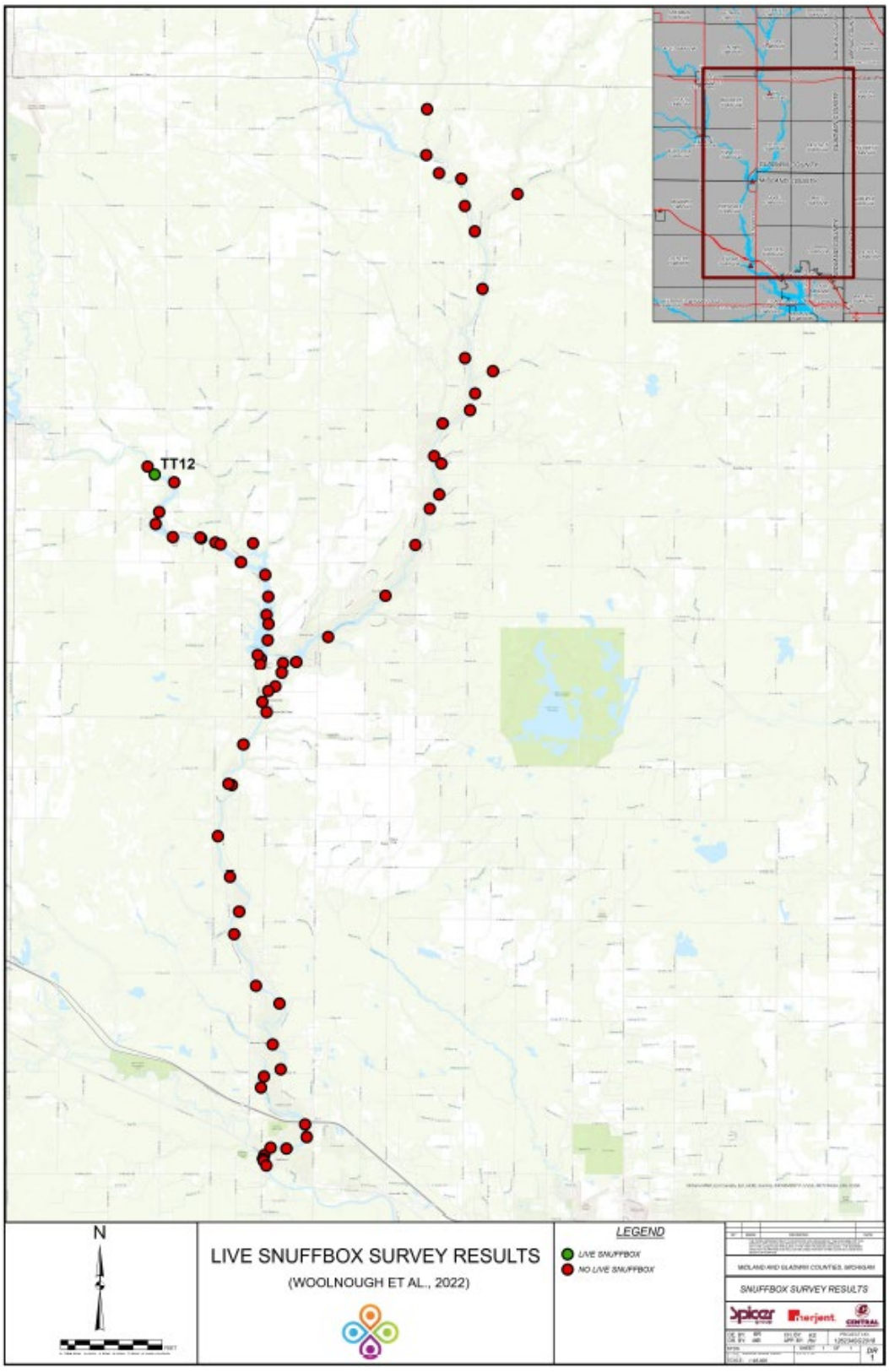

Figure 16. Live Snuffbox Survey Results[11,12]

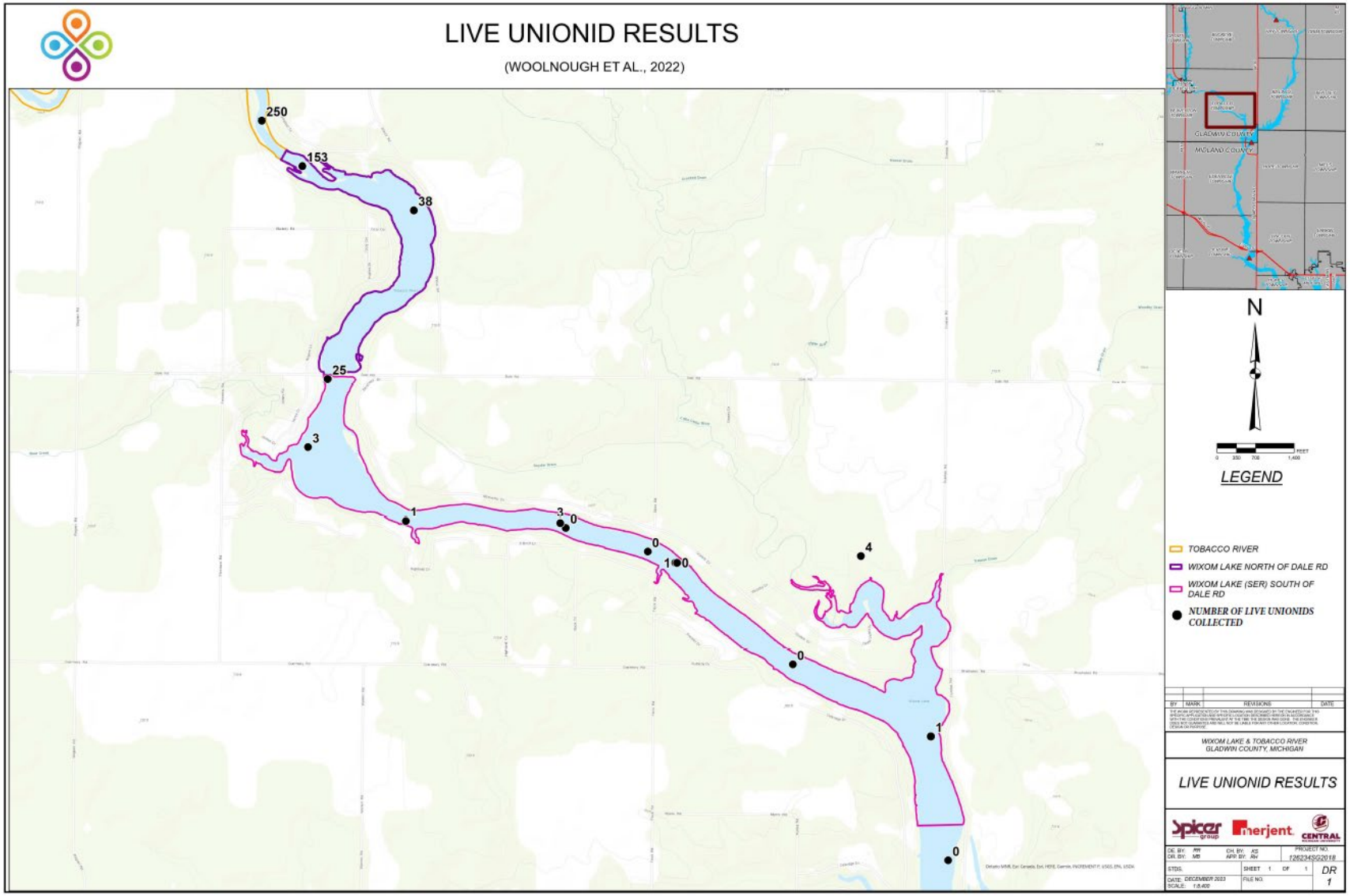

Figure 17. Live Unionid Results[11,12]

7.2 ANTICIPATED EFFECTS ON SNUFFBOX MUSSEL

7.2.1 Construction Activities

Snuffbox mussels were not identified during the 2022 survey effort upstream or downstream of the areas associated with the physical construction of the new dam facilities. Additionally, mussels were collected at very low abundance (<3 live mussels, consisting of common lake species) near the dam facilities as documented during 2022 surveys.[12]

Suitable mussel habitat can sometimes be found in the areas immediate up- and downstream of dam spillways. The 2022 field survey effort conducted surveys at 10 targeted sites in the areas immediately adjacent to the Edenville Dam construction workspace. One site each was surveyed upstream of the TBO and TBW spillways, respectively; four sites were surveyed downstream of each spillway. No snuffbox or shells of snuffbox were in the areas immediately upstream and downstream of Edenville dam.[11,12] Suitable habitat for snuffbox mussels was not identified.

Construction activities associated with dam and embankment repairs at both the TBO and TBW impoundments of Wixom Lake will not impact snuffbox mussels or the Permit Area. The Permit Area will not be impacted by sedimentation or runoff from areas of ground disturbance. Ground-disturbing activities will not be conducted in or near the Permit Area. The construction activities, including a minor rise in lake levels known as the 'interim refill,' will not influence water levels within the Permit Area.

7.2.2 Lake Refill Activities

As discussed in Section 6.1, the construction and repair of the dam structures, embankments, and appurtenances will allow for the refilling of Wixom Lake to the normal (legal) lake level, as mandated by the Lake Level Order [3], and as such, will result in impacts to snuffbox mussels.

Impounding the TBO would not impact the snuffbox population upstream of the Permit Area. The Edenville Dam would have an impact from its location to the upstream extent of Wixom Lake by creating an impounded environment. Upstream of this location, the riffles, mussel community, and suitable habitat that is currently present would not be changed due to this refill. The high-quality mussel community that currently exists in this stretch of the TBO between Beaverton Dam and Wixom Lake was established and existed prior to the draining of the impoundment. As such, the refill of the impoundment would not change the community or the habitat. If host fish species have migrated into the Permit Area or downstream reaches of Wixom Lake due to the lowering of the impoundment, they would be able to migrate back upstream as Wixom Lake is slowly refilled to the normal (legal) lake level.

The refilling of Wixom Lake to its normal (legal) lake level will impact the habitat currently present in the Permit Area. This area is currently characterized by very lotic and diverse substrates, gradually sloping shorelines lined with vegetation, and lack eroded channelized vertical banks created when water retreated following the scouring caused by the flood event that resulted in the draining of the impoundment. This is unlike other areas downstream of the Permit Area. Mussel surveys from 2022 indicate a diverse mussel community was present within the Permit Area. At this location, an abundance of mussel individuals and composition of species were sampled. Therefore, while the conditions which would result in the restoration of Wixom Lake are not ideal for snuffbox mussels, there is evidence to support that the species is able to survive within the Permit Area under proposed refill conditions. The point at which snuffbox habitation is not possible

is certain to occur at a minimum downstream of the Dale Road bridge, which is located at the most downstream extent of the Permit Area.

Although snuffbox may be able to survive within the Permit Area, restoration of Wixom Lake to the normal (legal) lake level may result in take of snuffbox mussels at this location. Take would primarily be related to the destruction of suitable or preferred habitat for the species. Impounding the TBO would result in a shift from a riverine to a more lacustrine system where impact to the flow regime would occur. Several abiotic factors would change within the Permit Area. Specifically, the establishment of a lentic environment will remove established riffle bed forms within the existing channel which is a preferred habitat for snuffbox mussel and their host species. Sediment transport dynamics would also change within a lentic environment and result in increased deposition of fine sediments and overtime result in reduced heterogenous substrates. Dissolved oxygen and temperature changes resulting from the restoration of Wixom Lake are not suggested as limiting factors to snuffbox and host fish habitation within the Permit Area based off historical dissolved oxygen and temperature profiles measured near the Edenville Dam. The bathymetric conditions within the Permit Area would likely not support dissolved oxygen concentration below 5 mg/L and temperature changes will be minimal within the water column, such that it would not limit the biological community. In addition to these water quality factors, a significant impact to snuffbox would occur as a result of the loss of the present, more diverse, mesohabitat types (riffle, run, pool) distribution within the Permit Area, to one dominated by primarily pool environment. Shallower riffle, run, and pool habitats, capable of transporting increased sediment loads which reduce sedimentation, will be lost with the establishment of an impounded environment. Currently marginal habitat for snuffbox will be degraded due to the transition to an impounded environment. Riffle habitat will be lost and deep pool habitat will be dominant, reducing the habitat variability within the Permit Area. The shift to more homogeneous substrates will reduce habitat suitability for snuffbox and their host fish species. Literature supports that snuffbox are found in substrate mixture of pebbles and sand and not in exclusively sandy regions.[11,76, 77, 78, 79]

As discussed in Section 4.1.11 and Section 7.1.7, mussel surveys completed in 2019, 2021 and 2022 documented mussels at various locations within the Permit Area. A review of the various studies suggest well established mussel communities were present within the Permit Area prior to the dam failure event. Specifically, mussel community density and diversity within the Permit Area had increased numbers of live mussels collected and overall species diversity, compared to downstream sites. Survey data located just upstream of the Wixom Lake's normal (legal) lake level had a similar diversity of mussels and similar habitat characteristics (average water depth, substrate composition) to that present within the Permit Area. Therefore, it is suggested impacts to the existing mussel community, and snuffbox specifically, may be very minimal within the Permit Area where the impoundment refill activities will occur. Additionally, the 2019 MDNR mussel survey had comparative mussel community data to nearby 2022 survey sites. The 2019 MDNR survey identified similar live species composition upstream and downstream of the 2022 mussel survey. A comparison of the 2019 MDNR data and the 2022 data further supports the assumption that the Permit Area contained suitable habitat conditions prior to the dam failure and supported a mussel community. Therefore, the refilling of the Wixom Lake to its legal (normal) lake level may have limited impact on mussels in this area.

7.2.3 Operations and Maintenance

As discussed in Section 6.2, operational processes associated with the restoration of Wixom Lake, including winter drawdown procedures, may impact the snuffbox mussel and host species. Currently, areas which would become dewatered in the winter are not within the current wetted

channel area of the TBO and therefore contain no snuffbox mussels at this time; however, if Wixom Lake normal (legal) lake level were restored, those areas would become wetted and become seasonally available for habitation. Because these areas are dewatered annually, they are not considered preferred habitat for colonization. This is due to the short amount of time within any one season in which snuffbox would need to become established in the areas, and the marginal mussel habitat that would be present in the areas. Mussels are inherently not highly mobile organisms, with specific movement rates (e.g., feet per year) for snuffbox unknown, so it is reasonable to conclude snuffbox migration laterally and up bed slope to these areas would be limited. The dewatered winter areas within the Permit Area will be low mussel habitat quality because they are located along the channel margins, backwater habitats or mid-channel depositional areas, such that reduced water currents and increased deposits of fine sediments (silt and sand) will be present. These areas would not be preferred habitats for snuffbox host species and therefore reduce the potential for larval snuffbox glochidia to be transported to these areas. The direct connection of the water channel during a significant portion of the year however, allows for the potential of snuffbox and host fish species to habitat these portions of the channel, and therefore, are considered a loss of habitat for the species.

The winter drawdown is suggested to have a positive impact on the permanently wetted portion of the Permit Area due to lowering of water levels. The lowering of lake levels reduces the wetted width of Wixom Lake, thereby concentrating flow within a more lotic environment, especially within the upstream 4,000 feet of the Permit Area, resulting in increased sediment transport capacity by the channel. The increase in sediment transport is likely to mobilize a portion of fine sediments that may have become deposited within these areas, and assist with maintaining suitable substrate conditions for snuffbox habitation. The change from a lotic to lentic environment would support the establishment of a larger zebra mussel community, and therefore could result in take of snuffbox mussel within the Permit Area due to fouling of zebra mussels on snuffbox. The restoration of Wixom Lake and continued maintenance of the Edenville Dam would assist in preserving the existing high quality mussel community upstream of Wixom Lake due to stable water levels. Additionally, the Edenville Dam, once rebuilt, will become a barrier to invasive sea lamprey, thereby reducing likelihood of the spread of the species within the TBO and TBW upstream of the dam. Reduced or absent populations of sea lamprey upstream of the Edenville Dam is beneficial to the biological communities of the TBO and TBW because it reduces the need for applications of lampricide, which can adversely impact snuffbox and host fish species.

The portion of the Permit Area that will be affected by seasonal winter drawdown operations is 69.21 acres. The current wetted area within the Permit Area is 18.17 acres. As proposed, the normal (legal) lake level will return, and wet an additional 51.04 acres within the Permit Area. This area would be reduced to a wetted surface of 50.64 acres (reduction of 18.57 acres) during annual winter drawdowns.

7.3 IMPACT ANALYSIS AND ESTIMATED INCIDENTAL TAKE

The changes to the environmental baseline conditions, which currently provide suitable habitat for snuffbox mussels, are expected to ultimately cause take of snuffbox mussel individuals which are currently found within the Permit Area. No impact to the areas of the TBO that are proposed to remain riverine upstream of the effects of the proposed Wixom Lake impoundment would occur (see Figure 2). Take would be associated with the expected changes in water level and associated conversion of lotic riffle/pool sequence bedforms to a lentic pool environment. This would lead to increases in sedimentation and changes to substrate characteristics that would cause loss of suitable snuffbox mussel habitat. The Permit Area contains 1.3 linear miles of snuffbox habitat. Within that area, the upstream 0.25 mile is considered high quality habitat, which is similar to that

upstream in the TBO outside of Wixom Lake's influence. The remaining 1.05 miles is considered marginal snuffbox habitat. The upstream 0.25 mile is a transition zone between lotic and lentic environments and contains very comparable morphological characteristics (i.e., wetted width, bedform diversity, substrate composition) as the upstream TBO, while the downstream remaining portion within Wixom Lake's influence becomes more lentic, with increased wetted width, reduced bedform diversity and increasing silt or sand sediment composition. 2022 mussel survey efforts within the Permit Area show a gradual decline in overall mussel abundance and species diversity the further downstream in the Permit Area sampled (see Figure 17). Specifically, in 2022 the most upstream site sampled within the Permit Area (TT12) resulted in 153 individuals being collected, representing 9 species, while the most downstream site in the Permit Area (TT14) resulted in 25 individuals collected, representing 6 species (see Figure 17).

The return of Wixom Lake to the normal (legal) lake level would have a greater negative effect to the existing mussel community within the downstream 1.05 miles of the Permit Area compared to the upstream 0.25 mile of the Permit Area (see Figure 2). This is determined because the upstream 0.25 mile of the Permit area will be a transition zone between lotic and lentic environments and the downstream 1.05 miles of the Permit Area will be a more pronounced lentic environment when Wixom Lake is returned to the normal (legal) lake level. As shown on Figure 17 and described in the previous paragraph, data from 2022 field surveys indicates that mussels were present within the Permit Area prior to the dam failure event, and at the very upstream location, a high-quality community was present; therefore, the return of the Wixom Lake normal (legal) lake level and associated habitat changes will not significantly impact mussels, specifically snuffbox, in the upstream extent of the Permit Area (upstream 0.25 mile). However, due to the potential changes in habitat it is reasonable to conclude that potential take of snuffbox may occur and therefore should be considered. Changes to the habitat and morphological characteristics of the TBO upstream from the Permit Area (see Figure 2 and Figure 3) will not occur due to the restoration of the Wixom Lake normal (legal) lake level. The stability of the Edenville Dam and resulting Wixom Lake normal (legal) lake level will preserve the TBO upstream from the Permit Area by providing stable water levels.

Potential take to snuffbox within the Permit Area could affect all life stages of snuffbox by contributing to the loss of suitable habitat and potential loss of host fish species in the area. Increases in sedimentation will occur at varying degrees within the Permit Area due to the transition from lotic to lentic environments which may render habitats unsuitable for snuffbox habitation. The loss of preferred riffle bedforms will result when the Wixom Lake normal (legal) lake level is restored and therefore limit future establishment and abundance of adult and juvenile snuffbox. Loss of preferred habitat within the Permit Area will result in the host fish species moving to upstream areas within the TBO and therefore limit future reproduction success of snuffbox within the Permit Area. The TBO, upstream of the Permit Area to the Beaverton Dam will be preserved, which provides approximately 4.3 miles of high-quality snuffbox habitat and host species habitat suitable for all life stages.

The estimated take of snuffbox mussel within the Permit Area is 84 individuals. This is based on a snuffbox mussel density of 0.0003/m^2 over a 280,082.9 m^2 (69.21 acres) area. This is the snuffbox density sampled during 2022 field surveys[12] compared to the area that is currently wetted within the Permit Area of Wixom Lake.

Project-based conservation measures and other AMMs will reduce impacts to mussels and mussel habitat, but the refilling of Wixom Lake to the normal (legal) lake level may render these areas unsuitable for snuffbox. See Sections below.

8.0 CONSERVATION STRATEGY

While an HCP provides a path forward for non-federal projects to receive incidental take authorization, the ultimate goal of an HCP is to fully offset the impacts of take on the covered species. To that end, the conservation strategy should define how that offset will be achieved, how progress toward that goal will be measured and tracked, and an adaptive management process that will be implemented in the case of changed circumstances or progress is not as expected.

Studies conducted over the last 3 years have identified a small population of snuffbox mussels within the Permit Area; there is also evidence of a small but reproducing population upstream of Wixom Lake within the TBO immediately upstream of the proposed Wixom Lake impoundment and downstream of the Beaverton Dam (i.e., the TBO portion of the Plan Area. These individuals have persisted, albeit at extremely low densities, despite the dewatering event related to the 2020 flood event. While FLTF is extremely limited in their ability to implement measures outside of the Wixom Lake normal (legal) lake level, there are strategies that may be employed to maintain and possibly improve the conditions which are necessary to support the small, but significant population of snuffbox in this reach. In addition, there is an opportunity to learn more about the species, its ecology, and the limiting factors of lacustrine habitat on the species and to assist with future conservation efforts.

Although snuffbox may be able to survive within the Permit Area, restoration of Wixom Lake to the normal (legal) lake level may result in take of snuffbox mussels where the lake refill activities lead to the destruction of habitat suitable for the species. Impounding the TBO would result in a change from a riverine to a more lacustrine system, where changes to the flow regime (primarily to a pool environment) which would result in changes to several abiotic factors, including the loss of established riffle bed forms within the existing channel and changes in sediment transport dynamics, primarily leading to increased sedimentation. The currently marginal habitat for snuffbox in the Permit Area will be further degraded due to this transition to an impounded environment. This shift to more homogeneous substrates will reduce habitat suitability for both snuffbox and their host fish species.

Under Section 10(a)(2)(B) of the ESA[10], HCP applicants are required to define and specify the steps that will be taken to avoid, minimize and mitigate impacts to the species for which an ITP is requested. It has been determined that impacts to snuffbox mussels from the refilling of Wixom Lake cannot be entirely avoided. As such, avoidance, minimization, and mitigation measures are required for covered activities within the Permit Area.

Opportunities for mitigation for snuffbox mussels within the Permit Area are few: logperch do not appear to be a limiting factor, and as such, developing a host fish stocking program is not a useful mitigation strategy to offset take of snuffbox mussels. Other limiting factors are those that FLTF cannot influence (i.e., availability of suitable habitat, sessile nature of the species); as such, FLTF may be limited in mitigation opportunities. One remaining possibility is for FLTF to collaborate with a mussel propagation lab to further fund work that increases dwindling mussel populations. However, these efforts would have challenges related to the taking of snuffbox mussels within the Permit Area. This population of snuffbox mussels is genetically different than other known populations of snuffbox mussels and is quite small in numbers. Thus, it would be difficult to propagate and transplant snuffbox mussels through traditional means, as introducing a genetically different population may further risk the existing population within the Permit Area. Due to the population's limited size, it would be difficult to collect and propagate local individuals without

further risking take of the species. Thus, propagation efforts would not necessarily be effective or apply to the impacted snuffbox population within the Plan Area.

As such, FLTF has developed a conservation strategy with a goal of maintaining or improving and sustaining the existing snuffbox mussel and freshwater mussel habitats within the TBO portion of the Plan Area and upper impoundment of Wixom Lake (i.e., the Permit Area). This strategy includes achievable biological goals and objectives; conservation measures (minimization and mitigation) that are intended to fully offset the impact of the proposed action's mussel take; and, monitoring requirements to determine the degree to which these measures are having an effect. A summary of the proposed minimization and mitigation measures is provided in Table 26 below; the measures are discussed in more detail in the following sections.

TABLE 26

Proposed Minimization and Mitigation Measures

Minimization Measures	
Maintain or Improve Water Quality	• Complete Water Quality Monitoring • Develop a Public Information Campaign • Develop a Lake Management Plan with Grant-Funded Opportunities • Avoid Impacts
Maintain or Improve Bank Stability and Bed Integrity	• Complete Bank Stability and Bed Integrity Monitoring • Develop a Public Information Campaign • Develop a Lake Management Plan with Grant-Funded Opportunities
Maintain or Improve Suitable Aquatic Habitat	• Develop a Public Information Campaign • Develop a Lake Management Plan with Grant-Funded Opportunities • Avoid Impacts
Maintain Hydrology	• Complete Water Level Monitoring • Construct and Operate Edenville Dam as run-of-the-river • Prescribed Water Elevation Changes
Develop a Lake Management Plan	• Use to Implement Mitigation Efforts
Mitigation Measures	
Provide $280,000 in Grant Funded Opportunities	• Maintain or Improve Water Quality • Maintain or Improve Bank Stability and Bed Integrity • Maintain or Improve Suitable In-Water Aquatic Habitat

8.1 BIOLOGICAL GOAL 1: MAINTAIN OR IMPROVE WATER QUALITY

Biological Goal 1: Ensure water quality parameters remain at levels that can maintain or improve the existing snuffbox mussel population and promote a healthy freshwater mussel community within the Plan Area.

Objective 1: Monitor water quality parameters such as temperature, dissolved oxygen, pH, conductivity, flow, total suspended solids, and nutrient concentrations within the Plan Area for the permit term.

Conservation Measure: FLTF will establish two water quality monitoring sites within the TBO Plan Area at the USGS Glidden Road gage and TT11. FLTF will establish two additional water quality

monitoring sites within the Permit Area at TT12 and the Dale Road bridge. These are the locations where healthy mussel communities are currently known to exist based on survey results.

From May to October for the first three years following the completion of the lake refill, water temperature and dissolved oxygen monitoring will be completed by the installation of continuous data loggers, such as HOBO U26 dissolved oxygen data logger or similarly capable equipment. The logger will be installed within approximately the center 1/3 portion of the channel cross-section, or an area with consistent and/or representative flow, and be set at a depth approximately equal to or less than the middle depth of the water column. Data loggers will take measurements hourly at a minimum and record data continuously from May to September of each year. This timeframe would allow for continuous operation of battery-operated loggers and would occur during months in which there would typically be limiting factors for snuffbox mussel populations, such as low dissolved oxygen concentrations or high water temperatures.

Maintenance and data download visits will be completed monthly during this three-year monitoring period to ensure proper function of the data loggers and ensure installation materials are not compromised or failing. During monthly visits, in situ (in the natural position) samples will be collected at each site to confirm accuracy of logger data and assess additional water quality parameters. In situ measurements to be collected include water temperature, dissolved oxygen (mg/L and percent saturation), pH, conductivity and turbidity. Additionally, the following parameters will be analyzed from water grab samples at each sampling site for analysis at an accredited laboratory: total phosphorus, dissolved ortho phosphorus, ammonia-nitrogen, nitrate-nitrogen, total Kjeldahl nitrogen and total suspended solids. Water samples shall be relinquished to an accredited laboratory for analysis under chain of custody.

Following the initial three-year baseline monitoring period, FLTF would monitor and obtain water quality data consistent with operation and maintenance of lake levels for the term of the permit. It is assumed that this would occur once annually following the refill of the Wixom Lake impoundment to the summer normal (legal) lake level. Water quality monitoring would occur between May and October.

Objective 2: Develop, provide, and promote an annual public information campaign focused on water quality BMPs that can be acted on by the general public and/or local governing bodies (municipalities, lake boards) aimed at maintaining or improving the existing snuffbox mussel population and promoting a healthy freshwater mussel community within the Plan Area for the term of the permit.

Conservation Measure: FLTF will establish a dedicated public outreach program that adheres to a strict implementation schedule. This program will provide outreach to the public who interact with the Plan Area and upstream watersheds. This includes outreach to the public who live on and in the vicinity of Wixom Lake, people who visit the area for recreational and tourism purposes, and local boards and municipalities that influence lake management activities and land or lake use decisions. This campaign would focus on the promotion of maintaining or improving water quality within the Wixom Lake and TBO watershed. Materials would include information on the importance of freshwater mussel communities and actions that the public can take to promote water quality and healthy lakes.

By April 1, 2028, FLTF would maintain and use their existing media outlets (e.g., Facebook, e-mail lists, mailing lists) to provide communications annually to the public for the term of the ITP. This would include outreach to local municipalities and lake boards to promote and influence policy related to conservation of water quality. Information would promote actions directly relatable to

the maintenance and/or improvement of water quality within the region. This would include information on BMPs related to fertilizer use; natural vegetation buffers; importance of aquatic and native vegetation; chemical and fuel containment; zebra mussel identification and reporting; stormwater management BMPs; proper disposal of common household contaminants, lawn clippings, and algicide treatments; citizens role in protecting and preserving water quality in the region; and, other related topics.

By April 1, 2028, FLTF will have partnered with willing and appropriate organizations, such as EGLE, NRCS, MDNR, and/or USFWS to develop an in-person event for the public who reside on or use Wixom Lake that promotes implementation of low impact development practices which have a primary purpose of improving water quality. FLTF will host at least one training event for interested public by year end 2029.

Objective 3: Develop a Lake Management Plan through partnerships with willing stakeholders that provides a process for applicants to receive up to $280,000 in FLTF funding to implement projects that focus on maintaining or improving water quality for the existing snuffbox mussel population and promote a healthy freshwater mussel community within the Plan Area according to the provided implementation schedule.

Conservation Measure: FLTF will work with willing stakeholders to develop a comprehensive Lake Management Plan that includes a dedicated chapter on the maintenance and improvement of the existing snuffbox mussel population and promotion of a healthy freshwater mussel community within the Plan Area.

FLTF will set aside $280,000 in grant funded project opportunities that provide an avenue for the public or organizations to fund and implement projects that meet the objective of this biological goal. This funding may be used to implement projects for one or more of the biological goals listed in this HCP, with a focus of the proposed projects to be those that would have a meaningful impact on maintaining or improving the existing snuffbox mussel population.

Opportunities that could maintain or improve water quality for snuffbox mussels include, but are not limited to, improvements to existing features that currently contribute pollutants and additional nutrients and sediment into the Plan Area. This may include upstream or direct drain, ditch, and waterway improvement projects that outfall into the TBO, improvements to landowner septic and wastewater systems that are improperly installed and treated, and/or programs that would provide and implement BMPs to reduce these inputs to the system, such as road maintenance activities (e.g., salting, sanding), storm sewer inlet cleaning, maintenance, and filtering, and providing proper storage of household or commercial chemicals for adjacent property owners who are located within the floodplain of the watershed.

FLTF will adhere to a strict implementation schedule for the development of the Lake Management Plan, release of funding for projects, and project implementation as follows:

- December 31, 2027: By this date, FLTF will have developed a draft Lake Management Plan. This draft plan will be comprehensive of several issues that may affect the existing snuffbox mussel population within the Plan Area, including maintenance and/or improvement of water quality for the species. This plan will also include components outlined in other biological goals of this HCP. During this draft development, stakeholder outreach (e.g., MDNR, EGLE, USFWS, USDA) will be completed to gauge interest in forming a working group or review process designed to support the plan's development. Upon completion of the draft, the plan

would be provided to willing stakeholders for review and input. This plan will outline a process that would allow applicants/stakeholders to apply for and receive funds to conduct water quality improvements in the watershed that could affect the existing snuffbox mussel community.

- December 31, 2028: By this date, FLTF will have finalized the Lake Management Plan. This plan would incorporate feedback from identified stakeholders. The final plan and grant funding application opportunities would be published to the FLTF's website and coordinated through their existing media outlets (e.g., Facebook, e-mail lists, mailing lists, agency partnerships). FLTF would target parties who will have the ability and know-how to implement projects that would contribute to maintaining or improving water quality.

- 2029: During the 2029 calendar year, FLTF would solicit project funding opportunities. This would include working with identified stakeholders to consider proposals for grant funding and selecting opportunities that best meet the goals of the Lake Management Plan.

- December 31, 2030: By this date, a goal of at least $140,000 of grant-funded projects would be awarded to applicants. If sufficient applications totaling or exceeding the set aside value of $280,000 have not been obtained by this date, additional solicitations for grant funding opportunities would be solicited in subsequent years.

- December 31, 2035: By this date, all $280,000 of grant-funded projects would be awarded to applicants. At least $140,000 in projects would have been implemented or be in the process of being implemented.

  At this time, all remaining grant funds that have not been awarded to applicants for applicable projects will be tallied. These remaining funds would be used to support alternative mitigation. Alternative mitigation would be coordinated with the USFWS by December 31, 2036. Offsite alternative mitigation would be implemented within 6 months of coordination with the USFWS. Alternative mitigation would consist of offsite mitigation depending on available opportunities within Michigan or the United States. This alternative mitigation would provide funding to projects that would contribute to recovery actions and conservation efforts for snuffbox mussels. Additional information on this approach is provided under Section 9 of this HCP.

- December 31, 2040: By this date, all $280,000 in grant funded projects will have been implemented or be in the process of being implemented.

Objective 4: Avoid impacting water quality in areas containing the known snuffbox mussel population and healthy mussel communities within the Plan Area during physical construction activities associated with Edenville Dam for the term of the permit.

Conservation Measure: Work within the known snuffbox mussel population and healthy mussel community areas will be avoided by the physical construction of the Edenville Dam. As such, water quality within these areas will not be impacted by physical construction of the Edenville Dam. All construction will be limited to the Edenville Dam Property and the area located immediately adjacent within the bottomlands of Wixom Lake. The location of physical construction

activities has been informed by the freshwater mussel surveys completed for the Project. As such, construction has been designed to avoid all areas where snuffbox mussels, as well as native freshwater mussel populations, are known to occur at the present time. This includes avoidance of the TBO Plan Area and the upper Wixom Lake impoundment (i.e., Permit Area).

The following conditions are anticipated to be required as a part of the EGLE permit obtained for the rebuilding of the Edenville Dam structure. Implementation of these conditions will further ensure that all activities associated with construction, except for the proposed action (lake refill), avoid impacts on snuffbox mussels and freshwater native mussel communities.

FLTF will implement SESC BMPs where necessary during the physical construction of Edenville Dam. In doing so, unnatural erosion and sedimentation will be limited within Wixom Lake.

- If the Project, or any portion of the Project, is stopped and lies incomplete for any length of time other than that encountered during a normal work week, every precaution will be taken to protect the incomplete work from erosion.

- No work shall be done in the stream during periods of above-normal flows except as necessary to prevent erosion.

- Prior to the initiation of any permitted construction activities, SESC BMPs shall be installed downgradient of the construction site. Except as permitted by EGLE, all excavated or dredged spoils will be stored in an upland area and stabilized. All slurry from dewatering activities would be discharged through a filter bag or pumped to a sump located away from wetlands and surface waters.

FLTF will implement the following BMPs to further promote a healthy environment and lake ecosystem.

- All equipment to be used shall be pressure washed or steam cleaned prior to use for in-water work to help prevent the spread of invasive species.

- Prior to commencing work activities, and following the completion of any work activities, personnel shall remove any mud and plants from footwear, field equipment, and vehicles, to be disposed of properly as a preventative measure to reduce the spread of invasive species.

- All water shall be drained from vehicles and equipment prior to leaving an area of in-water work activities to help prevent the spread of invasive species.

- Immediately prior to any activity, the contractor shall evaluate all vehicular equipment for gas or oil leaks and/or other defects and shall rectify any leaks or defects identified prior to their use.

- Any area of disturbed ground shall be reseeded with native vegetation, including pollinator-dependent species.

- Any temporary fills or equipment necessary to complete activities shall be of clean inert material that would not cause siltation nor contain soluble chemicals, organic matter, pollutants, or contaminants.

At any time during the physical construction of Edenville Dam should the activities result in potential impacts beyond the proposed and permitted construction limits, work activities would be halted and further coordination with EGLE, MDNR, and USFWS would occur prior to work resuming. This could include unforeseen impacts on adjacent waters and wetlands, the upstream reaches of the Wixom Lake impoundment (i.e., Permit Area) or TBO Plan Area, the public trust, or other natural resources of the state.

8.2 BIOLOGICAL GOAL 2: MAINTAIN OR IMPROVE BANK STABILITY AND BED INTEGRITY

Biological Goal 2: Ensure bank erosion and bed integrity remain at levels that can maintain or improve the existing snuffbox mussel population and promote a healthy freshwater mussel community within the Plan Area.

Objective 1: Monitor bank stability and bed integrity throughout the nearshore areas of the Plan Area to provide data related to bank height, vegetated condition, bank angle, root density, and bank material as they relate to erosion and sedimentation that could affect waters and their suitability for snuffbox mussels and freshwater mussel populations. These measures would occur in the spring of every year following the refill of Wixom Lake for the permit term.

Conservation Measure: FLTF will assess the nearshore areas on foot or by small watercraft and within the Plan Area. Bank erosion hazard index (BEHI) assessments would be completed at a minimum of four locations where the most severe bank erosion is identified within the TBO Plan Area and the upper Wixom Lake impoundment (i.e. Permit Area).

The BEHI assessment is a multi-metric approach that integrates information about bank height, bank angles, vegetation characteristics, and bank materials to estimate a numeric rating of the risk of bank erosion.[88] While not initially developed to be a monitoring assessment tool, it has been adapted for monitoring purposes to document bank characteristics. The established method of calculating BEHI provides a repeatable method to assess the overall bank stability rating and documents the metrics of the assessment. Changes in BEHI score from year to year can be compared to confirm bank stability or identify potential sources of instability. Lack of bank stability could have effects on bed integrity.

Objective 2: Develop, provide, and promote an annual public information campaign focused on bank stability and bed integrity BMPs that can be acted on by the general public and/or local governing bodies (municipalities, lake boards) aimed at maintaining or improving the existing snuffbox mussel population and promoting a healthy freshwater mussel community within the Plan Area for the term of the permit.

Conservation Measure: FLTF will establish a dedicated public outreach program that adheres to a strict implementation schedule. This program will provide outreach to the public who interact with the Plan Area and upstream watersheds. This includes outreach to the public who live on and in the vicinity of Wixom Lake, people who visit the area for recreational and tourism purposes, and local boards and municipalities that influence lake management activities and land or lake use decisions. This campaign would focus on the importance of maintaining or improving bank stability and bed integrity within the Plan Area. Materials would include information on the

[88] Rosgen, 2001

importance of freshwater mussel communities and actions that the public can take to promote bank stability and bed integrity within the watershed.

By April 1, 2028, FLTF would maintain and use their existing media outlets (e.g., Facebook, e-mail lists, mailing lists) to provide annual communications to the public for the term of the ITP. This would include outreach to local municipalities and lake boards to promote and influence policy related to bank stability and bed integrity conservation. Information would promote actions directly relatable to the maintenance or improvement of bank stability and bed integrity of the water resources in the area. This would include information on BMPs related to natural vegetation buffers, importance of aquatic and native vegetation, boating wave action, anchoring or mooring on the bed of waters in areas colonized by mussels, stormwater management BMPs, citizens' roles in protecting and preserving bank stability and bed integrity in the region, and other related topics.

By April 1, 2028, FLTF will have partnered with appropriate organizations, such as the Michigan Natural Shoreline Partnership, and appropriate agencies, such as EGLE, NRCS, MDNR, and/or USFWS to develop an in-person event for the public who reside on or use Wixom Lake that promotes implementation of low impact development practices that have a primary purpose of improving bank stability. FLTF will host at least one natural shoreline training event for interested public by year-end 2029.

Objective 3: Develop a Lake Management Plan through partnerships with willing stakeholders that provides a process for applicants to receive up to $280,000 in FLTF funding to implement projects that focus on maintaining or improving bank stability and bed integrity in areas where the known snuffbox mussel population and healthy freshwater mussel communities exist within the Plan Area according to the provided implementation schedule.

Conservation Measure: FLTF will work with willing stakeholders to develop a comprehensive Lake Management Plan that includes a dedicated chapter on the maintenance and improvement of the existing snuffbox mussel population and promotion of a healthy freshwater mussel community within the Plan Area.

FLTF will set aside $280,000 in grant funded project opportunities that provide an avenue for the public or organizations to fund and implement projects that meet the objective of this biological goal. This funding may be used to implement projects for one or more of the biological goals listed in this HCP, with a focus of the proposed projects to be those that would have a meaningful impact on maintaining or improving the existing snuffbox mussel population.

Opportunities that could maintain or improve bank stability and bed integrity for snuffbox mussels include, but are not limited to, natural shoreline stabilization projects, implementation of soft shoreline projects, or installation of native buffer strip plantings between adjacent development and aquatic or wetland habitats.

FLTF will adhere to a strict implementation schedule for the development of the Lake Management Plan, release of funding for projects, and project implementation as follows:

- December 31, 2027: By this date, FLTF will have developed a draft Lake Management Plan. This draft plan will be comprehensive of several issues that may affect the existing snuffbox mussel population with the Plan Area, including maintenance and/or improvement of bank stability and bed integrity that are integral requirements for the species. This plan will also include components

outlined in other biological goals of this HCP. During this draft development, stakeholder outreach (e.g., MDNR, EGLE, USFWS, USDA) will be completed to gauge interest in forming a working group or review process designed to support the plan's development. Upon completion of the draft, the plan would be provided to willing stakeholders for review and input. This plan will outline a process that would allow applicants/stakeholders to apply for and receive funds to conduct bank stability and bed integrity improvements in the watershed that could affect the existing snuffbox mussel community.

- December 31, 2028: By this date, FLTF will have finalized the Lake Management Plan. This plan would incorporate feedback from identified stakeholders. The final plan and grant funding application opportunities would be published to FLTF's website and coordinated through their existing media outlets (e.g., Facebook, e-mail lists, mailing lists, agency partnerships). FLTF would target parties who will have the ability and know-how to implement projects that would contribute to maintaining or improving streambank stability and streambed integrity.

- 2029: During the 2029 calendar year, FLTF would solicit projects for these funding opportunities. This would include working with identified stakeholders to consider proposals for grant funding and select opportunities that best meet the goals of the Lake Management Plan.

- December 31, 2030: By this date, a goal of at least $140,000 of grant-funded projects would be awarded to applicants. If sufficient applications totaling or exceeding the set aside value of $280,000 have not been obtained by this date, additional solicitations for grant funding opportunities would be solicited in subsequent years.

- December 31, 2035: By this date, all $280,000 of grant-funded projects would be awarded to applicants. At least $140,000 in projects would have been implemented or be in the process of being implemented.

  At this time, all remaining grant funds which have not been awarded to applicants for applicable projects will be tallied. These remaining funds would be used to support alternative mitigation. Alternative mitigation would be coordinated with the USFWS by December 31, 2036. Offsite alternative mitigation would be implemented within 6 months of coordination with the USFWS. Alternative mitigation would consist of offsite mitigation depending on available opportunities within Michigan or the United States. This alternative mitigation would provide funding to projects that would contribute to recovery actions and conservation efforts for snuffbox mussels. Additional information on this approach is provided under Section 9 of this HCP.

- December 31, 2040: By this date, all $280,000 in grant funded projects will have been implemented or be in the process of being implemented.

Objective 4: Avoid impacts to the banks and bed of areas containing the known snuffbox mussel population and healthy mussel communities within the Plan Area during physical construction activities associated with Edenville Dam for the term of the permit.

Conservation Measure: Work within the known snuffbox mussel population and healthy mussel community areas will be avoided by the physical construction of the Edenville Dam. As such, banks and beds of the aquatic ecosystems where these mussel populations currently reside will not be impacted by physical construction of the Edenville Dam. All construction will be limited to the Edenville Dam Property and the area located immediately adjacent to the bottomlands of Wixom Lake. The location of physical construction activities has been informed by the freshwater mussel surveys completed for the Project. As such, construction has been designed to avoid all areas where snuffbox and native freshwater mussel populations are known to occur at the present time. This includes avoidance of the TBO Plan Area and the upper Wixom Lake impoundment (i.e., Permit Area).

The following conditions are anticipated to be required as a part of the EGLE permit obtained for the rebuilding of the Edenville Dam structure. Implementation of these conditions will further ensure that all activities associated with construction, except for the proposed action (lake refill), avoid impacts on snuffbox mussels and freshwater native mussel communities.

FLTF will implement SESC BMPs where necessary during the physical construction of Edenville Dam. In doing so, unnatural erosion and sedimentation will be limited within Wixom Lake.

- If the Project, or any portion of the Project, is stopped and remains incomplete for any length of time other than that encountered during a normal work week, every precaution will be taken to protect the incomplete work from erosion.

- No work shall be done in the stream during periods of above-normal flows except as necessary to prevent erosion.

- Prior to the initiation of any permitted construction activities, SESC BMPs shall be installed downgradient of the construction site. Except as permitted by EGLE, all excavated or dredged spoils will be stored in an upland area and stabilized. All slurry from dewatering activities would be discharged through a filter bag or pumped to a sump located away from wetlands and surface waters.

FLTF will implement the following BMPs to further promote a healthy environment and lake ecosystem.

- All equipment to be used shall be pressure washed or steam cleaned prior to use for in-water work to help prevent the spread of invasive species.

- Prior to commencing work activities, and following the completion of any work activities, personnel shall remove any mud and plants from footwear, field equipment, and vehicles, to be disposed of properly as a preventative measure to reduce the spread of invasive species.

- All water shall be drained from vehicles and equipment prior to leaving an area of in-water work activities to help prevent the spread of invasive species.

- Immediately prior to any activity, the contractor shall evaluate all vehicular equipment for gas or oil leaks and/or other defects and shall rectify any leaks or defects identified prior to their use.

- Any area of disturbed ground shall be reseeded with native vegetation, including pollinator-dependent species.

- Any temporary fills or equipment necessary to complete activities shall be of clean inert material that would not cause siltation nor contain soluble chemicals, organic matter, pollutants, or contaminants.

At any time during the physical construction of Edenville Dam should the activities result in potential impacts beyond the proposed and permitted construction limits, work activities would be halted and further coordination with EGLE, MDNR, and USFWS would occur prior to work resuming. This could include unforeseen impacts on adjacent waters and wetlands, the upstream reaches of the Wixom Lake impoundment (i.e., Permit Area) or TBO Plan Area, the public trust, or other natural resources of the state.

8.3 BIOLOGICAL GOAL 3: MAINTAIN OR IMPROVE SUITABLE AQUATIC HABITAT

Biological Goal 3: Ensure the preservation of the aquatic conditions necessary for maintaining and/or improving existing habitat for the extant snuffbox mussel population, and which will promote a healthy freshwater mussel community within the Plan Area.

Objective 1: Develop, provide, and promote an annual public information campaign focused on preservation of suitable aquatic habitat that can be acted on by the general public and/or local governing bodies (municipalities, lake boards) aimed at maintaining or improving the existing habitat for the extant snuffbox mussel population and promoting a healthy freshwater mussel community within the Plan Area for the term of the permit.

Conservation Measure: FLTF will establish a dedicated public outreach program that adheres to a strict implementation schedule. This program will provide outreach to the public who interact with the Plan Area and upstream watersheds. This includes outreach to the public who live on and in the vicinity of Wixom Lake, people who visit the area for recreational and tourism purposes, and local boards and municipalities that influence lake management activities and land or lake use decisions. This campaign would focus on the importance of maintaining or improving suitable aquatic habitat within the Plan Area. Materials would include information on the importance of freshwater mussel communities and actions that the public can take to promote suitable aquatic habitat within the watershed.

By April 1, 2028, FLTF would maintain and use their existing media outlets (e.g., Facebook, e-mail lists, mailing lists) to provide annual communications to the public for the term of the ITP. This would include outreach to local municipalities and lake boards to promote and influence policy related to preservation of suitable aquatic habitat. Information would promote actions directly relatable to the maintenance or improvement of suitable aquatic habitat in the area. This would include information on BMPs related to preservation of aquatic vegetation, importance of aquatic and native vegetation, boating wave action and its potential to dislodge or damage aquatic plant life, anchoring or mooring on the bed of waters in areas colonized by aquatic vegetation, citizens role in protecting and preserving aquatic vegetation in the region, and other related topics.

By April 1, 2028, FLTF will have partnered with appropriate organizations, such as the Michigan Natural Shoreline Partnership, and appropriate agencies, such as EGLE, NRCS, MDNR, and/or USFWS to develop an in-person event for the public who reside on or use Wixom Lake that promotes implementation of low impact development practices that have a primary purpose of maintaining or improving suitable aquatic vegetation for freshwater mussels. FLTF will host at

least one training event highlighting the importance of natural shoreline protection for the community by year-end 2029.

Objective 2: Develop a Lake Management Plan through partnerships with willing stakeholders that provides a process for applicants to receive up to $280,000 in FLTF funding to implement projects that focus on maintaining or improving suitable aquatic habitat for the existing snuffbox mussel population and promote a healthy freshwater mussel community within the Plan Area according to the provided implementation schedule.

Conservation Measure: FLTF will work with willing stakeholders to develop a comprehensive Lake Management Plan that includes a dedicated chapter on the maintenance and improvement of the existing snuffbox mussel population and promotion of a healthy freshwater mussel community within the Plan Area.

FLTF will set aside $280,000 in grant funded project opportunities that provide an avenue for the public or organizations to fund and implement projects that meet the objective of this biological goal. This funding may be used to implement projects for one or more of the biological goals listed in this HCP, with a focus of the proposed projects to be those that would have a meaningful impact on maintaining or improving the existing snuffbox mussel population.

Opportunities that could maintain or improve in-water suitable aquatic habitat for snuffbox mussels include, but are not limited to, the conservation and/or augmentation of existing habitat areas with plantings of eel grass (*Vallisneria* spp.), early detection and implementation of BMPs (i.e., washing stations, provision of disinfecting materials, public education) to limit the spread of zebra mussels, and identification of mussel-safe alternatives for historic aquatic nuisance plant and zebra mussel control programs.

FLTF will adhere to a strict implementation schedule for the development of the Lake Management Plan, release of funding for projects, and project implementation as follows:

- December 31, 2027: By this date, FLTF will have developed a draft Lake Management Plan. This draft plan will be comprehensive of several issues that may affect the existing snuffbox mussel population with the Plan Area, including maintenance and/or improvement of suitable aquatic habitat for the species. This plan will also include components outlined in other biological goals of this HCP. During this draft development, stakeholder outreach (e.g., MDNR, EGLE, USFWS, USDA) will be completed to gauge interest in forming a working group or review process designed to support the plan's development. Upon completion of the draft, the plan would be provided to willing stakeholders for review and input. This plan will outline a process that would allow applicants/stakeholders to apply for and receive funds to conduct suitable aquatic habitat improvements within the watershed that could affect the existing snuffbox mussel community.

- December 31, 2028: By this date, FLTF will have finalized the Lake Management Plan. This plan would incorporate feedback from identified stakeholders. The final plan and grant funding application opportunities would be published to the FLTF's website and coordinated through their existing media outlets (e.g., Facebook, e-mail lists, mailing lists, agency partnerships). FLTF would target parties that will have the ability and know-how to implement projects that maintain or improve suitable aquatic habitat for the extant snuffbox mussel population and the freshwater mussel community in general.

- 2029: During the 2029 calendar year, FLTF would solicit project funding opportunities. This would include working with identified stakeholders to consider proposals for grant funding and select opportunities that best meet the goals of the Lake Management Plan.

- December 31, 2030: By this date, a goal of at least $140,000 of grant-funded projects would be awarded to applicants. If sufficient applications totaling or exceeding the set aside value of $280,000 have not been obtained by this date, additional solicitations for grant funding opportunities would be solicited in subsequent years.

- December 31, 2035: By this date, all $280,000 of grant-funded projects would be awarded to applicants. At least $140,000 in projects would have been implemented or be in the process of being implemented.

  At this time, all remaining grant funds that have not been awarded to applicants for applicable projects will be tallied. These remaining funds would be used to support alternative mitigation. Alternative mitigation would be coordinated with the USFWS by December 31, 2036. Offsite alternative mitigation would be implemented within 6 months of coordination with the USFWS. Alternative mitigation would consist of offsite mitigation depending on available opportunities within Michigan or the United States. This alternative mitigation would provide funding to projects that would contribute to recovery actions and conservation efforts for snuffbox mussels. Additional information on this approach is provided under Section 9 of this HCP.

- December 31, 2040: By this date, all $280,000 in grant funded projects will have been implemented or be in the process of being implemented.

Objective 3: Avoid impacts to suitable aquatic habitat in areas containing the known snuffbox mussel population and healthy mussel communities within the Plan Area during physical construction activities associated with Edenville Dam for the term of the permit.

Conservation Measure: Work within the known snuffbox mussel population and healthy mussel community areas will be avoided by the physical construction of the Edenville Dam. As such, suitable aquatic habitat where these mussel populations currently reside will not be impacted by physical construction of the Edenville Dam. All construction will be limited to the Edenville Dam Property and the area located immediately adjacent within the bottomlands of Wixom Lake. The location of physical construction activities has been informed by the freshwater mussel surveys completed for the Project. As such, construction has been designed to avoid all areas where snuffbox mussels, as well as native freshwater mussel populations, are known to occur at the present time. This includes avoidance of the TBO Plan Area and the upper Wixom Lake impoundment (i.e., Permit Area).

The following conditions are anticipated to be required as a part of the EGLE permit obtained for the rebuilding of the Edenville Dam structure. Implementation of these conditions will further ensure that all activities associated with construction, except for the proposed action (lake refill), avoid impacts on snuffbox mussels and freshwater native mussel communities.

FLTF will implement SESC BMPs where necessary during the physical construction of Edenville Dam. In doing so, unnatural erosion and sedimentation will be limited within Wixom Lake.

- If the Project, or any portion of the Project, is stopped and lies incomplete for any length of time other than that encountered during a normal work week, every precaution will be taken to protect the incomplete work from erosion.

- No work shall be done in the stream during periods of above-normal flows except as necessary to prevent erosion.

- Prior to the initiation of any permitted construction activities, SESC BMPs shall be installed downgradient of the construction site. Except as permitted by EGLE, all excavated or dredged spoils will be stored in an upland area and stabilized. All slurry from dewatering activities would be discharged through a filter bag or pumped to a sump located away from wetlands and surface waters.

FLTF will implement the following BMPs to further promote a healthy environment and lake ecosystem.

- All equipment to be used shall be pressure washed or steam cleaned prior to use for in-water work to help prevent the spread of invasive species.

- Prior to commencing work activities, and following the completion of any work activities, personnel shall remove any mud and plants from footwear, field equipment, and vehicles, to be disposed of properly as a preventative measure to reduce the spread of invasive species.

- All water shall be drained from vehicles and equipment prior to leaving an area of in-water work activities to help prevent the spread of invasive species.

- Immediately prior to any activity, the contractor shall evaluate all vehicular equipment for gas or oil leaks and/or other defects and shall rectify any leaks or defects identified prior to their use.

- Any area of disturbed ground shall be reseeded with native vegetation, including pollinator-dependent species.

- Any temporary fills or equipment necessary to complete activities shall be of clean inert material that would not cause siltation nor contain soluble chemicals, organic matter, pollutants, or contaminants.

At any time during the physical construction of Edenville Dam should the activities result in potential impacts beyond the proposed and permitted construction limits, work activities would be halted and further coordination with EGLE, MDNR, and USFWS would occur prior to work resuming. This could include unforeseen impacts on adjacent waters and wetlands, the upstream reaches of the Wixom Lake impoundment (i.e., Permit Area) or TBO Plan Area, the public trust, or other natural resources of the state.

8.4 BIOLOGICAL GOAL 4: MAINTAIN HYDROLOGY

Biological Goal 4: Ensure water levels and their rate of change remain within prescribed parameters that would maintain necessary hydrology within Wixom Lake for snuffbox mussels and healthy freshwater mussel communities. Monitor TBO water levels upstream of Wixom Lake's

influence to assist in early detection of potential risk (due to lack of hydrology) to the known existing snuffbox mussel population.

Objective 1: FLTF would install and maintain or would fund and contract USGS to install and maintain, one new water level gage at the Dale Road intersection of the Permit Area. Monitor water levels at this new location and the existing USGS gage at Glidden Road (located on the TBO) on a weekly basis following the refill of Wixom Lake to the legal lake level for the term of the permit.

Conservation Measure: The USGS gage at Glidden Road currently measures water level (actual elevation) and discharge rates in real time and is available online through their website. FLTF would install and maintain, or would fund and contract USGS to install and maintain, a similar water level gage at the upstream intersection of Dale Road and the Wixom Lake impoundment within the Permit Area. These two gage locations will allow FLTF to monitor water levels on a weekly basis at both the TBO Plan Area and the Permit Area.

Maintenance and improvement of hydrology within lands under FLTF's ownership and the Edenville Dam's influence is possible. FLTF will ensure hydrology is maintained within the Permit Area throughout construction, post-construction, and ongoing dam maintenance and operation efforts for the life of the ITP. The Edenville Dam will be operated as a run-of-the-river facility where the lake levels are maintained as a prioritization to passing of downstream flows. The FLTF is required to maintain the normal (legal) lake levels as defined by Court Order and Part 307. Therefore, fluctuations in water elevation will not occur as they did historically, thus minimizing the effect on the wetted surface of the Permit Area. Water level monitoring will ensure that these conditions are being met and that hydrology is maintained for snuffbox mussel and other freshwater mussel populations within the Permit Area.

The normal (legal) lake level Court Order allows for a maximum change in normal (legal) lake levels within a 24-hour period to be a maximum of 0.7 feet. This may have historically been a part of normal operations of the Edenville Dam when it was used for electrical power generation. FLTF operations of the Edenville Dam proposes to further minimize effects on snuffbox mussel by choosing to not store additional water in Wixom Lake; therefore, the lake levels will not fluctuate throughout the year as they did when the dams previously produced power. The Edenville Dam is being designed such that when the LLO reaches maximum discharge, the spillway crest gates will open. When the crest gates are at maximum discharge, the auxiliary spillway will be used. This auxiliary spillway is designed for a 5,000-year flood event; therefore, as designed, the water levels will not exceed the normal (legal) lake level unless there is a greater-than-5000-year rainfall event that leads to catastrophic flooding of the region.

The TBO Plan Area is located between the upper limit of the Wixom Lake impoundment and Beaverton Dam upstream. This area is critical as it contains the existing snuffbox mussel population. Water levels within this area are directly influenced by Beaverton Dam's operations. Monitoring of water levels within this location will occur, however FLTF has no influence over this dam's activities. The Beaverton Dam is not owned or operated by FLTF. Operations to release or hold back water are purely the purview of the current owner. As such, any actions on the part of Beaverton Dam that could impact the hydrology within the TBO Plan Area may have impacts that can't be strictly foretold or planned for. However, information collected from this monitoring effort may inform decisions by the Beaverton Dam owner and regulating agencies.

Objective 2: Construct the Edenville Dam to a 5,000-year flood standard and operate the dam as run-of-the-river to maintain hydrology of the Permit Area and promote healthy mussel communities for the term of the permit.

Conservation Measure: The Edenville Dam will be operated as a run-of-the-river facility where the lake levels are maintained as a prioritization to passing of downstream flows. FLTF is required to maintain the normal (legal) lake levels as defined by Court Order and Part 307. Therefore, fluctuations in water elevation will not occur as they did with historical Edenville Dam operations, thus minimizing the effect on the wetted surface of the Permit Area. There is no foreseeable scenario where water levels would fluctuate beyond the legally established lake levels, thus maintaining suitable wetted area for snuffbox mussels.

The normal (legal) lake level Court Order allows for a maximum change in normal (legal) lake levels within a 24-hour period to be a maximum of 0.7 feet. This may have historically been a part of normal operations of the Edenville Dam when it was used for electrical power generation. FLTF operations of the Edenville Dam proposes to further minimize effects on snuffbox mussel by choosing to not store additional water in Wixom Lake; therefore, the lake levels will not have these minor fluctuations throughout the year as they did when the dams previously produced power. The Edenville Dam is being designed such that when the LLO reaches maximum discharge, the spillway crest gates will open. When the crest gates are at maximum discharge, the auxiliary spillway will be used. This auxiliary spillway is designed for a 5,000-year flood event, therefore, as designed, the water levels will not exceed the normal (legal) lake level unless there is a greater-than-5000-year rainfall event that leads to catastrophic flooding of the region. Downstream of the dam, the rivers will be a natural flow, with minimum outputs being maintained and outflows equaling inflows during normal conditions. Operating as run-of-the-river will have less negative impact on the shoreline due to decreased fluctuations of water levels than historical operations.

Objective 3: Conduct court-ordered normal (legal) lake level winter drawdowns and summer refills within prescribed parameters to limit the water level rate of change and to provide a set minimum elevation that is suitable for maintaining healthy freshwater mussel communities for the term of the permit.

Conservation Measure: Prescribed refill and drawdown activities, including the initial refill of Wixom Lake, will be conducted at a controlled rate to allow for the monitoring of the constructed Edenville Dam structures and to evaluate its effects on shoreline erosion that could lead to a decrease in water quality and shoreline stability of the Permit Area. In the event adverse impacts in water quality and/or shoreline stability are observed, the reservoir refilling will be stopped, reversed as needed, or detrimental effects to the shoreline of the Plan Area will be mitigated. The refill will be monitored closely by both FLTF and EGLE staff.

The refilling of Wixom Lake to its normal (legal) lake level will impact the habitat currently present in the Permit Area. This area is currently characterized by very lotic and diverse substrates, gradually sloping shorelines lined with vegetation, and lack eroded channelized vertical banks created when water retreated following the scouring caused by the flood event that resulted in the draining of the impoundment. This is unlike other areas of Wixom Lake downstream of the Permit Area.

FLTF, as a part of EGLE permit conditions, will develop a final refill plan. This plan must be in place prior to refill operations as a condition of other required permits and will be developed to govern the process. This plan can be modified to accommodate environmental needs such as

potential impact on snuffbox mussels and the Permit Area. Wixom Lake will be filled at a maximum of 1 foot per day or as flows allow. Minimum flow will be maintained through the LLOs during refilling. Care will be taken to monitor the weather forecasts regularly and compared to the publicly available rainfall depth-duration curves and peak discharge values estimated for the basins using the NOAA Atlas 14 precipitation frequency tool online[68] and the EGLE Flood Discharge Database.[69]

FLTF will conduct routine maintenance inspections and repairs of Edenville Dam. These inspections and repairs would be conducted during the impoundment's drawdown to the winter normal (legal) lake level, foregoing the need to drawdown the lake outside of its prescribed winter and summer normal (legal) lake level cycle. During the winter normal (legal) lake level drawdowns, FLTF proposes to conduct routine dam maintenance inspections on a 3-year cycle. The purpose of these inspections is to identify required maintenance and repairs. These inspections are completed via visual observations and use of a dive team to evaluate conditions below the water's surface. All inspections would occur within the permitted normal (legal) lake levels.

Maintenance activities may be identified that would require work on portions of the Edenville Dam spillways that control the normal (legal) lake level. To ensure lake level changes do not occur during these maintenance activities, FLTF has designed the Edenville Dam reconstruction to incorporate a stop log system so that a stop log can be placed to maintain the normal (legal) lake level during repairs. This stop log system will be in place for potential maintenance of both the proposed crest gates and LLO.

Maintenance activities may be identified that would require work on portions of the Edenville Dam embankment. To ensure lake level changes do not occur during embankment maintenance activities, FLTF has designed the reconstruction of the Edenville Dam to contain a newly installed cutoff wall through the center of the embankment. This cutoff wall would prevent the lowering of the normal (legal) lake level while work is performed on the embankment. An isolated cofferdam may be installed at the localized repair area to allow for dry working conditions along the embankment.

FLTF does not plan, in the foreseeable future, to ever drop Wixom Lake's water elevation below the defined normal (legal) lake level elevations. Routine operations and maintenance of the Edenville Dam will continue to maintain the established summer and winter normal (legal) lake levels. The reconstruction of the Edenville Dam has been designed, as such, to avoid the need for a future emergency drawdown of Wixom Lake. In the unanticipated and unfortunate event that a dam failure was to occur or an imminent failure was to take place, FLTF would lower the elevations of Wixom Lake to a level ordered by EGLE's Dam Safety Program. At this point, the elevation of Wixom Lake could be lowered to the top elevation of the dam's LLO structure (649 feet); if this is necessary, it is anticipated that this HCP would require modification to address the changes these actions would cause in the Permit and Plan Areas.

9.0 MONITORING AND ADAPTIVE MANAGEMENT

Monitoring and reporting are mandatory elements of all HCPs. Monitoring provides the USFWS within the information needed to determine whether or not FLTF is in compliance with their incidental take permit and HCP, progress is being made towards achieving the HCP's biological goals and objectives, that the HCP's conservation program is effective at minimizing and/or mitigating impacts, and if there is a need for adjusting measures to improve the HCP's conservation strategy. Monitoring requirements, as discussed within the subsections below, are an integral component of the HCP's conservation strategy.

9.1 BASELINE MONITORING

As discussed within Section 4, Environmental Setting, several baseline studies have been completed within the Plan Area. This includes studies relevant to the conservation strategy of this HCP including information on water quality, bank stability and substrate, hydrology, and review of past reporting on Edenville Dam and Wixom Lake's operations. Additionally, mussel surveys were completed throughout the Plan Area to quantify the current distribution, diversity, and species richness of current freshwater mussel communities.

This information is directly relevant to the conservation strategy for snuffbox mussels and healthy freshwater mussel communities within the Plan Area. It may be used to compare, analyze, and discuss the results of biological effectiveness monitoring and to inform adaptive management strategies.

9.2 BIOLOGICAL EFFECTIVENESS MONITORING

Biological effectiveness monitoring is conducted to determine if the avoidance, minimization, and mitigation measures defined in the conservation program are functioning such that they are meeting the Biological Goals and Objectives of this HCP. This monitoring, to be enacted during and following the proposed action for the term of the permit, would be compared to baseline and year-over-year results to analyze and discuss the success of conservation measures and to inform adaptive management strategies. Monitoring would be completed in order to provide the data necessary to inform the compliance of the terms and conditions of the ITP. All data shall be summarized and provided in a yearly report, due January 31 of the following year, to the USFWS for the term of the ITP.

FLTF will monitor the progress of the biological goals and objectives discussed in Section 8 in the following ways. In the event that the hypothesized result of the monitoring does not support the biological goal (i.e., water quality decreases), monitoring data will be used to inform adaptive management approaches for the conservation program which are further discussed in a subsequent section.

Biological Goal 1: Ensure water quality parameters remain at levels that can maintain or improve the existing snuffbox mussel population and promote a healthy freshwater mussel community within the Plan Area.

Objective 1: Monitor and obtain baseline data for water quality parameters such as temperature, dissolved oxygen, pH, conductivity, flow, total suspended solids, and nutrient concentrations within the Plan Area from May to October for three years following the completion of the lake refill. Following this initial baseline monitoring period, monitor and obtain water quality data consistent with operation and maintenance of lake levels for the term of the permit.

Monitoring Goals: FLTF will conduct water quality monitoring from May to October for three years following the completion of the lake refill. Following this initial baseline monitoring period, FLTF would monitor and obtain water quality data consistent with operation and maintenance of lake levels for the term of the permit. Water quality data will be reviewed following each measurement collection effort to identify trends in water quality conditions between the year-over-year and baseline conditions since sampling was initiated. Water quality metrics will be assessed for potential effects on the survivability and maintenance of snuffbox mussels and the potential for the collected parameters to improve/enhance the existing snuffbox population in the Permit Area. Water quality data will also be compared between the TBO Plan Area and Permit Area sampling sites to evaluate the suitability of water quality parameters within a riverine system versus that of the transitional area of the impounded lake system. Water quality improvements may be the result of implementation of any of the objectives of Biological Goal 1. Results would be analyzed to theorize which objective(s) are providing the most value to the maintenance and/or improvement of water quality within the Plan Area.

Objective 2: Develop, provide, and promote an annual public information campaign focused on water quality BMPs that can be acted on by the general public and/or local governing bodies (municipalities, lake boards) aimed at maintaining or improving the existing snuffbox mussel population and promoting a healthy freshwater mussel community within the Plan Area for the term of the permit.

Monitoring Goals: Success of the public information campaign would be measured via the water quality monitoring outlined in Objective 1. It is anticipated that the public outreach campaign would lead to BMPs being implemented within the watershed that would result in maintaining or improving water quality. FLTF will also measure the progress of this goal by monitoring all public outreach efforts in a yearly report to the USFWS for the first three years of the ITP term. Following the initial campaign effort, FLTF will measure progress of this goal by monitoring all public outreach efforts in a report that is delivered every five years for the remaining term of the ITP. Reporting shall include a summary of outreach materials provided to the public, a summary of events hosted by FLTF, estimated numbers of the public who received outreach materials, the number of participants at in-person events, a list of partners contributing to outreach materials and the in-person event, a communications log of public comments and outreach feedback, and a written summary of the topics covered.

Objective 3: Develop a Lake Management Plan through partnerships with willing stakeholders that provides a process for applicants to receive up to $280,000 in FLTF funding to implement projects that focus on maintaining or improving water quality for the existing snuffbox mussel population and promote a healthy freshwater mussel community within the Plan Area.

Monitoring Goals: The Lake Management Plan and grant funding opportunity would target primary influences on viability of snuffbox mussels outlined in the snuffbox Species Status Assessment (SSA)[89] report and Action Items in the snuffbox Draft Recovery Plan[90]. Primary risk factors listed in the snuffbox SSA which would be addressed by the Lake Management Plan and grant funding opportunity include: reducing contaminants such as sediment and nutrients (e.g., phosphorus, nitrogen); proper control of contaminants from invasive species chemical treatments; thoughtful landscape alterations or restoration of historic land use; and, invasive species control (invasive aquatic plants and zebra mussels BMPs). Specific to the snuffbox Draft Recovery Plan, action item 1 “Manage, protect and enhance habitat,” and item 5, “Engage the public and partners in

[89] USFWS, 2022d
[90] USFWS, 2023c

freshwater mussel conservation," would be addressed by the Lake Management Plan and grant funding opportunity.

FLTF will measure the progress of this goal by monitoring adherence to the Lake Management Plan development, finalization, and implementation schedule. FLTF will document its outreach with potential willing stakeholders, maintain a communications log and plan revision history, and record the number of applications received for grant funding and a scorecard that assesses projects and their proposed benefit to meeting the biological goal. Progress on the schedule of the development of the Lake Management Plan, funding opportunities, and implementation of projects will be closely monitored.

Projects that are awarded and subsequently implemented would need to be monitored. Monitoring regimes would need to be developed specific to each project. Upon award of each project, FLTF would coordinate with the USFWS to develop acceptable project-specific monitoring regimes to be implemented.

FLTF will measure the progress of this goal by providing a yearly report to the USFWS over the first 10 years of the term of the ITP (through December 31, 2035). Following this date, additional reporting may be necessary on an annual basis for the term of the permit where required, to document grant activities and their funding, implementation, monitoring, and completion. This monitoring schedule will be further coordinated with the USFWS, and may include reporting that documents funding provided for offsite alternative mitigation.

This report shall include a summary of all grant funding announcements, private, public, and stakeholder outreach, applications received, awards granted, and implementation schedules. This report will be used to inform USFWS on the status of grant funded opportunities and projects as they relate to snuffbox mussel mitigation. FLTF will coordinate with USFWS if grant funded projects are not meeting the requirements of the implementation schedule. This would include coordination related to alternative mitigation discussed further under Section 9.4.4.

Objective 4: Avoid impacting water quality in areas containing the known snuffbox mussel population and healthy mussel communities within the Plan Area during physical construction activities associated with Edenville Dam for the term of the permit.

Monitoring Goals: During the physical construction of Edenville Dam, FLTF will hire a competent environmental inspector who will monitor construction activities to ensure complete avoidance of actions that would otherwise affect the known snuffbox mussel population and healthy mussel communities within the Plan Area. Weekly reports will be generated during this time period that will include documentation of compliance with this task.

Biological Goal 2: Ensure bank erosion and bed integrity remain at levels that can maintain or improve the existing snuffbox mussel population and promote a healthy freshwater mussel community within the Plan Area.

Objective 1: Monitor bank stability and bed integrity throughout the nearshore areas of the Plan Area to provide data related to bank height, vegetated condition, bank angle, root density, and bank material as they relate to erosion and sedimentation that could affect waters and their suitability for snuffbox mussels and freshwater mussel populations. These measures would occur in the spring of every year following the refill of Wixom Lake for the permit term.

Monitoring Goals: Bank stability and bed integrity monitoring assessment would be completed on an annual basis within two months of lake refill activities that occur as a part of normal dam operations and maintenance activities. Data will be reviewed following each assessment period to identify trends in BEHI scores between the current year and the historical period since assessments were initiated. A decrease in BEHI rating score would indicate that bank erosion potential is decreasing and that there has been improvement. An increase in BEHI score would indicate that bank erosion potential is increasing, and that evaluation is required to determine where the change is occurring, why it is occurring, and solutions that could be targeted to reduce future scores. This information would be used to identify, promote, and partner with individuals to enact stream bank stabilization projects. This data will also be compared between the TBO Plan Area and Permit Area assessment locations to evaluate the suitability of bank erosion and bed integrity parameters within a riverine system versus that of the transitional area of the impounded lake system.

Objective 2: Develop, provide, and promote an annual public information campaign focused on bank stability and bed integrity BMPs that can be acted on by the general public and/or local governing bodies (municipalities, lake boards) aimed at maintaining or improving the existing snuffbox mussel population and promoting a healthy freshwater mussel community within the Plan Area for the term of the permit.

Monitoring Goals: Success of the public information campaign would be measured via bank stability and bed integrity monitoring that is completed as described under Objective 1. It is anticipated that the public outreach campaign would lead to BMPs being implemented within the watershed that would result in maintaining or improving bank stability and bed integrity. FLTF will also measure the progress of this goal by monitoring all public outreach efforts in a yearly report to the USFWS for the first three years of the ITP term. Following the initial campaign effort, FLTF will measure progress of this goal by monitoring all public outreach efforts in a report that is delivered every five years for the remaining term of the ITP. These reports shall include a summary of outreach materials provided to the public, a summary of events hosted by FLTF, estimated numbers of the public who received outreach materials, the number of participants at in-person events, a list of partners involved in providing input to outreach materials and the in-person event, a communications log of public comments and outreach feedback, and a written summary of the topics covered.

Objective 3: Develop a Lake Management Plan through partnerships with willing stakeholders that provides a process for applicants to receive up to $280,000 in FLTF funding to implement projects that focus on maintaining or improving bank stability and bed integrity in areas where the known snuffbox mussel population and healthy freshwater mussel communities exist within the Plan Area over the course of the permit.

Monitoring Goals: The Lake Management Plan and grant funding opportunity would target primary influences on viability of snuffbox mussels outlined in the snuffbox SSA[34] and Action Items in the snuffbox Draft Recovery Plan[35].

Success of the Lake Management Plan and grant funding opportunity would be measured via bank stability and bed integrity monitoring outlined in Objective 1. It is anticipated that projects would reduce the total number of tons of sediment per year and total suspended solids, historically input into the Plan Area. Thus, projects are anticipated to improve bank stability and bed integrity.

FLTF will also measure the progress of this goal by monitoring adherence to the Lake Management Plan development, finalization, and implementation schedule. FLTF will document

its outreach with potential willing stakeholders, maintain a communications log and plan revision history, and record the number of applications received for grant funding and a scorecard that assesses projects and their proposed benefit to meeting the biological goal. Progress on the schedule of the development of the Lake Management Plan, funding opportunities, and implementation of projects will be closely monitored.

Projects that are awarded and subsequently implemented would need to be monitored. Monitoring regimes would need to be developed specific to each project. Upon award of each project, FLTF would coordinate with the USFWS to develop acceptable project-specific monitoring regimes to be implemented.

Objective 4: Avoid impacts to the banks and bed of areas containing the known snuffbox mussel population and healthy mussel communities within the Plan Area during physical construction activities associated with Edenville Dam for the term of the permit.

Monitoring Goals: During the physical construction of Edenville Dam FLTF will hire a competent environmental inspector who will monitor construction activities to ensure complete avoidance of actions that would otherwise affect the known snuffbox mussel population and healthy mussel communities within the Plan Area. Weekly reports will be generated during this time period that will include documentation of compliance with this task.

Biological Goal 3: Ensure the preservation of the aquatic conditions necessary for maintaining and/or improving existing habitat for the extant snuffbox mussel population, and which will promote a healthy freshwater mussel community within the Plan Area.

Objective 1: Develop, provide, and promote an annual public information campaign focused on preservation of suitable aquatic habitat that can be acted on by the general public and/or local governing bodies (municipalities, lake boards) aimed at maintaining or improving the existing habitat for the extant snuffbox mussel population and promoting a healthy freshwater mussel community within the Plan Area for the term of the permit.

Monitoring Goals: It is anticipated that the public outreach campaign would lead to BMPs being implemented within the watershed that would result in maintaining or improving suitable aquatic habitat. FLTF will measure the progress of this goal by monitoring all public outreach efforts in a yearly report to the USFWS for the first three years of the ITP term. Following the initial campaign effort, FLTF will measure progress of this goal by monitoring all public outreach efforts in a report that is delivered every five years for the remaining term of the ITP. These reports shall include a summary of outreach materials provided to the public, a summary of events hosted by FLTF, estimated numbers of the public who received outreach materials, number of participants at in-person events, list of partners involved in providing input to outreach materials and the in-person event, a communications log of public comments and outreach feedback, and a written summary of the topics covered.

Objective 2: Develop a Lake Management Plan through partnerships with willing stakeholders that provides a process for applicants to receive up to $280,000 in FLTF funding to implement projects that focus on maintaining or improving suitable aquatic habitat for the existing snuffbox mussel population and promote a healthy freshwater mussel community within the Plan Area over the course of the permit.

Monitoring Goals: The Lake Management Plan and grant funding opportunity would target primary influences on viability of snuffbox mussels outlined in the snuffbox SSA[34] and Action Items in the snuffbox Draft Recovery Plan[35].

Success of the Lake Management Plan and grant funding opportunity would be measured via the implementation of projects that maintain or improve suitable aquatic habitat. It is anticipated that projects would improve in-water suitable aquatic habitat for snuffbox mussels by promoting the conservation of and/or augmenting existing habitat areas with plantings of eel grass, early detection and implementation of BMPs (i.e., washing stations, provision of disinfecting materials, public education) to limit the spread of zebra mussels, and identification of mussel-safe alternatives for historic aquatic nuisance plant and zebra mussel control programs. FLTF will also measure the progress of this goal by monitoring adherence to the Lake Management Plan development, finalization, and implementation schedule. FLTF will document its outreach with potential willing stakeholders, maintain a communications log and plan revision history, and record the number of applications received for grant funding and a scorecard that assesses projects and their proposed benefit to meeting the biological goal. Progress on the schedule of the development of the Lake Management Plan, funding opportunities, and implementation of projects will be closely monitored.

Projects that are awarded and subsequently implemented would need to be monitored. Monitoring regimes would need to be developed specific to each project. Upon award of each project, FLTF would coordinate with the USFWS to develop acceptable project-specific monitoring regimes to be implemented.

Objective 3: Avoid impacts to suitable aquatic habitat in areas containing the known snuffbox mussel population and healthy mussel communities within the Plan Area during physical construction activities associated with Edenville Dam for the term of the permit.

Monitoring Goals: During the physical construction of Edenville Dam, FLTF will hire a competent environmental inspector who will monitor construction activities to ensure complete avoidance of actions that would otherwise affect the known snuffbox mussel population and healthy mussel communities within the Plan Area. Weekly reports will be generated during this time period that will include documentation of compliance with this task.

Biological Goal 4: Ensure water levels and their rate of change remain within prescribed parameters that would maintain necessary hydrology within Wixom Lake for snuffbox mussels and healthy freshwater mussel communities. Monitor TBO water levels upstream of Wixom Lake's influence to assist in early detection of potential risk (due to lack of hydrology) to the known existing snuffbox mussel population.

Objective 1: FLTF would install and maintain, or would fund and contract USGS to install and maintain, one new water level gage at the Dale Road intersection of the Permit Area. Monitor water levels at this new location and the existing USGS gage at Glidden Road (located on the TBO) on a weekly basis following the refill of Wixom Lake to the legal lake level for the term of the permit.

Monitoring Goals: Weekly water level data collection would be reviewed to identify trends or potential upcoming events that could predict loss of sufficient hydrology to support snuffbox mussel and other freshwater mussel populations within the TBO Plan Area and the upper Wixom Lake impoundment (i.e., Permit Area). Should a catastrophic event occur that may lead to the loss of required hydrology that would put these mussel populations at risk (i.e., catastrophic

drought or flooding), FLTF would immediately report details of the event to applicable agencies (EGLE, MDNR, USFWS). While it is not anticipated that such an action would ever be required, this would allow for agencies with purview over protected mussel species to coordinate actions with the upstream Beaverton Dam owner to potentially allow for an unplanned release of water to maintain downstream hydrology within the TBO, thereby maintaining the hydrologic conditions necessary to support snuffbox mussels and other freshwater mussel populations.

Historic water levels recorded by the USGS Glidden Road gage would be compared to new data collected following the refill of the Wixom Lake impoundment. Comparisons would be made to assess minimum, maximum, and hydrologic regimes of the riverine system. These measures would be assessed to determine if they are the result of natural events or upstream influences such as that of the Beaverton Dam. Water levels recorded by the newly installed Dale Road gage would be used to evaluate the success of the impoundment in maintaining the normal (legal) lake levels and the rate of decrease or increase in water levels that would occur as the result of routine operations and maintenance activities associated with the Edenville Dam. These measures would ensure that water level change activities remain in compliance with the prescribed water level and date ranges as laid out in court ordered documents, and with approved lake drawdown and refill plans. This information would also be used to inform future plan and permit renewals should hydrology not be maintained as currently anticipated.

Objective 2: Construct the Edenville Dam to a 5,000-year flood standard and operate the dam as run-of-the-river to maintain hydrology of the Permit Area and promote healthy mussel communities for the term of the permit.

Monitoring Goals: FLTF will ensure hydrology is maintained throughout construction and post-construction operations. Monitoring would ensure that the passage of water at the Edenville Dam will regularly occur during and after construction. During periods of low flow, minimum flow releases would be approximately equivalent to the stream flow of the impoundment. At any point during construction, fill will not be placed to prevent surface water drainage across the site, rather, runoff would be directed to public or natural drainageways and not unnaturally discharged onto adjacent properties, surface waters, or wetlands.

Objective 3: Conduct court-ordered normal (legal) lake level winter drawdowns and summer refills within prescribed parameters to limit the water level rate of change and to provide a set minimum elevation that is suitable for maintaining healthy freshwater mussel communities for the term of the permit.

Monitoring Goals: FLTF will monitor water levels within the Permit Area during prescribed drawdown and refill events to ensure that rate of change and legal (normal) lake levels remain in prescription for the duration of each activity. This includes weekly monitoring of hydrologic levels as discussed under Objective 1.

9.3 COMPLIANCE MONITORING

Compliance monitoring is necessary to ensure that FLTF as the Permittee is meeting the terms and conditions of their ITP. FLTF will be in compliance with the ITP and HCP provided they are able to demonstrate progress is being made toward meeting the HCP's biological goals and objectives, and that the HCP's conservation program is effective in minimizing and/or mitigating impacts on the existing snuffbox mussel population and promoting healthy mussel communities within the Plan Area. As necessary, FLTF would follow an adaptive management approach to

adjust conservation measures to improve the HCP's conservation strategy based on the results of monitoring activities (see Section 9.4).

FLTF would submit an annual report to the USFWS by January 31 of the year following proposed monitoring activities. These reports will document the status of HCP compliance including a summary of all activities implemented, monitoring activities implemented, and funds expended for implementation. These reports will document the effectiveness of the conservation plan implementation in meeting the stated biological goals and objectives. This includes a status and trends of quantitative monitoring efforts, the status and trends of public outreach and Lake Management Plan development, the status and trends of known threats, and effects on management actions in achieving the desired condition of improving and maintaining the existing snuffbox mussel population and healthy freshwater mussel communities within the Plan Area.

9.4 ADAPTIVE MANAGEMENT

In developing adaptive management tools, the USFWS and FLTF would work together to create, in advance, a mechanism for determining the magnitude of change that may need to be employed based on the results of the monitoring and the degree of deviation significance from the desired condition.

FLTF's biological effectiveness monitoring will gauge the efficacy of the conservation measures associated with the biological goals and objectives and will inform the need for adaptive management in the future. In most cases, adaptive management will include a different approach to outreach and education, as FLTF does not have purview over other land or lake management decisions outside of the boundaries of the legal lake level. FLTF is required to restore the normal (legal) lake level of Wixom Lake to pre-flood conditions, and to maintain the dam and impoundment to achieve that goal. As such, the measures they are able to implement specifically to avoid and minimize impacts of the action on snuffbox mussels are extremely limited; these limitations also extend to adaptive management. Specifically, FLTF has no ability to implement conservation measures upstream of the Upper Wixom Lake Permit Area and must rely on outreach to and developing relationships with landowners, community members, agencies, academic groups, and other stakeholders to further the conservation goals of this HCP.

9.4.1 Water Quality

If it is determined through FLTF's yearly monitoring that the objectives associated with Biological Goal 1 (ensuring water quality parameters remain at levels that maintain or improve the existing snuffbox mussel population and promote a healthy freshwater mussel community within the Plan Area as described in Section 8.1 above) are not being met, FLTF will install additional water quality data loggers to gather supplemental data to better understand the processes driving the decrease in water quality. FLTF will then develop targeted outreach to identify and engage additional stakeholders to determine potential projects to address the issues.

In addition, the Lake Management Plan may be amended as needed, and the grant funding selection criteria may also be adjusted; projects capable of addressing these emerging concerns will receive priority in the selection process.

FLTF's year-over-year monitoring will review the effectiveness of this goal on potential impacts to the Permit Area to inform an adaptive approach to ongoing outreach and education.

9.4.2 Bank Stability and Bed Integrity

If it is determined through biological effectiveness monitoring that the objectives associated with Biological Goal 2 (ensuring bank erosion and bed integrity remain at levels that can maintain or improve the existing snuffbox mussel population and promote a healthy freshwater mussel community within the Plan Area as described in Section 8.2 above) are not being met, FLTF will develop additional targeted outreach to identify and engage additional stakeholders to determine potential projects to address the issues.

In addition, the Lake Management Plan may be amended as needed, and the grant funding selection criteria may also be adjusted; projects capable of addressing these emerging concerns will receive priority in the selection process.

9.4.3 Suitable Aquatic Habitat

If it is determined through biological effectiveness monitoring that the objectives associated with Biological Goal 3 (ensuring the preservation of the aquatic conditions necessary for maintaining and/or improving existing habitat for the extant snuffbox mussel population, and which will promote a healthy freshwater mussel community within the Plan Area as described in Section 8.3 above) are not being met, FLTF will develop additional targeted outreach to identify and engage additional stakeholders to determine potential projects to address the issues.

In addition, the Lake Management Plan may be amended as needed, and the grant funding selection criteria may also be adjusted; projects capable of addressing these emerging concerns will receive priority in the selection process.

9.4.4 Lake Management Plan and Grant Funding – Lack of Applicants

A situation may arise where there is a lack of grant applicant interest, lack of applications for grant-funded projects that would directly benefit snuffbox and snuffbox habitat in the Permit Area, or inability to implement projects within the defined implementation schedule for the development of the Lake Management Plan. In the event that the full sum of grant money is not able to be awarded and implemented according to schedule for water quality, streambank and streambed integrity, and/or habitat preservation projects, FLTF would use the remaining funds by contributing to alternative mitigation projects.

FLTF would coordinate alternative mitigation projects with the USFWS by December 31, 2036. Alternative mitigation would consist of redirecting remaining mitigation funds outside of the Plan Area for offsite mitigation that would benefit the recovery of the species in other parts of its range. Primary consideration would be given to projects that would provide benefits to snuffbox mussel conservation in Michigan. If opportunities in Michigan are not present, additional locations within the United States may be considered. This alternative mitigation would provide funding to projects that would contribute to the recovery actions and conservation efforts for snuffbox mussels.

9.5 CHANGED CIRCUMSTANCES

Changed circumstances are circumstances that can be reasonably anticipated and specifically addressed in an HCP prior to permit issuance. Changed circumstances are planned responses are treated as part of the HCP's operating conservation program. Changed circumstances related to the refill of Wixom Lake and the impacts to snuffbox mussels include the potential for hydrology degradation as a result of the upstream Beaverton Dam's operations and land use changes that

contribute negatively to the water quality within the watershed. Should a changed circumstance present itself, FLTF would consult direction with the USFWS for appropriate actions following emergency response.

9.5.1 Beaverton Dam

The Beaverton Dam, owned and operated by the City of Beaverton, was granted an exemption form licensing by the FERC on December 30, 1981. As a part of this exemption, the City of Beaverton is required to comply with the terms and conditions specified by the state and federal resource agencies. A MDNR letter dated November 24, 1981, required a minimum flow of 200 cubic feet per second from the project diversion structure, or inflow to the project, whichever is less, into the bypassed reach of the Tobacco River for the protection of aquatic resources. The terms and conditions also required that the City of Beaverton operate the dam as run-of-the-river so that instantaneous outflow equals inflow to the project.

Communications took place in 2023 and 2024 between MDNR, FERC, and the City of Beaverton are outlined in a FERC letter dated February 26, 2024[91]. The MDNR and FERC are currently investigating the City of Beaverton's compliance history for alleged violations related to the failure to satisfy the run-of-the-river and minimum flow requirements of the FERC licensing exemption. This investigation is ongoing.

With the recent history of concern for passing of minimum flows into the Plan Area of this HCP, it is reasonable to anticipate that there is potential for loss of suitable hydrology that supports the existing snuffbox mussel population within the TBO. However, the Beaverton Dam is not owned or operated by FLTF. While operations are regulated by the FERC, the City of Beaverton’s ability to release or hold back water is purely under their purview. FLTF has no influence over these activities and depends on regulations and legal authority. As such, any actions on the part of City of Beaverton related to their dam’s operation that could impact certain features of the Plan Area. FLTF will continue to run Edenville Dam as run-of-the-river and would at a minimum retain the normal (legal) lake level elevation regardless of the upstream inputs or reductions.

As such, there is no action that FLTF can take to ensure the maintenance of suitable hydrology within the TBO portion of the Plan Area. However, FLTF can ensure that the legal (normal) lake levels are maintained within the limits of Wixom Lake where other freshwater mussel communities may continue to persist. Should hydrology decrease to a point where risk of take to snuffbox mussels would seem reasonably likely to occur, information collected from hydrology monitoring efforts (see Biological Goal 4) would be provided to the City of Beaverton and regulatory agencies to inform decisions and due process.

9.5.2 Surrounding Land Use

Human land use, including agricultural and development pressures, are an ever-increasing contribution to the degradation of a local environment. The FLTF has ownership over the Wixom Lake bottomlands below the ordinary high water mark of the normal (legal) lake levels. However, landowners who own properties within the watershed and immediately adjacent to the Plan Area, are above the normal (legal) lake level and outside of the lands controlled by FLTF.

These landowners have the potential to impact the ecosystem in both beneficial and detrimental ways. Land use activities on these private lands, such as use of herbicides, pesticides, fertilizers,

[91] FERC, 2024

and other lawn and garden care items, agricultural practices, removal of turf, runoff from unvegetated and/or impervious surfaces, and/or significant development projects could have direct impacts to snuffbox mussels and/or host fish, and/or negatively impact water quality, indirectly harming species.

As such, there is no action that FLTF can take to directly control the changes in human land use on surrounding lands within the watershed. However, FLTF is proposing conservation measures that include development of a public information campaign and development of a Lake Management Plan with grant-funded opportunities. The campaign, plan, and associated grant-funded opportunities may be informed by land use pressures within the watershed. The public information campaign could target select developers, agricultural lands, and other contributors to the degradation of the surrounding ecosystem. FLTF would advocate for policy changes. The Lake Management Plan would be modified to incorporate additional actions based on the changing or new land uses in the region. Grant-funded opportunity solicitations would consider new threats to the watershed as they arise. The success of these conservation measures would continue to be evaluated by following the biological effectiveness monitoring strategy outlined in the HCP with the addition of water quality measurements where they make the most sense as they relate to inputs from changes in land use.

9.5.3 Lake Management Plan and Grant Funding – Lack of Applicants

A situation may arise in which there is a lack of grant applicant interest, lack of applications for grant-funded projects that would directly benefit snuffbox and snuffbox habitat in the Permit Area, or inability to implement projects within the defined implementation schedule for the development of the Lake Management Plan. In the event that the full sum of grant money is not able to be awarded and implemented according to schedule for water quality, streambank and streambed integrity, and/or habitat preservation projects, FLTF would use the remaining funds by contributing to alternative mitigation projects.

FLTF would coordinate alternative mitigation projects with the USFWS by December 31, 2036. Alternative mitigation would consist of redirecting remaining mitigation funds outside of the Plan Area for offsite mitigation that would benefit the recovery of the species in other parts of its range. Primary consideration would be given to projects that would provide benefits to snuffbox mussel conservation in Michigan. If opportunities in Michigan are not present, additional locations within the United States may be considered.

The status of snuffbox mussel recovery planning could look very different by 2036. As such, FLTF would be required to coordinate closely with the USFWS to provide adequate alternative mitigation. This alternative mitigation would provide funding to projects that would contribute to the recovery actions and conservation efforts for snuffbox mussels.

9.6 UNFORSEEN CIRCUMSTANCES

Unforeseen circumstances are defined as changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the Services at the time of the negotiation and development of the plan and that result in a substantial and adverse change in the status of the covered species.[92] Unforeseen circumstances related to the refill of Wixom Lake and the impacts to snuffbox mussels are related to extreme weather activities that may be exacerbated by climate change. Should an

[92] United States Code, 50 CFR 17.3

unforeseen circumstance present itself, FLTF would consult direction with the USFWS for appropriate actions following emergency response.

9.6.1 Extreme Weather

Extreme weather events are becoming more common, possibly driven in whole or in part by climate change. As discussed in Section 4.1.2, a climatic analysis revealed that the region of the Permit Area has become warmer with increased precipitation over the past century. It is difficult or impossible to predict all manner of weather events that could impact this system, including the Plan Area. Extreme flooding events like that experienced in 2020, severe drought, extreme snowfall, and/or ice storms could all contribute to radical changes to this ecosystem and temporarily or permanently alter the Plan Area.

The Edenville Dam reconstruction has been designed to withstand a 5,000-year flood event. This event was considered by both FLTF and EGLE during the design process to ensure that factors such as climate change are considered in the design process and to eliminate severe flooding as a potential for the dam's ability to not maintain the normal (legal) lake levels. As such, even during significant flood events, the prescribed lake levels would not change.

Conversely, severe drought may impact the Plan Area. However, this drought would have to be unlike any ever experienced in the region before. The existing snuffbox mussel population and healthy freshwater mussel community has persisted in this area. Thus, a drought that would decrease the wetted area of the Plan Area to an extent that would be catastrophic to these populations is highly unlikely and unforeseeable.

Freezing conditions may impact the Plan Area. However, freezing conditions would need to exceed any ever experienced in the region before as the snuffbox mussel population and healthy freshwater mussel community have persisted in this area. The climatic trend of the area is that of warmer conditions when compared to historic measures. As such, significant freeze events that would fully encompass the aquatic habitat where the known snuffbox mussel population and healthy freshwater mussel communities currently exist within the Plan Area are highly unlikely and unforeseeable.

10.0 IMPLEMENTATION COSTS AND FUNDING ASSURANCES

The ESA requires that FLTF provide implementation costs and funding assurance for those actions listed within this HCP prior to issuance of an ITP.

10.1 IMPLEMENTATION COSTS

The USFWS must ensure that adequate funding will be provided by FLTF for implementation of actions listed within this HCP. This includes all costs associated with proposed minimization and mitigation measures.

10.1.1 FLTF Operations and Maintenance

FLTF is a 501(c)(3) nonprofit organization managed and operated by lake residents and industry experts. Funding for FLTF comes via an operation and maintenance assessment to the Four Lakes SAD made possible by Part 307. FLTF is the Delegated Authority of Midland and Gladwin counties for the Four Lakes SAD. The SAD makes it possible for FLTF to administer and oversee the maintenance and operations of the Edenville Dam and Wixom Lake. This ensures sustainable management and maintenance of the dams for generations to come. Details on the computation of costs for this operating budget are provided in Table 27 below. This value is for the first five years of operations and maintenance. This value is reassessed every five years and would likely increase with inflation.

TABLE 27

FLTF Average Annual Operating Budget

Task	Cost
Administration: • Labor (Finance and Administration) • Legal • Communications • Insurance, Bank Services and Supplies • Accounting Services, Annual Audit	**$242,000**
Operations and Maintenance • Labor • Insurance • Utilities and Telecommunications • Vehicles • Supplies • Contract Labor • Equipment Rental • Consulting Services	**$1,337,000**
Establishment of a Special Assessment District • Preparation of Assessment Roll • Surveying • Hearings • Cost of Levying Assessments • Roll Maintenance • Estimated Cost of Mailing, Publishing, Notices • Appeals	**$35,000**
10% Contingency	**$161,200**
Total Average Annual Operating Budget	**$1,775,200**

The Four Lakes and their dams are operated as a system, with the FLTF Operations Team responsible for their operations and maintenance in compliance with Part 315, Dam Safety of NREPA. The centralized operations team carries out the responsibilities of each of the four individual lakes and facilities. A single management team can operate efficiently, creating cost savings by avoiding the duplication of efforts that would occur if there were four independent lakes with their own management structures and resources. The aggregation of management responsibilities better assures consistent and thorough policies, procedures, and performance across the four lakes system. Specifically, operations staff can assist one another to complete work issues and betterment projects without having to rely on outside contractors for frequent assistance. Also, having one management team allows for a broader watershed perspective of situations, opportunities, and abilities to address them more optimally.

FLTF's Operations Team along with their trusted contractors and consultants would be the primary resource for ensuring implementation of the HCP's listed actions. This team consists of three full-time operators, as well as a supervisor. FLTF also hires two seasonal positions in the summer. The operators are responsible for general dam maintenance. FLTF further has two employees dedicated to administration and maintenance activities. These positions are in charge of invoicing, paying contractors, budgeting, cash management, and overseeing reporting to federal and state agencies.

These activities ensure the dam structures are in safe and operational condition to the extent that their current compromised conditions allow. Operations activities monitor the facilities and take action to correct potential or active issues. The operations team also ensures dam safety and security. These activities ensure the dams remain structurally sound and continually operate as designed while meeting regulatory requirements. FLTF's Operations team has offices located at the Edenville Dam where consultants will also work out of on occasion. FLTF has D&O, workmen's compensation and unemployment insurance. FLTF has four work trucks to travel between all four dams, which span 40 miles. All vehicles are ensured. Further, FLTF has a variety of equipment such as lawn mowers and trailers necessary to perform the ongoing maintenance at the dams. FLTF also contracts with consultants for dam safety and environmental services, to ensure expertise is available as it is needed.

Primarily, HCP implementation would occur concurrently with typical day-to-day operations and maintenance duties. As such, costs associated with these actions would be indistinguishable from the average annual operating budget. Costs for these tasks related to HCP implementation would be incurred against the operating budget described above for the term of the ITP. This includes funding for internal FLTF staff labor and equipment use to support or wholly perform the following minimization actions.

- Supporting biological monitoring related to water quality, bank stability and bed integrity, and water level monitoring activities.
- Development and oversight of a public information campaign, which includes a dedicated $200,000 fund for Low Impact Development efforts in accordance with EGLE permit conditions.
- Development and oversight of a Lake Management Plan.
- Development and oversight of grant-funded opportunities.

- Oversight of physical construction and maintenance activities associated with Edenville Dam and Wixom Lake.

10.1.2 Specialized Contractor and Equipment Requirements

Specialized contractors and equipment would be required to implement select tasks associated with implementation of this HCP. These tasks would occur outside of the normal day-to-day operations and maintenance of the Four Lakes. As such, these funds have been isolated from the average annual operating budget provided in Section 10.1.1 and provided in Table 28 below. These costs are accounted for within the funding assurances section of this document (see Section 10.2).

TABLE 28

Specialized Contractor and Equipment Costs

Task	Initial Cost	Annual Cost Without Inflation	Total Cost for Monitoring Term*
Biological Goal 1: Specialized Monitoring and Equipment (First 3 Years)			
• Equipment and Equipment Maintenance	$11,000	$2,500	$16,151
• Study Implementation	$2,700	$2,700	$8,263
• Data Collection/Monitoring Field Work	$14,000	$14,000	$42,846
• Lab Testing	$2,200	$2,200	$6,733
• Data Analysis and Reporting	$8,400	$8,400	$25,707
Biological Goal 1: Specialized Monitoring and Equipment (Years 3-30)			
• Equipment and Equipment Maintenance	$100	$100	$3,534
• Data Collection/Monitoring Field Work	$2,337	$2,337	$82,600
• Lab Testing	$2,200	$2,200	$77,758
• Data Analysis and Reporting	$2,400	$2,400	$84,826
Biological Goal 1: Total (First 3 Years)	**$38,300**	**$29,800**	**$99,700**
Biological Goal 1: Total (Years 3-30)	**$7,037**	**$7,037**	**$248,718**
Biological Goal 1: Total			**$348,418**
Biological Goal 2: Specialized Monitoring and Equipment			
• Initial Reconnaissance Survey	$3,300	$0	$3,300
• Data Collection/Monitoring Field Work	$3,500	$3,500	$141,988
• Data Analysis and Reporting	$1,350	$1,350	$54,767
Biological Goal 2: Total			**$200,055**
Biological Goals 1 and 2: Specialized Contractor and Equipment Total			**$548,473**

* Includes Initial Cost + Annual Cost Without Inflation + an estimated 2% inflation cost per year. The length of time for the Total Cost for Monitoring Term is defined based on the monitoring period for each activity as discussed under Section 9.2 Biological Effectiveness Monitoring.

10.1.3 Mitigation

FLTF will set aside $280,000 in grant funded project opportunities that provide an avenue for the public or organizations to fund and implement projects that meet the objective of this biological goal. This funding may be used to implement projects for one or more of the biological goals listed in this HCP, with a focus of the proposed projects to be those that would have a meaningful impact on maintaining or improving the existing snuffbox mussel population.

In the event that the full sum of grant money is not able to be awarded and implemented according to schedule for water quality, streambank and streambed integrity, and/or habitat preservation

projects, FLTF would use the remaining funds by contributing to alternative mitigation projects. This mitigation would occur in coordination with the USFWS.

FLTF understands that federal funding from another source cannot be used to implement mitigation funding efforts. However, this funding can be used in conjunction with other federal funds to complete larger joint effort projects.

10.2 FUNDING ASSURANCES

FLTF will provide adequate, sufficient, and reliable funding for the required tasks of this HCP. This is referred to as “No Surprises” assurances. These funding sources are required to keep the permit in good standing.

This HCP’s funding strategy consists of three funding mechanisms. This strategy will ensure that funding is available for HCP implementation and that avoidance, minimization, and mitigation measures can be implemented to avoid, reduce, and offset impacts on snuffbox mussels associated with the HCP covered activities.

10.2.1 Operations and Maintenance – Stay-Ahead Provision

For longer-term projects, such as the Edenville Dam Restoration Project, the funding assurance mechanism is proposed to be a stay-ahead provision. Municipalities, non-profit organizations, and other similar groups that depend on annual funding from a tax-based budget over the term of the permit.

FLTF has demonstrated that they have the authority and ability to collect fees, enact the SAD, and the ability to draw on these funds to implement the HCP. The FLTF SAD is an established tax program that provides funds to FLTF for annual operations of the Four Lakes system. FLTF has legal authority to receive funding for operation and maintenance from FLTF SAD, which is reassessed every five years. This funding provides positions for dedicated administrative and operations staff (see Section 10.1.1) that would lead efforts related to implementation of this HCP’s required actions.

FLTF will provide the annual FLTF SAD budget, future assessment budgets, hearing documents, and approved assessment notices to USFWS for the term of the permit.

10.2.2 Letter of Credit – Specialized Contractor and Equipment

FLTF will provide a letter of credit to USFWS in the amount of $46,450 to cover the cost of specialized contractor and equipment requirements that are necessary to implement and appropriately monitor actions required to comply with the permit (see Section 10.1.2). This financial assurance document would be provided to and accepted by USFWS prior to issuance of the permit.

On an annual basis, the cost estimate would be reassessed based on factors such as inflation. Sufficient funding in the form of a revised letter of credit would be provided to USFWS for the following year’s activities. Provision of a letter of credit on an annual basis would allow this long-term project to stay adequately funded with regular releases of funding occurring if FLTF remains compliant with HCP-listed actions.

10.2.3 Surety Bond – Mitigation

FLTF will provide a surety bond to USFWS in the amount of $280,000 to ensure that the HCP's proposed mitigation actions (see Section 10.1.3) are implemented, appropriately monitored, and adaptive management processes are followed if warranted as required to comply with the permit. This financial assurance document would be provided to and accepted by USFWS prior to issuance of the permit.

11.0 PERMIT IMPLEMENTATION

The USFWS Michigan Ecological Services Field Office will take the lead in overseeing implementation and coordination with FLTF in accordance with to be established implementation schedules; the USFWS Region 3 Office will provide support as needed. The HCP and the permit conditions will provide the framework for implementation, monitoring, reporting requirements, and scheduled reviews.

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