Lake Vegetation Management Plan

☐ **Variance Requested by Cooperator**
☐ **Variance Approved (see Section VI)**

Section I: Lake Information

Name: Sarah DOW Number: 27-0191-01 (Lake Sarah - West Bay) and 27-0191-02 (Lake Sarah - East Bay) County: Hennepin
Fisheries Area: West Metro Surface Acres: 553 Littoral Acres: 356
Classification: ☐ Natural Environment ☒ Recreational Development ☐ General Development
Cooperator(s): Pioneer Sarah Creek Watershed Management Commission, Three Rivers Park District

Section II: Water Quality and Plant Community

A. Water Quality

☒ Total Phosphorus: 101.0 Date: Average during 1996-2008, except 1999, 2001, 2003
☒ Secchi Disc: 1.5 Date: Average during 1996-2008, except 1999, 2001, 2003
☒ chlorophyll 'a': 41.9 Date: Average during 1996-2008, except 1999, 2001, 2003

Narrative (describe water quality concerns, quantify TSI): Lake Sarah was listed in Minnesota's impaired waters list in 2006 due to excessive phosphorus, which negatively affected the lake's suitability to support recreational uses like fishing and swimming. Based on monitoring data collected between 1996 and 2008, water quality in the lake is worse than the lake eutrophication standards for deep lakes in the North Central Hardwood Forest (NCHF) ecoregion of 40 ug/l total phosphorus, 14 ug/l chlorophyll a, and 1.4 meters water clarity as June-September mean values. Lake Sarah typically has TSI values for each parameter that range between 54 and 71, indicating eutrophic conditions. High phosphorus concentrations have caused severe algal blooms that have had a signficant negative affect on water clarity. This in turn appears to be favoring aquatic exotic invasives such as eurasian water milfoil and curly leaf pondweed that have a competitive advantage over native macrophytes under low light conditions. A TMDL and associated implementation plan were completed for the lake in 2011 and are being executed.

B. Plant Community:

Narrative (describe plant community, list common, rare, or other important aquatic plant species, list plant surveys): The most recent aquatic plant surveys for Lake Sarah were completed in 2011 by Three Rivers Park District. The surveys were completed on June 6 and August 11, 2011 and followed the point intercept methodology developed by Madsen (1999). Aquatic plants were surveyed at 197 points within the littoral zone of both basins of the lake. Both surveys of Lake Sarah had a species richness of 16, including free-floating plants (4), floating-leaf plants (2), and submergent plants (10). The most dominant plant species include curly-leaf pondweed, Eurasian watermilfoil, and coontail. Both curly-leaf pondweed (CLPW) and Eurasian watermilfoil (EWM) are non-native plant species.

The percent frequencies of the following aquatic plant species found in Lake Sarah (west and east basins) during the early summer (Table 1) and late summer (Table 2):

Table 1. Lake Sarah Aquatic Plant Survey on June 9, 2011

Scientific Name	West	East	
Ceratophyllum demersum	16	43	(Coontail)
Potamogeton cripus	64	69	(CLPW)
Myriophyllum spicatum	17	41	(EWM)
Nuphar advena	0	3	
Nymphaea odorata	8	14	
Lemma minor	3	0	
Stuckenia pectinata	2	1	
Elodea canadensis	2	7	
Potamogeton folius	2	8	
Lemna trisulca	7	14	
Wolffia columbiana	1	0	
Potamogeton zosteriformis	0	3	
Chara	0	3	

Table 2. Lake Sarah Aquatic Plant Survey on August 11, 2011

Scientific Name	West	East	
Ceratophyllum demersum	38	51	(Coontail)
Potamogeton cripus	6	7	(CLPW)
Myriophyllum spicatum	15	17	(EWM)
Nymphaea odorata	12	12	
Lemma minor	0	3	
Stuckenia pectinata	0	1	
Wolffia columbiana	0	1	
Elodea canadensis	0	4	
Potamogeton folius	1	1	
Vallisneria americana	3	3	
Lemna trisulca	17	23	
Spirodela polyrhiza	0	4	
Najas flexilis	1	0	
Nuphar advena	0	3	

Aquatic plant surveys were also completed for Lake Sarah between 2006 and 2009.

Information was also recorded on the density ratings for curlyleaf pondweed in each basin for the 2011 June survey. The density ratings for clpw for 2011 are shown below and are based on a rating scale of 0 to 5, with 0 being no evidence of clpw, 3 being moderate growth where recreation and navigation activities may be hindered, and 4 and 5 being heavy growths where navigation and recreational activities are severely limited.

Density	Number of Acres	
	West	East
0	87.4	38.2
1	29.8	27.5
2	39.6	7.5
3	29.8	10.7
4	19.9	0.0
5	33.6	32.0

The data indicates that at the time of the survey on June 9, 2011, 83.3 acres of the west basin and about 43 acres of the east basin (almost 35% of the littoral zone surveyed) supported moderate to heavy growths of curly-leaf pondweed.

Section III: Public Input Process (narrative):
There are approximately 165 shoreline owners surrounding Lake Sarah, of which the largest lakeshore owner is the Three Rivers Park District (as part of Rebecca Park). Due to the recent TMDL process, a public input meeting was held in January 2011. Further, the Lake Sarah Improvement Association (LSIA) has mailed three educational newsletters and held three open meetings (including non-members) in April, July, and November 2011. All of these meetings included public education and awareness from Richard Brasch as to the TMDL findings, the specific TMDL Implementation Plan, and LSIA proposed specific actions which are consistent with the TMDL Implementation Plan.

LSIA membership has grown 33% just this past year, to an all-time record 179 paid members. With this increased membership, our ability to educate and gain consensus as a lake association as to how we propose to address internal phosphorus loading is much improved as well. Additionally, we are fortunate to have an actively managed and monitored website (www.lakesarah.com) to serve our lake community. You will not find a more comprehensive and content fresh website serving our lake association as this one!

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<u>Section IV</u>: Problems to be Addressed in this Plan (narrative):

Problems to be addressed in Lake Sarah via this plan are:
1) Protect and/or improve water quality
2) Enhance native plant community diversity
3) Protect the fishery
4) Increase the area of the lake supporting active uses and recreational access

Lake Sarah is heavily used for both recreation and fishing. Poor water quality in Lake Sarah and the corresponding algal blooms (as described above in Section II) have contributed to negative impacts on the native plant/fish communities and recreational access to the lake. Low disolved oxygen, resulting from seasonal algal blooms and macrophyte decomposition (primarily curlyleaf pondweed, in the summer) have caused severe algal blooms that have had a signficant negative affect on water clarity, and likely contribute to only higher densities of invasive plants species and reduced native plant diversity. Consequently, it becomes increasingly important to shift Lake Sarah from the algal dominated state to a clear water state, which supports a more diverse native plant community and improved water quality.

The primary driver of poor water quality in Lake Sarah is high concentrations of phosphorus, currently at 101 ug/l which is 2.5 times greater than the 40 ug/l standard for our type of lake. Based on observations in Lake Sarah and surrounding lakes (most notably Lake Rebecca), phosphorus loads from both internal and external sources must be reduced to return the lake to a clear-water state.

Agricultural land uses throughout the watershed historically provided significant sources of nutrient loading to Lake Sarah. Several grants have recently been submitted to help reduce watershed loading, and further projects focused on reducing external loading are currently being explored.

In-lake water quality conditions for Lake Sarah appear to be more heavily influenced by the internal loading of nutrients that have accumulated within the lake over time. The two sources of internal loading that have been identified are related to changes in the aquatic plant community and sediment release of phosphorus.

Curly-leaf pondweed (Potamogeton crispus) has been identified as a factor inhibiting recreational use (via surface matting) as well as potentially degrading in-lake water quality. According to the aquatic plant surveys in Section II above, Lake Sarah has substantial surface area coverage of curly-leaf pondweed, with nusiance growth conditions in the spring. Curly-leaf pondweed is an invasive species that competes with other native plant species because of its unique life cycle. The plant germinates from turions (seed structures) in early fall and continues to grow slowly during the winter months when other native plants are dormant. Curly-leaf pondweed growth increases after ice-out, due to an increase in light availability. The plant begins to die-off (referred to as senescence) after the completion of turion production by the end of June or early July. The approved TMDL identifies decomposition of curly-leaf pondweed as contributing over 900 pounds of phosphorus load to the lake, about 17% of the overall phosphorus load entering the lake under existing conditions.

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<u>Section V</u>: Goals for Management of Aquatic Plants (narrative, include a description of efforts to protect rare features):
The goals we have are to:
1) Reduce the occurrence of curly-leaf pondweed
2) Enhance native plant community diversity
3) Improve water quality
4) Protect the fishery
5) Increase recreational access on Lake Sarah

Early spring applications of Aquathol to control curly-leaf pondweed are proposed for the next 5 years (2013-2017; following the first "pilot" year of application in 2012). Chemical application will occur prior to the germination of native plants - specifically targeting curly-leaf pondweed and minimizing potential impacts to the native plant community. In addition, these early season treatments will occur before the development of turions, leading to a long-term reduction in the sediment turion density. A similar approach for CLPW control has been employed at Lake Rebecca during the last three years and has generated positive results in curly leaf pondwed control and enhancement of native macrophyte populations.

Our pilot approach, which with a timely approval of this LVMP, will begin in 2012. We have explored with other leading lake associations - most notably Beebe Lake and Lake Sylvia - who as lake associations have performed their own early season low dose Aquathol treatments - and have been extremely pleased with their results. Professional herbicide applicaton companies operating in the state of Minnesota we feel are inundated with both whole lake and individual orders for spring treatments such that they can't possibly monitor the precise lake water temperatures and the precise stage of the curly-leaf pondweed - combined with the ideal weather conditions for applicating that are required in order to achieve an optimal application result. By doing this ourselves, with responsible volunteers, we feel strongly we can best monitor the precise timing and conditions for an optimal treatment, and from what we've learned from other lake associations that have self-applied their treatments, the cost savings to the total application costs can be from 50-70% by using volunteer labor. We plan to build our own application system, and will model it after what Beebe Lake has been using sucessfully for several years. We will use GPS mapping technology to ensure we have the appropriate coverage. This can be supervised preferably by a DNR expert staff member or by an experienced Three Rivers Park District staff member. During our first "pilot" year, we will not target the treatment of all our littoral acres, but rather will select certain bays and/or shorelines that have a high density of curly-leaf pondweed - and of which all of the contiguous shoreline owners have provided their approval for the treatment. We will also plan to monitor these pilot areas - and actively share the results to all lakeshore owners - so that we can educate and build the consensus for what we hope will be a cost effective treatment of our entire littoral zone in 2013-2017.

Curly-leaf pondweed suppresses native plant growth due to its early season growth patterns and potentially contributes to internal loading of phosphorus through two mechanisms; direct release from plant tissue decomposition and an increased potential for sediment resuspension (from reduced macrophyte root coverage). Thus if curly-leaf pondweed is controlled, phosphorus release from tissue

decomposition will be reduced, but phosphorus release from sediment resuspension and anoxia may continue to perpetuate an algal dominated lake-state - suppressing native macrophyte growth. To further reduce internal loading of phosphorus and stimulate native plant growth, an alum treatment will be conducted sometime after signficant completion of the proposed 5-year curly leaf pondweed control effort and after most of the watershed load reduction has been achieved. Thus, a well-timed alum treatment could improve lake water clarity such that native plant diversity may increase dramatically.

In summary, as neighboring Lake Rebecca is just three years ahead of Lake Sarah in this journey, we plan to monitor closely their results and learn with every treatment step of their process - such that we can better ensure our cost effective success in reducing phosphorus.

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Section VI: Operational Treatment Plan (map marked with areas where control of plants is anticipated):

A. Commons Area (>150' from shore)

☐ Mechanical Control: acres to be treated, % of littoral area

Narrative:

☒ Herbicide Control: up to 356 acres to be treated, up to 100 % of littoral area

Product(s): Aquathol - K (or equivalent approved Endothal)
Rate of Application: 1 to 1.5 mg/L
Timing of Application: Early Spring - late April to early May

Narrative: Early spring applications of Aquathol to control curly-leaf pondweed are proposed for the next 5 years. The first year (ideally in 2012) we will only apply on a pilot basis an estimated 50 - 100 acres of the littoral area. However, as we develop our application process in this first pilot year, we would intend to self apply the entire littoral area starting in 2013 and taper the application area over several years as we see no curly-leaf pondweed present. Chemical application will occur prior to the germination of native plants to specifically target curly-leaf pondweed and before the development of turions. Water temperatures will be monitored by LSIA volunteers to ensure applications are made in the recommended 50 to 60 degree Fahrenheit range. As water temperatures reach this ideal range, an Invasive Species Specialist will then make the recommendation regarding the appropriate day(s) for treatment to take place. Each year, the treatment area will be established based on annual in-lake point intercept surveys.

☒ Other: 197 acres to be treated, 0 % of littoral area

Narrative: An alum treatment is proposed to be applied sometime after the intial 5-year and after the bulk of the watershed load reduction measures have been implemented. It is anticipated that the improvement in water clarity conditions will enhance native plant growth. We understand that this document does not authorize an alum treatment, we simply mention it here as part of our longer term plan to reduce phosphorus levels, improve water clarity, which in turn will help to restore native plant populations.

B. Individual Permit Standards (new permits)

Chemical Treatment of Submerged Vegetation: feet along shore feet lakeward

Narrative:

Mechanical Treatment of Emergent Vegetation: feet along shore to open water

Narrative:

Other Treatment - : feet along shore feet lakeward

Narrative:

Section VII: **Funding** [check all that apply]

- ☒ Lake Association
- ☒ DNR Grant
- ☐ Lake Improvement District (LID)
- ☐ Conservation District

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Section VIII: Variance(s) and Justification(s) [check all that apply]

☒ **Application of pesticides to control submerged vegetation along more than 100 feet of shoreline per site belonging to an individual riparian property owner (M.R. 6280.0350, Subpart 4, A), (list justification below) [Example justification: To maximize the control of curly-leaf pondweed by treating as large a contiguous area as possible to minimize dilution of herbicide.]**

☒ **Application of pesticides to control dense growths of aquatic macrophytes that do not interfere with watercraft use, swimming, or other traditional recreational uses (M.R. 6280.0250, Subpart 2, A, (2)) [Includes the prohibition on application of pesticides to improve the appearance of undeveloped shoreline (M.R. 6280.0250, Subp. 4, B)].**

☒ **Application of pesticides to control submerged vegetation in more than 15 percent of the littoral area (M.R. 6280.0350, Subp. 4, A). (list justification below)**

☐ **Application of pesticides to control aquatic macrophytes in natural environment lakes established pursuant to part 6120.3000 (M.R. 6280.0250, Subp. 4, E.). (list justification below)**

☐ **Mechanical control of aquatic macrophytes in more than 50 percent of the littoral area (M.R. 6280.0350, Subp. 3, B). (list justification below)**

Justifications (identify which variance and provide the rational for all items checked above):

The justifications for the top three variances checked above have been recommended by Richard Brasch of the Three River's Park District, who was instrumental in the writing and specific recommendations of the detailed Lake Sarah TMDL implementation plan. Richard has also prescribed and implemented the same early season low dose herbicide approach for Lake Rebecca, which is now three years into their treatment approach and the resulting water quality is much improved. We clearly intend to follow in the footsteps of the success demonstrated on Lake Rebecca.

☐ **Variance approved without condition(s)**

☐ **Variance approved with following conditions(s):**

☐ **Pretreatment data collection**
Narrative:

☐ **Post treatment data collection**
Narrative:

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☐ **Evaluation**
Narrative:

☐ **Other:**
Narrative:

<u>Section IX</u>: Signatures

This Lake Vegetation Management Plan is in effect for years from date of Regional Fisheries approval.

DNR Approval

Submitted By: _____

Title: _____

Date: _____

_____ _____
Area Fisheries Supervisor Date

_____ _____
Regional Fisheries Approval Date

_____ _____
Regional Ecological Resources Approval Date

I affirm that I am an authorized representative of and acknowledge participation in the development and implementation of this lake vegetation management plan.

_____ _____
Cooperator's Signature and Title Date

Either party may terminate participation in this plan at any time, with or without cause, upon 30 days' written notice to the other party.