



Lake Maria Management Plan
DOW# 51006200
DRAFT – December 2021

Prepared By:

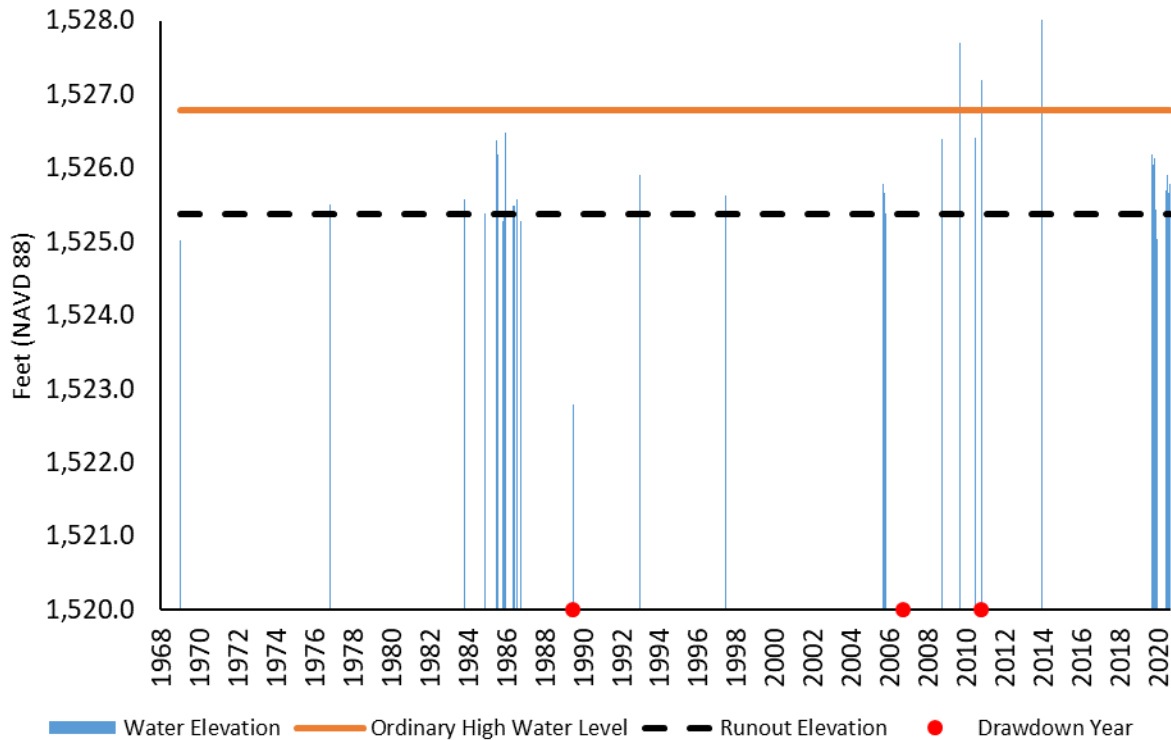
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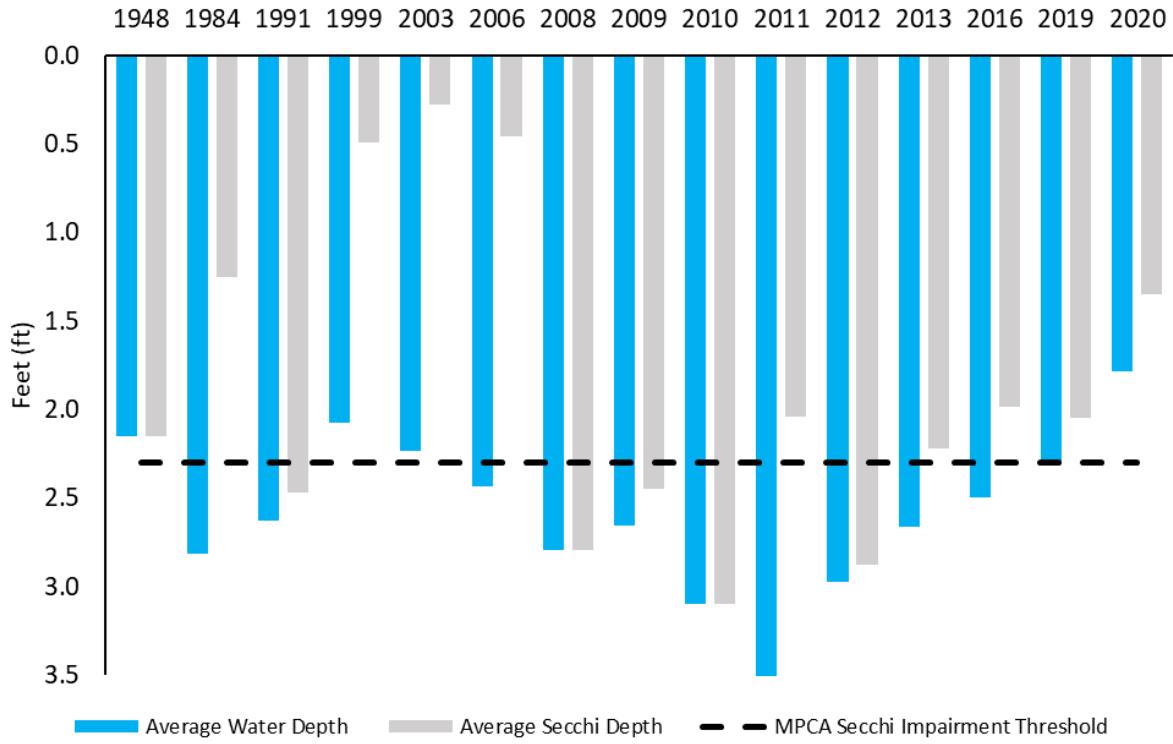
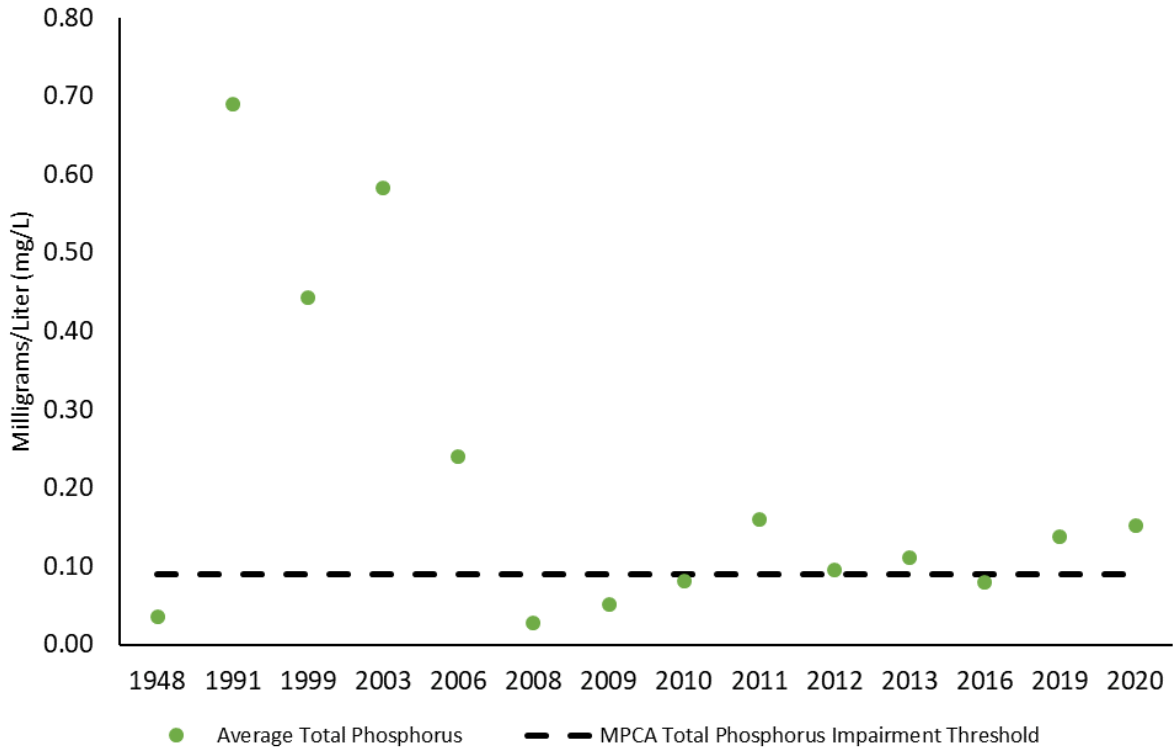
General Lake Information

- County: Murray
- Location: T108N, R41W, Section(s) 6, 7, 8, 17
- Size: 442 acres
 - This acreage includes the 73-acre wetland known as Mud Slough, which is located northwest of the main basin (Attachment A).
 - Special considerations: All acre and mile values in this plan were obtained using Minnesota Department of Natural Resources (DNR) data and Geographic Information System (GIS) software.
- Shoreline: 6 miles
- Access: There is one public water access present between the main basin and Mud Slough (Attachment A).
- Watershed: Des Moines River, West Fork Des Moines - Headwaters
 - Watershed Area: 7,388 acres (12 square miles)
 - Watershed to Lake Ratio: 17:1
 - Inlets: Four different unnamed streams inlet intermittently into Lake Maria (Attachment A).
 - Land Use: Recreation and row-crop agriculture.
- Depth: The average depth is around 2.4 feet (ft.) at normal summer pool, with a maximum depth closer to 3.3 ft. The greatest depth ever recorded was approximately 4.0 ft. in 2011.
- Outlet: The outlet for Lake Maria is located on the southeast side of the lake and flows under County Highway 30 through a concrete box culvert into an unnamed semi-permanent wetland, which discharges into Lake Sarah (Attachment A).
- Water Control Structure: The outlet for Lake Maria is controlled by two submersible non-clog 5,000 GPM pumps, a 75 ft. sheet pile structure with four 5 ft. stop-log bays, and a 12 ft. by 5 ft. reinforced concrete box culvert (Attachment B). The reinforced concrete box culvert contains seven recessed fiberglass channels which house the bar stock electrodes for the Lake Maria electric fish barrier. The DNR has an easement (#113070) with a local landowner to construct, access, and maintain the pump house, water control structure, and fish barrier.
 - Runout Elevation: The normal managed runout elevation is 1525.37 ft. However, the runout elevation will be held at 1526.37 ft. when using the pump system to ensure that water from Lake Sarah does not backflow into Lake Maria.
 - Reinforced Concrete Box Culvert Invert Elevation: 1523.00 ft.
 - Sill Elevation: 1522.75 ft.
- Ordinary High Water Level: 1526.78 ft. (established in 1977)
 - Special considerations: All elevations listed in this management plan are in NAVD 88 datum.
 - To convert NAVD 88 to NGVD 29, subtract 0.68 ft.
- Water Level Readings: Water level readings have been taken periodically since 1969 (Figure 1).



Water Quality

Water quality measurements (e.g., phosphorus, conductivity, chlorophyll-a) have been taken intermittently on Lake Maria since 1948. These measurements have primarily been collected by the DNR Division of Fish and Wildlife. The amount of total phosphorus in Lake Maria water samples increased from 1948 to the late 1990s but decreased during the early to mid-2000s (Figure 2). The lowest total phosphorus value across all water samples ($n = 19$) was 0.03 milligrams per liter (2008; mg/L) and the highest value was 0.69 mg/L (1991), with the average being around 0.18 mg/L. The 2020 water sample had a total phosphorus value of 0.15 mg/L, which is only somewhat higher than the established Minnesota Pollution Control Agency (MPCA) total phosphorus impairment threshold (i.e., 0.09 mg/L; Western Corn Belt Plains area). The average Secchi disk reading in Lake Maria also has been above the established MPCA Secchi disk reading impairment threshold (i.e., 2.3 ft.; Western Corn Belt Plains area) during several years (i.e., 5 out of 15 samples; Figure 3), especially in years following managed drawdowns. The highest average Secchi disk reading across all years ($n = 15$) occurred in 2010 and was 3.1 ft. (Figure 3).



The impairment thresholds established by MPCA are eutrophication standards for shallow lake ecosystems. These standards have been created to help establish a balanced population of aquatic plants that supports a broad array of aquatic life uses and recreation (Class 2b & 2c water quality standards; Minnesota Rule [M.R.] Chapter 7050, 2002). Maintaining these standards promotes the establishment of native plants while minimizing dominance of non-native species and nuisance algal blooms. Managing total phosphorus concentrations below a range that promotes excessive algal growth is an important consideration of this plan. However, water transparency is the most significant threshold in relation to lake health and submersed aquatic plant abundance in southwest Minnesota. For that reason, water clarity will be considered the most important measure when contemplating managed water level drawdowns.

The improvement in water clarity from 1984 to 1991, 2006 to 2008, and 2011 to 2012 (Figure 3) can probably be attributed to the water level drawdowns that occurred in 1990, 2007, and 2011 (Figure 1). The decrease in total phosphorus from 2006 to 2008 also was likely a result of the 2007 drawdown. The drawdown in 1990 was conducted using a crisafulli pump. This dewatering project was successful until 1993, when record high water levels and rough fish (e.g., black bullheads, fathead minnows, common carp) activity eliminated most vegetation from the lake. Rough fish were so abundant in Lake Maria following this high water period that a mechanical fish barrier was installed in 1994 to inhibit fish access. The drawdown in the mid-2000s began in late 2006 and continued through the growing season of 2007. The basin was dewatered using a new submersible axial flow pump that was installed in 2005. A crisafulli pump also was used to assist the submersible pump in dewatering the basin during the 2006 drawdown because the submersible pump was not able to keep up with the inflows on its own. The mechanical fish barrier was replaced with an electric fish barrier in 2005 as well. A full drawdown was achieved, and the basin refilled during the fall of 2007 from precipitation. The 2011 drawdown took place after carp entered the basin during an electrical failure at the fish barrier. This drawdown was successful too and Lake Maria remained in a clear water state until 2019, when there was another electrical failure at the fish barrier. A partial drawdown was implemented during the fall of 2020 to facilitate the renovation of the existing pump system, sheet pile structure, and electric fish barrier.

Fish and Wildlife Habitat

Lake Maria is located 12 miles north of Slayton in Murray County, adjacent to Lake Sarah and approximately 5.25 miles northwest of Lake Shetek. Other priority shallow lakes in this area include Round Lake, Clear Lake, and Robbins Marsh. Round Lake and Lake Maria are two of the four designated wildlife lakes (Minnesota Statute [M.S.] 97A.101) in Murray County. Clear Lake is designated under M.S. 103G.407 as a shallow lake to be managed for fish, wildlife, or other ecological purposes by the DNR. Robbins Marsh also is managed by the DNR Section of Wildlife. Furthermore, Lake Maria Wildlife Management Area (WMA) surrounds most of the western shoreline of Lake Maria (Attachment A). Shetek WMA and Skandia WMA are nearby as well.

Historically, Lake Maria has provided important habitat resources for fish and wildlife, especially waterfowl. Lake Maria was considered an exceptional waterfowl lake from the 1900s through the early 1960s. Large stands of hardstem bulrush were present throughout Lake Maria due to the more consistent shallow water conditions. These conditions also created an optimal growing environment for submersed aquatic vegetation, which provides cover for fish and is an important food resource for wildlife. Waterfowl using these abundant resources during fall migration provided excellent hunting opportunities to waterfowl hunters, with some hunters coming from as far away as Chicago. However, during the mid-1960s, the quality wildlife habitat in Lake Maria began to diminish because of some major changes in its watershed. These changes, mostly associated with artificial drainage, resulted in high water levels, excessive bounce, high carp and bullhead populations, and turbid water conditions. These issues were further exacerbated in 1977 when the outlet structure on Lake Sarah was filled with cement to prevent private citizens from tampering with the stop-logs in the structure. This modification to the outlet structure raised the runout elevation on Lake Sarah by approximately 1.5 ft., which increased water levels in Lake Maria even more.

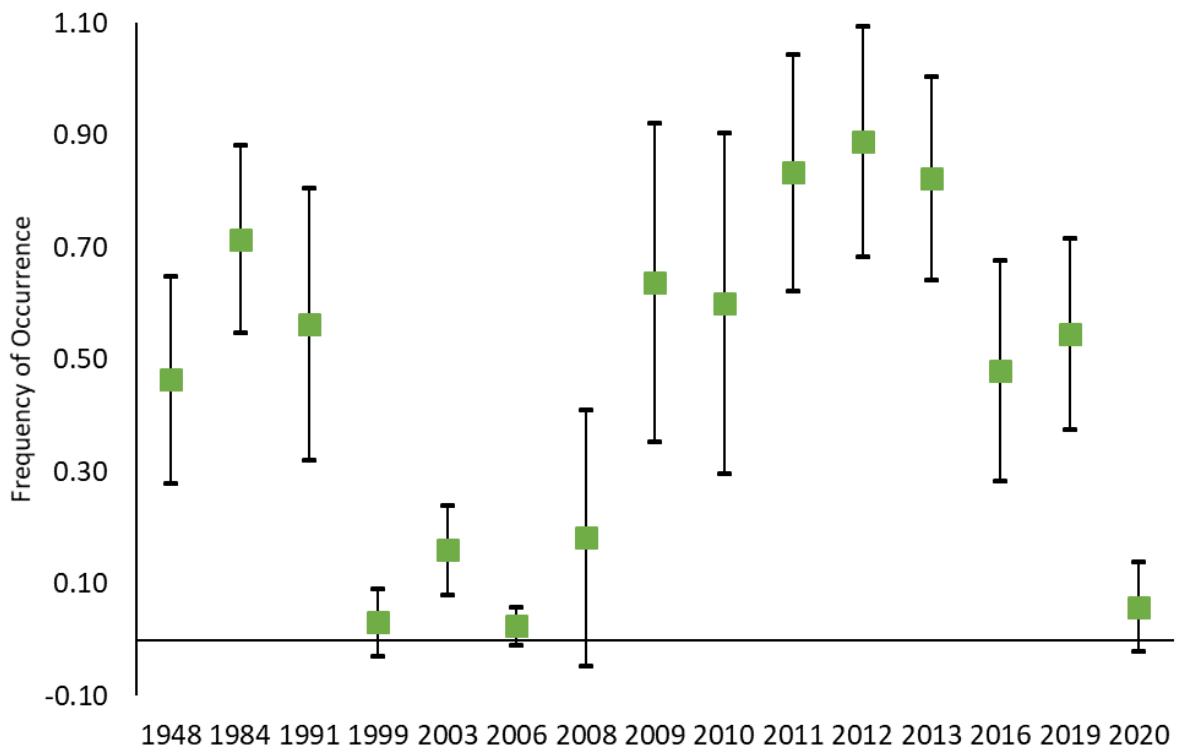


Figure 4. Frequency of occurrence for sago pondweed recorded during the game and wildlife lake surveys from 1948 to 2020.

There have been 4 game lake surveys and 11 wildlife lake surveys conducted on Lake Maria since 1948. Across all surveys, the average lake depth ranged from 1.8 to 3.5 ft. (Figure 3). Sago pondweed was the most dominant plant species and was observed across all surveys (Figure 4). However, the percentage of points with submersed aquatic vegetation varied from year to year. It should be noted that even though sago pondweed is considered an important waterfowl food, it is not a good indicator of habitat conditions because it tolerates high nutrient concentrations better than many other species of aquatic

vegetation. Furthermore, the greatest lakewide species richness (S) for aquatic vegetation (i.e., submersed and emergent vegetation) was observed in 2009 ($S = 10$) and the lowest lakewide species richness was observed in 1999, 2003, and 2006 ($S = 2$).

Wildlife Use

The wildlife use information for Lake Maria was collected during game and wildlife lake surveys. A variety of wildlife species have been observed throughout these surveys. Waterfowl observations included Canada geese, mallards, blue-winged teal, wood ducks, ruddy ducks, American wigeons, northern pintails, redheads, gadwall, red-breasted mergansers, and hooded mergansers. Waterbirds observed consisted of American white pelicans, great blue herons, pied-bill grebes, double-crested cormorants, killdeer, tree swallows, black terns, ring-billed gulls, American coots, Forster's terns, red-necked grebes, western grebes, trumpeter swans, common terns, Franklin's gulls, least bitterns, Virginia rails, great egrets, and sora rails. Other wildlife observations have included chironomids, water boatmen, snails, daphnia, water beetles, tadpoles, crayfish, painted turtles, leopard frogs, and muskrats.

Lake Maria has a long history of waterfowl hunting. Hunting camps on Lake Maria date back to the early 1900s and attracted waterfowl hunters from St. Paul, Milwaukee, and Chicago. One of the most prominent camps was leased from 1936 until the late 1970s by the employees of Minnesota Mining and Manufacturing Inc. (3M). Area residents also hunted Lake Maria during this time. However, waterfowl hunting declined dramatically after 1980 due to increased habitat degradation within the basin. There is little to no historical waterfowl harvest data on Lake Maria, despite all the reported hunting pressure, but many local hunters consider it one of the best waterfowl hunting lakes in southwestern Minnesota.

Fishery

Lake Maria is not managed for fish by the DNR Section of Fisheries because it is considered too shallow to support game fish. Therefore, there have been no formal fish netting surveys conducted on Lake Maria. The only information about fish assemblages in Lake Maria was collected during the game and wildlife lake surveys. Fish observations included common carp, black bullheads, fathead minnows, green sunfish, sticklebacks, yellow bullheads, yellow perch, orange-spotted sunfish, black crappies, northern pike, bigmouth buffalo, and walleye. The DNR Area Wildlife Manager and DNR Area Fisheries Manager may develop a predator fish stocking plan for Lake Maria in the future, if they agree that stocking predator fish would be feasible and result in prolonged habitat benefits.

Management Goals and Objectives

Goal: Optimize aquatic plant growth to improve water clarity and enhance fish and wildlife habitat.

- **Objective 1:** Re-establish aquatic vegetation communities and reduce undesirable fish populations through active water level management.
- **Objective 2:** Improve shallow lake habitat conditions, along with water quality and clarity.
- **Objective 3:** Maintain habitat and water quality improvements.

Proposed Management Actions to Achieve Objectives

Action 1: Conduct periodic temporary drawdowns, when climatic conditions provide an opportunity, as authorized by M.S. 97A.101.

Lake Maria was designated as a Wildlife Lake under M.S. 97A.101 in 1991. Wildlife Lake designation gives the DNR the discretion to restrict motorized watercraft use and manage water levels (e.g., conduct periodic lake drawdowns) to benefit wildlife. A lake drawdown is the temporary lowering of a lake's water level. Drawdowns are used to mimic natural low water periods because years with below average precipitation are occurring less frequently than in the past. Shallow lake ecosystems are adapted to periods of low water levels, but often deteriorate during periods of high or stable water levels. Therefore, drawdowns are an effective tool for shallow lake management.

Drawdowns on shallow lake basins enhance the abundance and diversity of aquatic vegetation. Bottom sediments hold a large, viable seed bank from the aquatic plants that historically grew in a basin. However, many species of emergent and submersed aquatic vegetation require a period of drying before their seeds will germinate. This dry period is most easily achieved by conducting a managed drawdown. Furthermore, drawdowns help consolidate bottom sediments and accelerate decomposition of organic material, which can provide a more stable substrate for aquatic plant growth. Drawdowns also are used to supplement the efforts of fish barriers in reducing and managing fish communities within a basin because fish barriers are fallible. These conditions (i.e., dense beds of aquatic vegetation and a reduced population of rough fish) help improve water quality and clarity, increase aquatic invertebrate abundance, and provide sufficient habitat resources for a variety of native fish and wildlife species.

Important Legal Considerations: A managed drawdown is a temporary lowering of a lake's water level that would not last longer than two consecutive years under normal climatic conditions (M.R. 6115.0271). The DNR will return the water level in Lake Maria to a normal managed pool elevation following a managed drawdown (M.R. 6115.0221). Drawdowns would not be done at times that would cause any downstream flooding damage to private property and or roads.

If a managed drawdown appears feasible based on climatic conditions, the DNR will consider implementing either a winter drawdown or a growing season drawdown on Lake Maria to the maximum extent possible. It is anticipated that winter drawdowns would occur from mid-August through April of the following year and growing season drawdowns would take place mid-August into summer of the following year. However, a managed drawdown will be considered anytime Lake Maria is experiencing a year with average or below average precipitation (i.e., the water elevation at the outlet is ≤ 1525.50 ft.) and at least one of the following drawdown triggers are met:

- Average summer Secchi disk reading from June-September falls below 2.3 ft.;
- Submersed aquatic plants cover less than 80% of the lake using present day systematic point sample stations;
- Emergent aquatic plants cover less than 20% of the lake using aerial imagery and present day systematic point sampling stations;

- Undesirable fish are present at densities high enough to affect water quality and habitat conditions.

It should be noted that the timing of a managed drawdown will be adaptive and based on local land conditions. Water levels in Lake Maria also will be monitored regularly during a managed drawdown in case adjustments need to be made to either the pump system or the drawdown timeline. Factors such as precipitation patterns, vegetation response (i.e., both emergent and submersed aquatic vegetation), water level data, presence or absence of rough fish in the basin, water clarity, sediment consolidation, and length of time since the previous drawdown will be used to evaluate the drawdown timeline and determine if a managed drawdown should extend into a second year. It should take approximately 15 days using both pumps operating together and 28 days using only one pump to dewater Lake Maria. The DNR's drawdown timeline can be adjusted if weather patterns, ice conditions, management objectives, or water flows indicate the need. The primary purpose of a winter drawdown will be to promote a fish winterkill in the basin and the intention of a growing season drawdown will be to encourage the growth of aquatic vegetation. Prior to conducting a drawdown, the DNR Section of Wildlife will notify the DNR Area Hydrologist and other stakeholders, as necessary. Given the design of the water control structure, 1522.75 ft. (i.e., the sill elevation) is the lowest elevation that Lake Maria could be lowered to.

Desired outcomes of a managed drawdown are as follows:

- Average summer Secchi disk reading from June–September exceeds 2.3 ft.;
- Average summer total phosphorus and chlorophyll-a levels from June–September are below MPCA impairment thresholds for shallow lakes in southwest Minnesota (i.e., total phosphorus < 0.09 mg/L and chlorophyll-a < 0.03 mg/L);
- Aquatic plant diversity and lake wide plant species richness of 6 or more;
- Submersed aquatic plants cover at least 80% of the lake using present day systematic point sample stations;
- Emergent aquatic plants cover more than 20% of the lake using aerial imagery and present day systematic point sampling stations;
- A substantial increase in waterfowl use, especially during spring and fall migrations.

Important Consideration: If hybrid cattail becomes overly abundant because of drawdown conditions, the DNR can pursue necessary permits and consider available tools (e.g., mechanical removal, aerial herbicide applications) to help control it.

The primary intent of a managed drawdown is to expose lakebed and/or increase the likelihood of fish winterkill. However, DNR personnel should examine the existing habitat conditions, migration patterns, and the needs of game and nongame species as well to limit unintended adverse impacts when determining the drawdown timeline. For example, if pursuing a later season drawdown, the DNR should think about providing a shallow pool area as refuge for hibernating reptiles and amphibians. When refilling a basin after a drawdown, DNR personnel also should consider the impact that changing water levels might have on wildlife and the flow to downstream areas.

Action 2: Maintain electric fish barrier.

A properly functioning fish barrier could minimize the need for managed drawdowns. The electric fish barrier between Lake Maria and Lake Sarah needs to be maintained in good working order so that it is always operational. Smith-Root, Inc. (Vancouver, WA, USA) will inspect the fish barrier on an annual basis and promptly resolve any problems identified by inspection. The DNR Section of Wildlife also will respond to any power failure (as notified by the e-mail system) by ensuring that the backup generator is functioning properly. The electric fish barrier will be turned on as soon as practical after ice-out in the spring and turned off prior to ice-up in the fall of each year. Additional fish management options also will be considered (e.g., rotenone, additional fish barriers) when applicable, especially as new information or techniques become available.

Action 3: Monitor water quality parameters, aquatic plants, and the fish community periodically to determine when additional management is necessary.

When conditions fall below the outlined thresholds, the previously proposed management actions will be considered and implemented. The DNR will conduct wildlife lake surveys periodically, using systematic point sampling methodology, to calculate aquatic plant distribution, diversity, and abundance for general monitoring purposes. Water quality parameters also will be monitored on a regular basis, using an approved water quality-sampling regime. In addition, the DNR will conduct both pre- and post-drawdown monitoring to determine drawdown success. An existing permanent water level gage is located on the outlet structure to monitor water levels during an attempted drawdown and outside the drawdown period (stipulated by M.R. 6115.0221).

Action 4: Collaborate with local partners to identify strategic watershed management opportunities and promote Best Management Practices in the watershed.

Conservation work within the watershed is an important tool in shallow lake management. The protection of existing habitats and restoration of critical areas within the watershed are vital to sustaining water quality and habitat conditions within the lake. Any improvements within Lake Maria (i.e., improved water quality, a reduction in rough fish, and enhanced wildlife habitat) and its watershed also should benefit other basins in the area, such as Lake Sarah and Lake Shetek. The DNR will continue to coordinate with local partners (e.g., Lake Sarah Pal's Club, Lake Shetek Improvement Association, Ducks Unlimited) to target conservation programs and land stewardship improvements within the Lake Maria watershed.

Management Plan Revisions

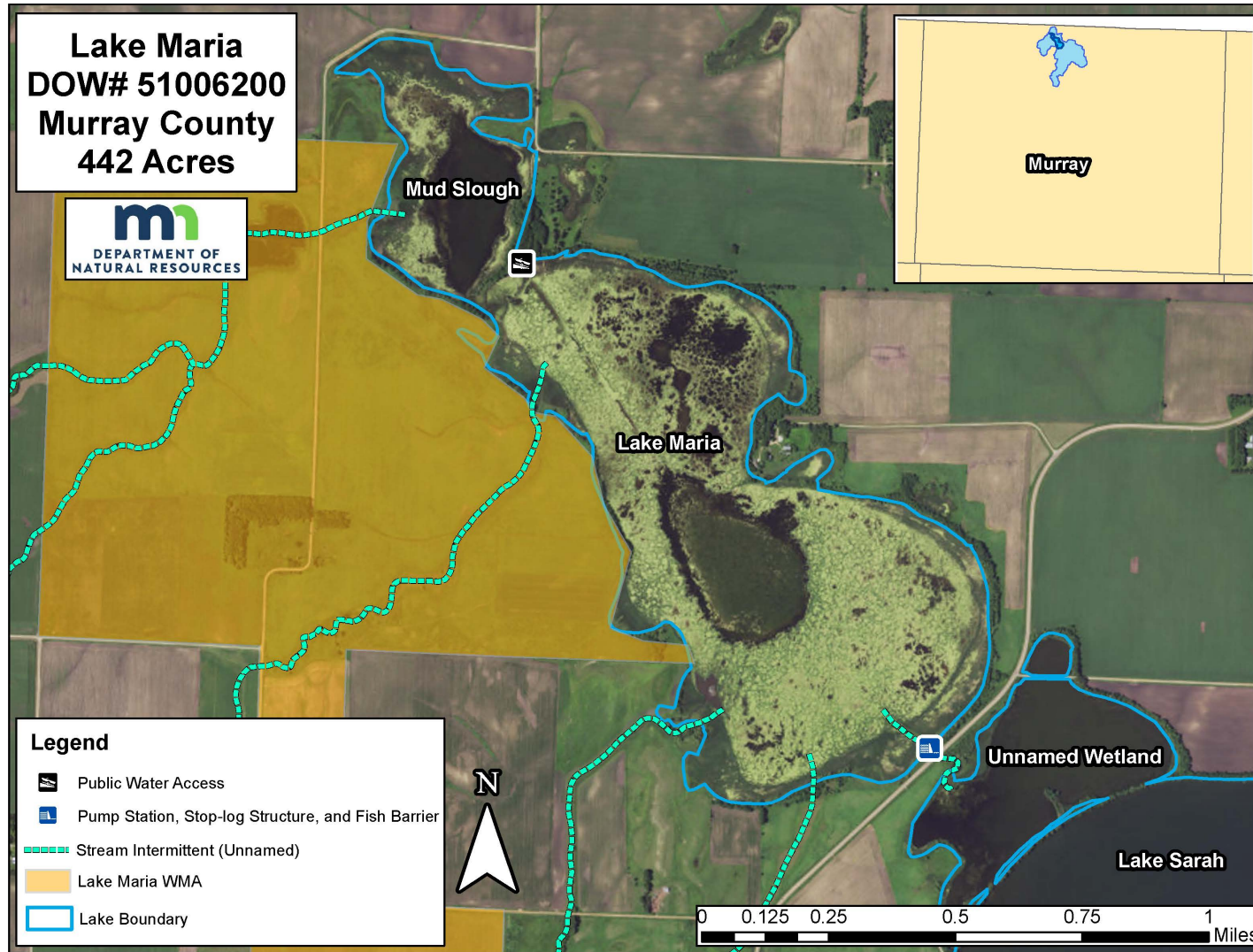
The management plan for Lake Maria will be revisited as necessary to assess the effectiveness of the plan and determine if changes and/or updates are required. Modifications to this management plan will be made in cooperation with local partners and stakeholders. Any substantial changes to this plan will require additional public input.

Lake Maria (DOW# 51006200), Murray County

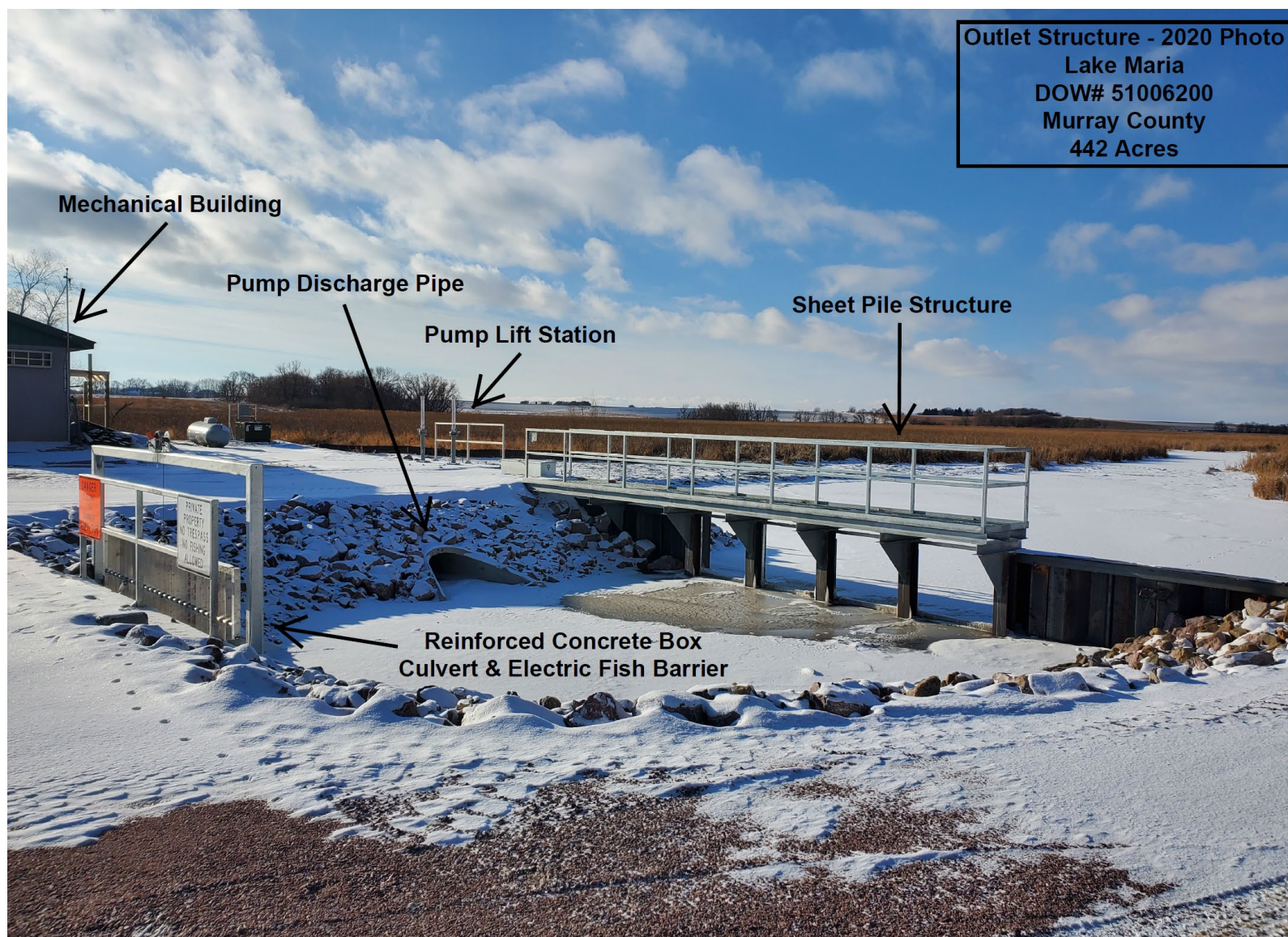
Management Plan

Signature/Approval Sheet

| Signature | Date |
|---|------|
| <hr/> X <hr/> Bill Schuna Area Wildlife Manager | |
| <hr/> X <hr/> David Trauba Regional Wildlife Manager | |
| <hr/> X <hr/> Kelly Straka Wildlife Section Manager | |
| X <hr/> Dave Olfelt Division Director | |



Attachment A. Map of Lake Maria illustrating the basin, wildlife management areas, inlets, outlets, public water access, and water control structure.



Attachment B. Picture of water control structure that displays the location of the sheet pile weir, electric fish barrier, pump station, and mechanical building at the outlet of Lake Maria.