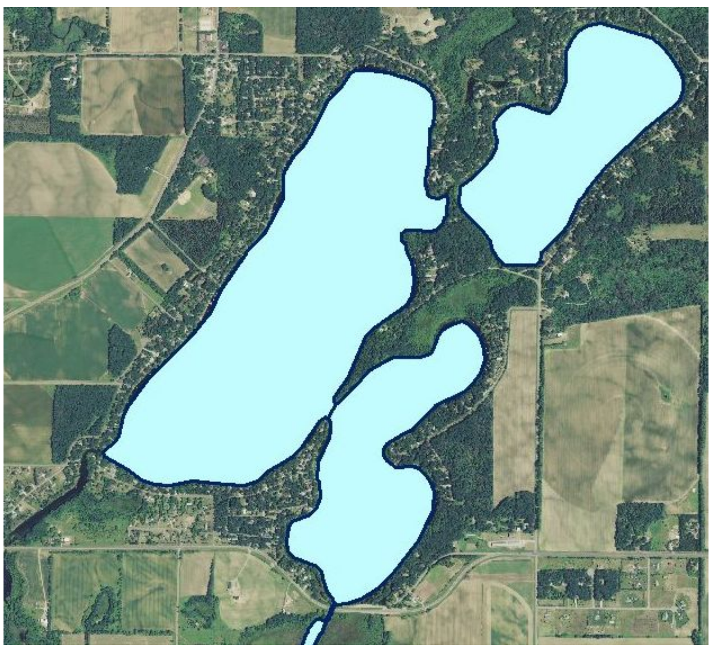
Lake Management Planning & Guidance

Briggs, Julia, and Rush Lake

Sherburne County, MN (#71-0146, 71-0145, 71-0147)

February 2018



Prepared By
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Funded By
Three Lake Improvement District

Purpose & Context

This management plan has been created to guide the Three Lake Improvement District (TLID) in its work to protect and improve Briggs Lake, Julia Lake, and Rush Lake in Sherburne County, MN. Other agencies and groups have developed various plans and programs that will help to protect and improve these lakes. These include:

(1) Mississippi River (St. Cloud) Watershed Total Maximum Daily Load (2015)
(2) Minnesota Pollution Control Agency Monitoring
(3) Minnesota DNR Fisheries and Aquatic Invasive Species Programs

These plans and programs are an important part of protecting and improving the lakes, but are generally written to manage water issues on a watershed-wide or regional scale. Consequently, they are not focused solely on the Briggs Chain of Lakes and do not provide adequate guidance on some of the issues identified by TLID and lakeshore homeowners.

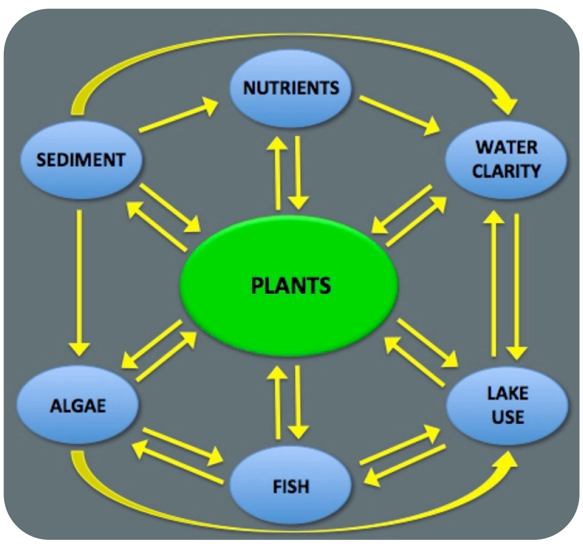
This plan is designed to complement these existing plans and programs by focusing on aspects of lake management that (1) directly impact lakeshore homeowners and how they use the lake, (2) are within the realm of influence of the lake improvement district, and (3) are feasible given the financial and time limitations of the lake improvement district. Furthermore, we have tried to keep this plan streamlined to make it easier for the TLID board to review, implement, and update items as needed. When possible, we have summarized or referenced supporting information from other sources rather than simply cutting and pasting large amounts of information into this document.

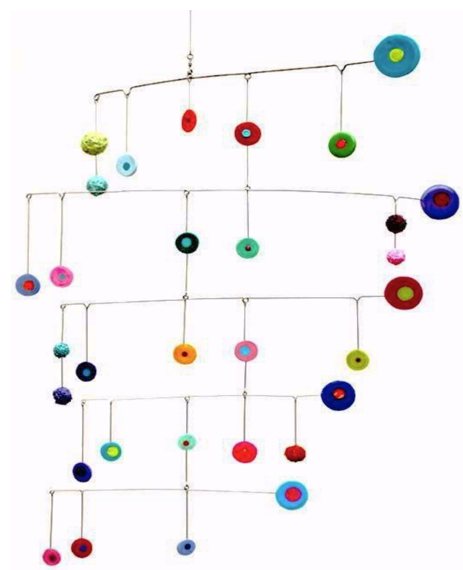
This plan should be thought of as a living document that adapts and grows in reaction to changes in the lake and its watershed. Accordingly, the TLID board should adopt a schedule for reviewing and updating this plan.

Understanding Lake Management

Lakes are complex. The things that we try to affect with lake management, like water clarity, aquatic plant abundance, and fish populations, are closely tied to many other lake conditions. Like a hanging mobile with many dangling weights, these interconnected aspects of lakes are always shifting and maintaining a dynamic balance. If we push one weight in a mobile, all of the other arms and weights bounce around and shift to maintain balance. Similarly, when we change one aspect of a lake, many other aspects of the lake will change until a new balance is achieved.

This complex and interconnected nature of lake ecology means that we need to think holistically to help us make the best management decisions, foster realistic expectations, and avoid undesirable consequences. To help foster this holistic thinking, each management item in this plan includes a list of contributing factors and possible impacts to other aspects of the lake. These should be considered and discussed before deciding on a course of action.





Summary of Lake Information

	Briggs	Julia	Rush
DOW#	71-0146	71-0145	71-0147
Morphometry			
Surface Area (acres)	404 [ab]	154 [a] / 152 [b] / 155 [c]	161 [a] / 160 [b]
Littoral Area (acres)	170 [a] / 218 [b]	154 [a] / 135 [b]	161 [a] / 160 [b]
Max Depth (ft)	25 ft	15 [ab]	11 [a] / 10 [b]
Mean Depth (ft)	11.7 [a] / 13 [b]	8 [ab]	6.7 [a] / 5 [b]
Volume (ac-ft)	5211 [b]	1203 [b]	984 [b]
Shoreline (mi)	3.9 [a]	2.3 [a]	2.7 [a]
Watershed			
Lakeshed Area [b]	8619	725	8892
Lakeshed:Lake Area	21:1	5:1	56:1
Land Use [b]			
-Developed	11%	15%	11%
-Forest	36	69	35
-Cropland	26	3	24
-Hay/Pasture	13	9	12
-Wetland	12	4	11
Nutrient Loading [b]			
-Total P Load (lbs/yr)	3032	376	2765
-External P Load	1343 (44%)	165 (44%)	1476 (53%)
-Internal P Load	1688 (56%)	212 (56%)	1290 (47%)
-No. of Septic Systems	177	116	90
-Est. % Failing	10-35%	10-35%	10-35%
Water Quality [c]			
-Secchi (ft)	1.3	2.3	1.1
-Total P (ppb)	94	–	–
-Chl-a (ppb)	46	–	–
Trophic State Index			
-Secchi	63	–	–
-Total P	70	–	–
-Chl-a	68	–	–
Trend [c]	No Trend	–	No Trend
Listed as Impaired	Yes (Nutrients)	Yes (Nutrients)	Yes (Nutrients)

[a] Minnesota DNR Lakefinder
[b] Mississippi River (St. Cloud) Watershed TMDL (2015)
[c] Minnesota Pollution Control Agency Website (2018)

Fishery [a] (see DNR fishery reports in the supporting materials)

Fish Consumption Guidelines in place for mercury [c]
Stocked with walleye fry in even years (1990–2016) [c]
Walleye (primary management)
Northern Pike (secondary management)
Largemouth Bass
Smallmouth Bass
Bluegill
Black Crappie
Pumpkinseed
White Crappie

Aquatic Plants

Floating and Submersed Species Present in the Briggs Chain of Lakes: [a]
Eurasian watermilfoil (Invasive; only found in Rush as of 2017)
Curlyleaf pondweed (Invasive)
Coontail
Canadian waterweed (Elodea)
Northern Watermilfoil
Water stargrass
Bushy pondweed
Illinois Pondweed
Largeleaf Pondweed
Claspingleaf Pondweed
Wild Celery
Horned Pondweed
White waterlily

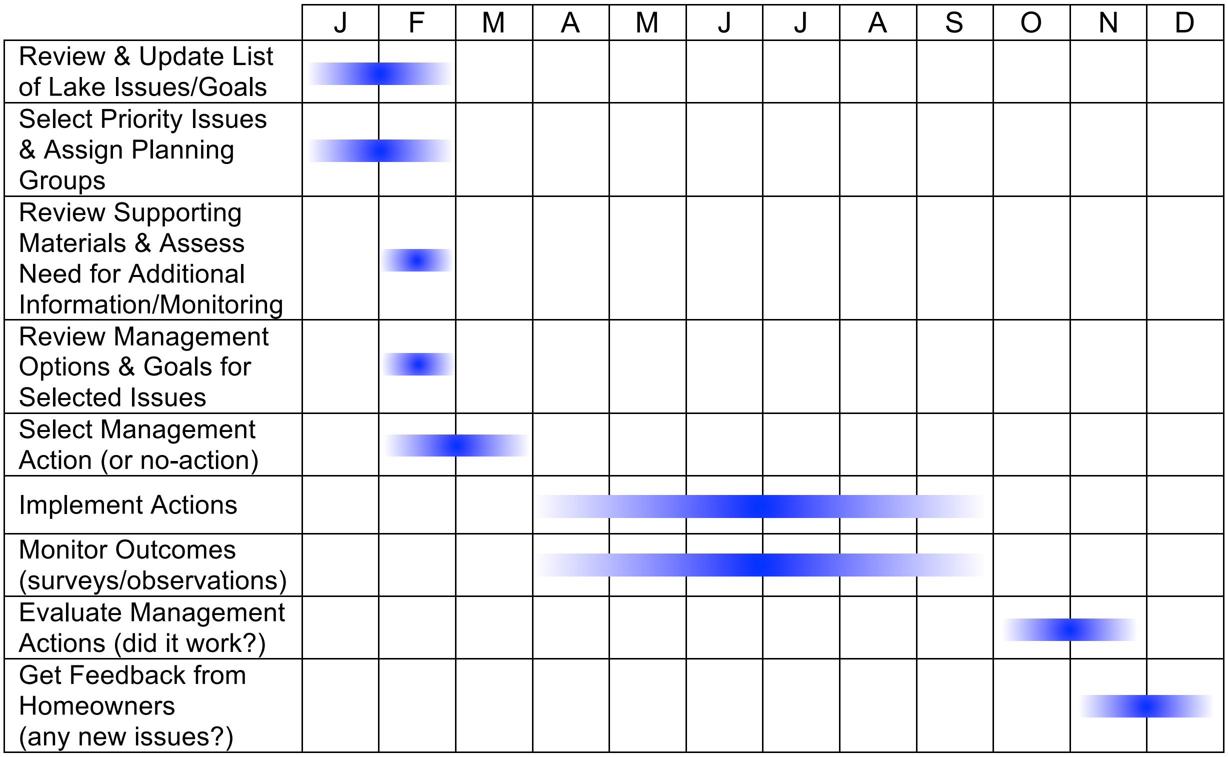
Point-Intercept Plant Surveys:
Rush and Julia Surveyed by University of Minnesota (James Johnson) 3x annually from 2006 through 2009

Delineation Surveys:
Conducted by James Johnson (Freshwater Scientific Services) for Curlyleaf Pondweed and Eurasian Watermilfoil

[a] Minnesota DNR Lakefinder

Management Planning Process

Recommended Annual Planning & Management Activities



Prioritized List of Lake Issues

Priority	Issue	Detail	Timing	Uses Impaired	See Page
1	Eurasian Watermilfoil	As of 2017, EWM has only been found in Rush Lake. However, EWM is slowly spreading and becoming more abundant despite active management	June-Sept	Potential to impair Access, Boating, Waterski/Tubing, Swimming, Aesthetics	8
2	Curlyleaf Pondweed	Invasive plant; forms areas of dense, surface-matted growth in some areas and releases nutrients upon die-off in early summer	April-May	Access, Boating, Waterski/Tubing, Swimming, Aesthetics	11
3	Preventing New AIS Infestations	Enhance prevention strategies; Early Detection/Rapid Response Planning	Year-Round	Boating, Waterski/Tubing, Swimming, Fishing, Aesthetics	14
4	Filamentous Algae	Filamentous algae mats floating and on plants, particularly bad in Briggs Bayou	May-June	Swimming, Aesthetics	16
5	Dense Native Plants	Coontail in Briggs Bayou, Chara and Naiad in Julia	July-Sept	Access, Boating, Swimming, Aesthetics	18
6	Low Water Clarity	Planktonic algae reduces water clarity; particularly in Briggs and Rush	June-Aug	Swimming, Aesthetics	20
7	Protect/Promote Diverse Native Plant Community	Protect areas that currently support diverse native plants; promote native plant colonization in additional areas where they will not interfere with boating and swimming	May-Sept	Fishing, Aesthetics	22
8	Invasive Carp	Carp may destroy aquatic plants, increase internal phosphorus load, and increase turbidity	Year-Round	Fishing, Swimming, Aesthetics	23

1 – Eurasian Watermilfoil: Context

Description of Problem:
Eurasian watermilfoil (EWM, *Myriophyllum spicatum*) was first reported in Rush Lake in 2014. As of 2017, no EWM has been found growing in Briggs or Julia. EWM is an invasive aquatic plant that forms dense areas of surface-matted growth in the summer and early fall. Areas of dense growth typically shade out native aquatic plants, reduce the quality and variability of habitat for fish, and impair boating and swimming in EWM beds.

EWM spreads between and within lakes primarily through the transport of plant fragments. Even small pieces of EWM stem can grow into mature plants. Established EWM plants form a root-ball in the sediment that sends up new stems each spring. For this reason, any management that does not remove or kill the roots will only provide temporary control. Furthermore, cutting and harvesting can create many EWM fragments and hasten the spread throughout a lake.

Contributing Factors:
Given that EWM was first reported only recently in the lake (2014), it is very likely that this infestation will expand to additional areas of the lake if not managed. Water clarity appears to be limiting the maximum depth of EWM growth in Rush Lake; increased water clarity resulting from reduced nutrient loading or the introduction of zebra mussels would likely lead to expansion of EWM into deeper areas. Furthermore, if EWM becomes established in Briggs or Julia, the clearer water in those lakes would allow EWM to colonize into deeper areas and form larger areas of dense growth.

Possible Side-Effects of Management:

On Other Plants:

(1) Aggressive management of EWM with auxin-mimic herbicides (such as 2,4-D and triclopyr) may impact water lilies and native milfoil in the vicinity of treatment
(2) Areas that support dense EWM likely have fertile sediments. If EWM is successfully controlled, homeowners should expect to see some areas of dense native plants in the treated areas; the goal is not to kill all plants, but to promote a diverse native plant community that will help to improve water clarity and provide good fish habitat.
(3) Successful control of EWM may lead to open areas of sediment that would allow CLP to expand rapidly. Consequently, these two invasives should be managed in tandem to help promote the establishment of native plants.

On Fish Population:

(1) Removal of large plant beds can expose small and newly hatched fish to greater predation (nowhere to hide)
(2) Fewer plants to support prey for small and newly hatched fish
(3) Dense plants may lead to stunted growth of panfish due to reduced predation and greater competition for food, and may favor a shift to bass over other gamefish; bass are better at feeding in dense plant beds

On Water Clarity:

(1) Barren sediment may support filamentous algae growth in the spring and is more easily stirred up by waves and boats
(2) Fewer plants to compete with algae for nutrients

1 – Eurasian Watermilfoil: Management

Management Goals:

Short-Term

(1) Control areas of dense EWM to minimize impairment of lake uses
(2) Minimize impacts to native plants in the vicinity of treated areas

Long-Term

(3) Prevent the expansion of EWM in Rush Lake and prevent spread to Briggs and Julia
(4) Achieve some degree of long-term control to reduce the need for future treatments

Potential Management Actions:

(1) **Treat with Herbicide** (up to 15% of littoral area)
  - **a.** *2,4-D*: Generally effective on non-hybridized EWM and fairly inexpensive
  - **b.** *Triclopyr*: More expensive than 2,4-D; may be more effective on hybrid milfoil
  - **c.** *Procellacor*: Very new herbicide that is thought to work better in small plots; could provide good control of EWM in Rush Lake given the current plot sizes. Also touted as being more gentle on native plants than other herbicides.
  - **d.** *Fluridone*: For whole-lake treatments, requires a variance permit; not recommended unless EWM expands substantially in the future

(2) **Harvesting:** Not recommended – would likely spread EWM in the lake

(3) **Hand-Pulling:** Given the current abundance of EWM in Rush Lake, this is a good option. Hand pulling should occur before the plants begin producing fragments (mid-summer), and care must be taken to remove all roots. Removal of only the above-ground portion of EWM plants will prevent herbicide damage to the plant (herbidice will not touch the roots), and any remaining roots will likely resprout the following spring.

(4) **Biocontrol:** Not recommended – although milfoil weevils have been shown to effectively reduce EWM in some lakes, results are very hit and miss. University researchers have shown that fish predation on weevils can be very high, leading to low weevil numbers. This may be an option if TLID is interested, but stocking of weevils should be considered very experimental at this time.

(5) **Require Boats to Clear Plants:** Boaters frequently travel between Rush, Briggs, and Julia. As the abundance of EWM in Rush Lake increases, so does the liklihood that a boat may pick up a fragment of EWM in Rush and transport it to another lake. TLID should consider adding signage at the ends of the channels between the lakes instructing boaters to reverse their motors to clear any plants from their propeller before entering.

(6) **Do nothing:** Not recommended – EWM would almost certainly persist and spread in Rush Lake, leading to much greater risk of spread to other lakes in the chain.

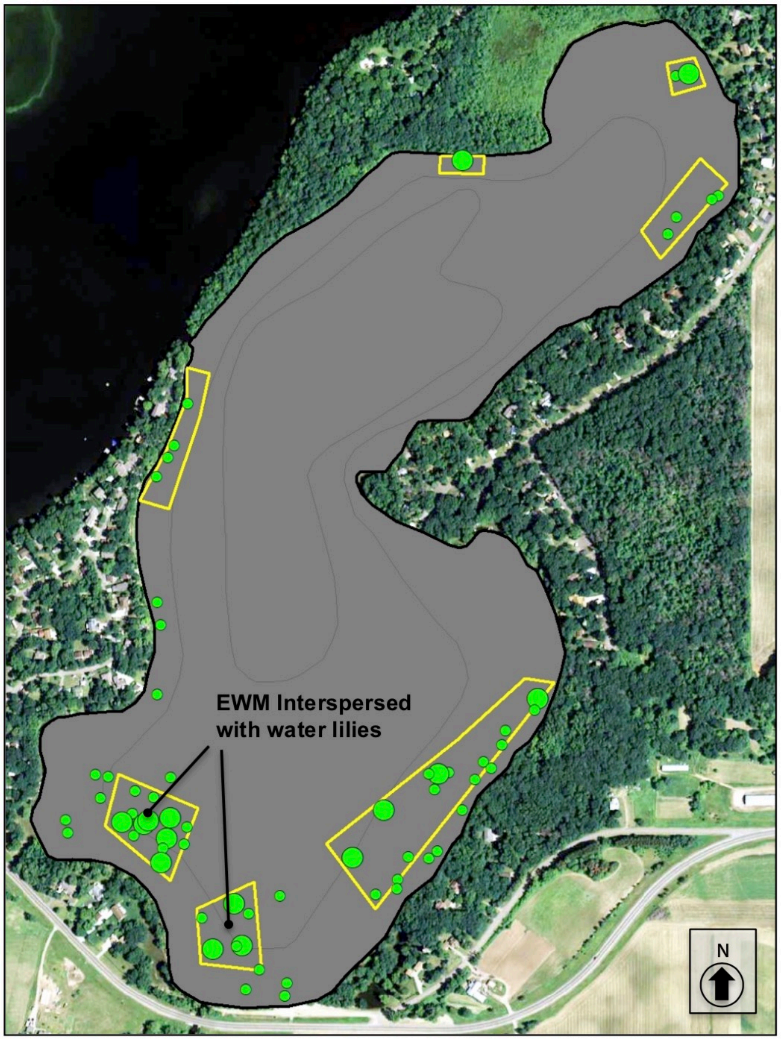
Monitoring:

(1) **Delineation Survey:** Before permitting a treatment, the DNR requires a delineation survey to map out potential treatment areas. For EWM, these surveys are generally conducted in June followed by treatment in July. However, your AIS Specialist may also accept a late-summer or early-fall survey to plan treatments for the following year. In some cases, the DNR may honor delineations from previous treatments if the treatment areas are not changed. Contact your AIS Specialist during the winter months to discuss whether they will require a new delineation.

(2) **Genetic Testing:** If EWM treatments are not providing effective control, you should consider having the EWM plants in your lake tested to see if they are hybrid milfoil.

(3) **Point-Intercept Plant Survey:** TLID should consider conducting a lake-wide point-intercept plant surveys roughly every 3-5 years to track changes in the plant community.

Rush Lake
2017 Eurasian Watermilfoil Management Plots



EWM Density
- 1 (solitary plants)
- 2 (dense patches)
- 3 (uniform matted)

EWM Plots

Surveyed: July 12-14, 2017
Methods: Visual, Sonar, Rake
Surveyor: JA Johnson

NALMS Certified Lake Manager
www.NALMS.org

Map produced for the
Three Lake Improvement District by:

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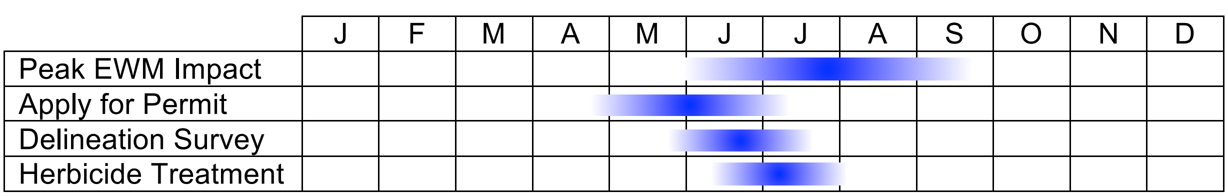
EWM Management Timeline



2 – Curlyleaf Pondweed: Context

Description of Problem:
Curlyleaf pondweed (CLP, *Potamogeton crispus*) is an invasive aquatic plant that forms dense areas of surface-matted growth in the mid to late spring. Areas of dense growth typically shade out native aquatic plants, reduce the quality and variability of habitat for fish, and impair boating and swimming in beds of dense CLP. Furthermore, CLP naturally dies off in June, leaving large areas barren of plants and releasing nutrients into the water as the dead plants decay.

In most Minnesota lakes CLP acts as an annual plant, sprouting from turions (reproductive buds) during the cold-water periods in the fall and spring of each year. As the water warms in the spring, CLP sprouts grow rapidly, produce new turions, and then naturally die off in mid June, depositing new turions to the lake sediment. When buried, these turions can remain dormant for at least 5 to 10 years. This means that although treatments can kill newly-sprouted CLP and prevent the production of new turions, CLP management requires multiple years of treatment to reduce the extent and abundance of CLP in a lake.

Contributing Factors:
CLP is widespread in the Briggs Chain and has been actively managed for many years. As of the last delineation survey (2014), dense CLP growth was isolated to several distinct areas in the three lakes (see map on page 13). This suggests that these areas could be easily targeted with herbicide treatment, but lake-wide management may be limited by funding and DNR permit restrictions (15% littoral maximum area). If these areas of dense CLP expand in the future, TLID should consider seeking a variance to treat additional areas to minimize matted CLP in the lakes. Water clarity appears to be limiting the maximum depth of CLP growth in the lake, particularly in Rush Lake; increased water clarity resulting from reduced nutrient loading, carp control, or the introduction of zebra mussels would likely lead to expansion of CLP into deeper areas.

Possible Side-Effects of Management:

On Other Plants:

(1) Aggressive management of CLP may also wipe out other native pondweeds growing in the vicinity of treated areas. Early spring treatments provide an additional degree of selectivity by killing the CLP before many native plants sprout.
(2) If CLP is successfully controlled, the treated areas may eventually support dense native plants. These areas clearly have fertile sediments that can support dense plant growth. Many lakes treated with endothall experience substantial increases in coontail and Elodea.
(3) Successful control of CLP may lead to open areas of sediment that would allow EWM to expand rapidly. Consequently, these two invasives should be managed in tandem to help promote the establishment of native plants in the southern portion of the lake.

On Fish Population:

(1) Removal of large plant beds can expose small fish to greater predation
(2) Fewer plants to support food/prey for small and newly hatched fish

On Water Clarity:

(1) In untreated lakes with severe CLP infestations, natural die-off can release nutrients and lead to increased algae growth.
(2) Barren sediment in treated areas may support filamentous algae growth in the spring
(3) Fewer plants to compete with algae for nutrients

2 – Curlyleaf Pondweed: Management

Management Goals:

Short-Term

(1) Control areas of dense CLP to minimize impairment of lake uses
(2) Reduce CLP biomass and the amount of nutrients released when CLP naturally dies off
(3) Minimize impacts to native plants in the vicinity of treated areas

Long-Term

(4) Prevent the expansion of CLP in the lake by preventing the production of new turions
(5) Reduce the abundance of turions in the lake sediment to decrease the potential for dense CLP growth and the need for future treatments
(6) Promote the reestablishment of diverse native plants in the treated areas

Potential Management Actions:

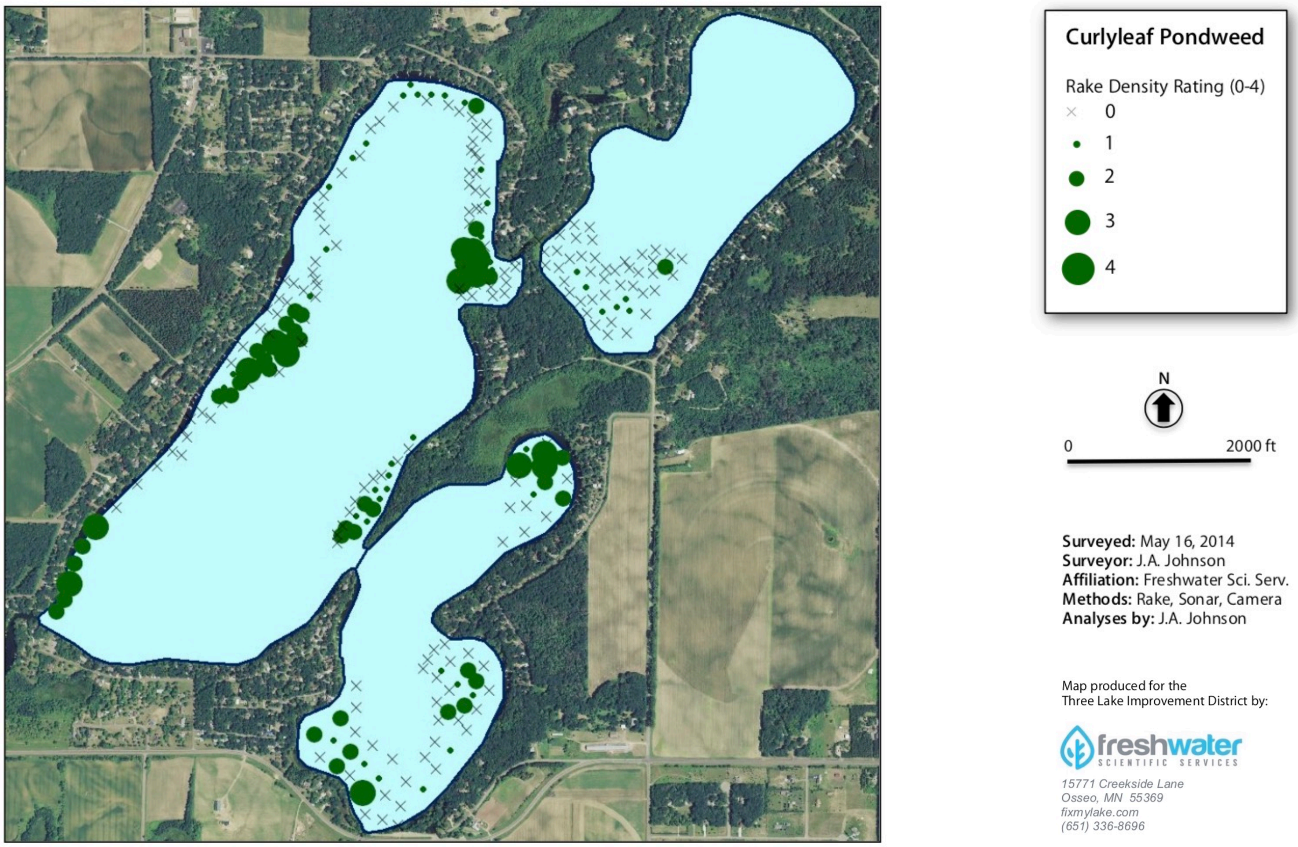
(1) Treat with Herbicide (up to 15% of littoral area)
- **a.** *Endothall*: Applied when water temperature is between 50° and 60°F. This is the most commonly used approach for CLP management. Generally effective on plots greater than 3 acres. May impact native pondweeds.
- **b.** *Diquat:* Less expensive than endothall and less selective (kills many plants). Applied when water temperature is between 50° and 60°F to kill CLP before most native plants sprout. Good for smaller plots where endothall may fail.
- **c.** *Galleon+Endothall*: Mixture of herbicides that works best for large plots >20 acres. Galleon very effective on CLP and is thought to cause less damage to native pondweeds than endothall or diquat. Only a few applicators offer this.
- **d.** *Fluridone*: Only used for whole-lake treatments; requires a variance permit, additional monitoring, and careful planning to prevent harming native plants.

(2) Harvesting: Not recommended – can effectively remove biomass and substantial number of turions, but not as effective as herbicides; DNR allows up to 50% of littoral area to be harvested.
(3) Hand-Pulling: Not feasible given the current extent of CLP in the lake.
(4) Do Nothing: Not recommended – CLP would likely persist in the current infested areas, and may expand to additional areas, particularly if water clarity increases.

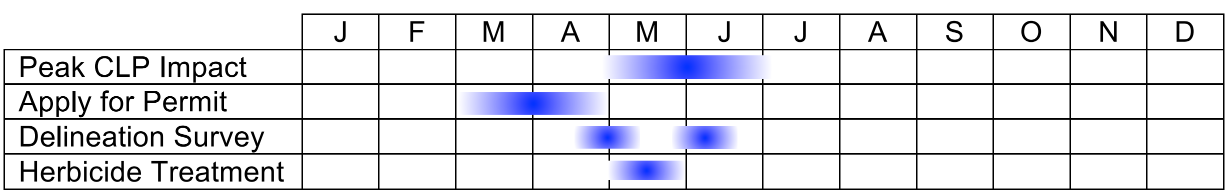
Monitoring:

(1) Delineation Survey: Before permitting a treatment, the DNR requires a delineation survey to map out potential treatment areas. For CLP, pretreatment surveys are conducted in April/May and posttreatment surveys (if desired) in June. The DNR may honor delineations from previous treatments if the treatment areas are not changed. Contact your AIS Specialist during the winter months to discuss whether they will require a new delineation.
(2) Point-Intercept Plant Survey: TLID should consider conducting a lake-wide point-intercept plant survey roughly every 3-5 years to track changes in the plant community.

Spring Delineation of Curlyleaf Pondweed: May 16, 2014



CLP Management Timeline



3 – Preventing New AIS: Context

Description of Problem:
As of 2017, the Briggs Chain of Lakes supported two species of submersed aquatic invasive plants (CLP and EWM). At this time, we are not aware of any other aquatic invasive species (AIS) in the lake. There are many invasive species threatening MN lakes (visit dnr.state.mn.us for the latest details), but zebra mussels and starry stonewort currently pose the greatest threat to the Briggs chain.

Zebra mussels have been spreading to new lakes in MN at an alarming rate. Given the proximity of the Briggs Chain to infested lakes in the metro and the rapid increase in the number of infested lakes over the past few years, it is very possible that the chain has already been exposed or will be exposed to zebra mussels in the coming years.

Starry stonewort is a macroalgae that grows like a bushy aquatic plant. This invasive has currently only been found in a handful of MN lakes, but has a propensity for forming extremely dense plant beds that displace native plants, impair lake use, and severely alter lake ecosystems.

Visit www.dnr.state.mn.us/invasives and www.maisrc.umn.edu for the latest details on these invasives and other emerging threats.

Contributing Factors:
(1) Proximity to infested waters
(2) Public boat launcghes and popularity as a fishing and water recreation destination

Prevention Strategies
(1) **Boat Launch Inspectors:** The MNDNR hires launch inspectors, but these DNR inspectors cover only a small percentage of the state's boat launches, with a focus on very popular launch sites. Additional inspections are generally provided by lake volunteers or people hired by counties or individual lake groups. Many counties offer funding to assist lakes in hiring launch inspectors. TLID should consider contacting the county to discuss increasing inspections at the public boat launches. Funding assistance for this may be available from Sherburne County http://www.sherburneswcd.org/ais-grant-program.html
(2) **Lake Service Providers:** The MNDNR has a certification program for any business or professional that moves equipment between lakes www.dnr.state.mn.us/lsp/index.html. This certification program ensures that these businesses have been trained on AIS prevention rules and laws. TLID should educate their lakeshore homeowners to make sure they are only hiring certified LSP's to install or remove docks, move boat lifts, transport boats, treat their lakeshore, or any other professional lake service.
(3) **Clean, Drain, Dispose:** www.dnr.state.mn.us/invasives/preventspread_watercraft.html Although it is easy to blame outsiders for bringing new invasive species to a lake, lake residents can be an unwitting source of new infestations as well. Any lake residents who visit other lakes should be sure to clean their boat or equipment to remove any visible AIS, drain any water from bilge areas, ballast tanks, livewells, and bait buckets; dispose of unused bait, and dry the equipment for at least 5 days before returning it to your lake (21 days for lifts and docks brought in from other lakes).

The above strategies are designed to prevent new invasives from entering your lake, but it is also important to monitor the lake for new invasives so that they can be found early and managed aggressively to prevent establishment and expansion in the lake. This process is commonly called **Early Detection & Rapid Response**.

3 – Preventing New AIS: Early Detection/Rapid Response

Goals:

(1) Detect any new AIS before it can become established in the lake chain
(2) Be prepared to rapidly respond to any newly found infestation

Early Detection

(1) **Conduct periodic inspections** to search for new AIS in the lakes, with a focus on boat launch sites and resident boat lifts/docks. These are the most common locations where new AIS are found. Volunteers can be a great first line of defense, but trained AIS professionals should be incorporated to maximize the likelihood of detecting any new infestation. Funding for AIS monitoring and prevention may be available from Sherburne County http://www.sherburneswcd.org/ais-grant-program.html
(2) **Inform lakeshore homeowners** of new AIS so that they will know if they see one. Additionally, provide them with a TLID contact to report any suspicious findings or to ask questions. Consider including this information in newsletters and on your website. Funding assistance for this may be available from Sherburne County (see link above).
(3) **Periodically check the MN Infested Waters List** to stay apprised of any new infestations in nearby lakes. www.dnr.state.mn.us/invasives/ais/infested.html

Rapid Response

If you suspect that you have found a new AIS in the Briggs Chain of Lakes:

(1) **Note or mark the location of the suspected AIS:** GPS coordinates, float, or description
(2) **Take a photo of the suspected AIS**
(3) **Contact your DNR AIS Specialist** http://www.dnr.state.mn.us/invasives/ais/contacts.html

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Be prepared to send photos, GPS locations (or a detailed description of the location). The DNR will typically send a staff member to visit the site and verify whether the site is infested with a new AIS.

If the DNR verifies that you have a new AIS infestation:

(1) **Contact Sherburne County SWCD** to inquire about assistance (staff, guidance, or funding). We highly recommend that this step be addressed prior to finding any new infestation.
(2) **Contact your lake surveyor/consultant** to discuss monitoring and management options
(3) **Develop a specific management plan for the new AIS** in cooperation with with the DNR, County, and your lake consultant
(4) **Solicit bids** for any planned monitoring or treatments
(5) **Notify lakeshore homeowners** and organize an emergency LID meeting to go over the plan and solicit funds from stakeholders for management. If possible, TLID should maintain an emergency AIS response fund to allow them to move quickly on new AIS.
(6) **Post temporary signage** at the launch announcing the newly found infestation and request permanent signage from the DNR
(7) **Apply for any necessary DNR AIS control permits**
(8) **Implement the management plan for the new AIS** as soon as is feasible (weeks, not months)
(9) **Follow up with periodic monitoring** in and around the managed site to determine if the management was effective or if additional management is needed.

4 – Nuisance Filamentous Algae: Context

Description of Problem:
Filamentous algae forms floating mats on the Briggs Chain in the spring of some years, typically in May and June. This type of algae grows like a carpet on the sediment in the early spring when the water is clear and there are not many plants to shade it out. As the water warms, the algae mats on the sediment begin to die. As the dead algae decays, it form gas bubbles that float the mats to the surface of the lake where they look like big clumps of slimy green hair. These floating mats are easily blown by the wind and tend to pile up on downwind shores. In most lakes, this is a temporary situation that improves quickly after a spring thunderstorm or windy day breaks up the mats. (Filamentous algae may also grow on dense plant beds.)

When the conditions are right, algae can grow very rapidly. This means that any management activities designed to kill the algae in the spring may only provide temporary relief (generally a few weeks of control).

Contributing Factors:

(1) Fertile sediments that release phosphorus (driven by low oxygen or high pH)
(2) Clear water in the spring (allows light to reach the algae growing on the sediment)
(3) Inflow of nutrients from spring rainfall can also fuel the growth of filamentous algae on the sediment and plants

Possible Side-Effects of Management:

On Fish Population:

(1) Copper compounds typically used to kill algae also harm small or newly-hatched fish as well as the invertebrates that they eat.
(2) Over time, copper from multiple treatments can accumulate in the sediment, making it toxic to aquatic organisms that serve as a source of food to fish.

On Water Clarity:

(1) Algae mats tend to pile up along shore where they are very visible to homeowners and can severely impair access and water recreation. Although the water may be quite clear underneath the algae, these mats are often thought of as a water quality problem by lake residents.
(2) Filamentous algae mats growing on the bottom of lakes can act as a barrier that intercept phosphorus as it is released from the sediment, thereby reducing the growth of planktonic algae and increasing water clarity. If a large portion of the lake bottom supports filamentous algae, any large-scale treatments could actually decrease water clarity by allowing this phosphorus to fuel the growth of planktonic algae.
(3) Any phosphorus inactivation (alum or phosloc) to control filamentous algae would also likely decrease the amount of planktonic algae and increase water clarity.

4 – Nuisance Filamentous Algae: Management

Management Goals:

(1) Reduce the prevalence of floating mats of filamentous algae

Potential Management Actions:

(1) **Treat with Algicide:** Any treatments with algicides would require a permit from the DNR and should be limited in scale to minimize the potential for undesirable impacts. If conditions favor algae growth, applying an algicide will only provide temporary relief.
   a. **Copper Compounds:** This is the most widely used treatment for algae, but copper is toxic to small fish and invertebrates. Any copper treatments should be limited in scale to minimize harm to these organisms.
   b. **Peroxide-Based Algicides:** More expensive than copper compounds, but touted as being gentler on aquatic organisms
   c. **Diquat:** This is a broad-spectrum herbicide that is typically used to control areas of nuisance plant growth. However, some applicators have noted reduced filamentous algae in some areas treated with diquat for plant control. Although diquat treatment should not be considered just to kill algae, if algae mats are growing in areas where invasive plants are also being managed, using diquat may allow control of both the plants and the algae. This approach may not be allowed by the DNR without additional discussions and monitoring.

(2) **Nutrient Reduction:** Filamentous algae growth is fueled by phosphorus that is released from fertile sediments or that washes into the lake during spring rains. Long-term reduction of filamentous algae requires reducing the availability of phosphorus.
   a. **Reduce Nutrient Inflow from Watershed** (detailed in TMDL)
   b. **Lakeshore Buffers:** Intercept nutrients running off of shoreland properties
   c. **Inactivation of Sediment Phosphorus:** Using alum or similar compound
   d. **Curlyleaf Pondweed Control:** The die-off of CLP in the late spring can release a substantial amount of phosphorus that can fuel filamentous algae growth on dying CLP plants or on other plants. Control of CLP in the early spring when the shoots are small can limit this release of phosphorus, and long-term reductions in CLP abundance may lead to less filamentous algae growth in the later spring.

(3) **Do nothing:** The prevalence of filamentous algae may fluctuate from year to year based upon differences in the weather, but the conditions in the lake are generally conducive to filamentous algae growth each spring. Without management, the current level of filamentous algae growth will likely continue. If impairment is severe, this may not be a feasible option.

Monitoring:

(1) **Document Impairment:** Homeowners should document problems caused by filamentous algae to help guide management activities and provide justification for permit applications. This should include photos, maps, and recorded dates and observations.

Filamentous Algae Management Timeline

	J	F	M	A	M	J	J	A	S	O	N	D
Peak Impact												
Apply for Permit												
Algicide												
P–Inactivation												

5 – Dense Native Plants: Context

Description of Problem:
Native aquatic plants (primarily coontail, Elodea, chara, and southern naiad) form dense surface-matted growth in some shallow near-shore areas of the Briggs Chain. In some of these locations, the native plant growth is dense enough to impair boating, swimming, and navigational access to the lake. In particular, homeowners have noted dense native plant growth in the Briggs bayou (southwest end of Briggs Lake) and shallow near-shore areas along much of the eastern side of Julia Lake. Currently, the low water clarity in Rush Lake limits the extent of dense native plant growth to areas shallower than 3 to 4 ft; any substantial increase of water clarity in Rush Lake would likely lead to widespread dense native plant growth in the lake.

Diverse native plants are a great benefit to lakes. They anchor sediments, compete with algae, and provide a rich diversity of habitat for fish and wildlife. Consequently, aggressive management of native plants is generally not advisable except in areas where they are impairing access or swimming. Any management of native plants to reduce impairment should be limited in scale to maintain substantial areas of native plants.

Contributing Factors:
The areas of the Briggs Chain that support dense native plants are shallow enough to receive ample light despite low water clarity, and have fertile sediments. The native plant species that are causing the greatest problems in the lakes are coontail, Elodea, chara, and southern naiad. All of these species tend to form dense carpets that can reach close to the surface of the water in shallow areas. Furthermore, these plants generally increase in lakes that are treated aggressively with endothall herbicide for curlyleaf control (see paper by Jones et al. 2012 in the supporting materials). Coontail draws its nutrients from the water (does not have roots) and is tolerant of low light. It is a great winter-time oxygen producer that typically forms a dense carpet in deep areas of lakes and does not die off in most winters. However, coontail can form dense surface-matted growth in shallow stagnant areas like the Briggs bayou.

Possible Side-Effects of Management:

On Other Plants:

(1) Aggressive management of natives may leave areas of bare sediment that would favor expansion of EWM or CLP into that area.

On Fish Population:

(1) Removal of large beds of native plants can expose small fish to greater predation
(2) Fewer plants to support food/prey for small and newly hatched fish
(3) Dense plants may lead to stunted growth of panfish due to reduced predation and greater competition for food, and may favor a shift to bass over other gamefish; bass are better at feeding in dense plant beds

On Water Clarity:

(1) Barren sediment in areas where native plants are treated or harvested may support filamentous algae growth in the spring and will be more easily stirred up by waves and boats.
(2) Fewer plants to compete with algae for nutrients

5 – Dense Native Plants: Management

Management Goals:

Short-Term

(1) Improve access and navigation for homeowners in areas with dense native plants
(2) Protect desirable areas of native plants that do not interfere with lake use

Long-Term

(3) Improve the overall quality and diversity of native plants growing in the lake

Potential Management Actions:

(1) Harvest or Cut Channels: Homeowners are allowed to cut or harvest a channel 15 ft wide to open water without a permit as long as they take out any cut plant fragments and do not remove floating or emergent plants (lilies, bulrush, etc.) Harvesting or cutting over larger areas would require a permit from the DNR. This is the most feasible management option for this issue, but would require TLID to hire a firm from the DNR list of harvesters or purchase a small mechanical or manual cutter.

(2) Treat with Herbicide: Any use of herbicides to control native plants requires a permit from the DNR and should be limited in scale to minimize the potential for undesirable impacts. Herbicides move easily in water, so any treatment may impact plants outside of the intended control area. TLID should discuss the extent of the problem with a herbicide applicator and DNR staff during the winter or early spring to determine whether such a treatment would be permitted.

(3) Nutrient Reduction: Limit nitrogen runoff entering the lake by following responsible lawn fertilizing practices and maintaining vegetated shoreline buffers. Nitrogen runoff favors the growth of dense coontail in the lake. Other options for reducing nutrient availability in the Briggs bayou would include applying alum/phosloc and aeration. These additional options should be considered experimental for reducing plant growth; if TLID decides to try any of these experimental approaches, they should limit them to small test areas before using on a larger scale.

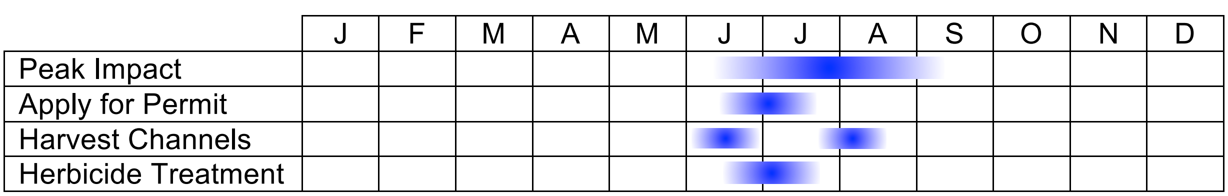
(4) Do Nothing: The abundance and diversity of native plants in the lake may change from year to year based upon weather and lake conditions, but the location and extent of areas of dense native plants will likely persist without management. If impairment of lake use by dense native plants is severe, this may not be a feasible option.

Monitoring:

(1) Document Impairment: Homeowners should document problems caused by native plants to help guide management activities and provide justification for permit applications. This should include photos, maps, and recorded dates and observations.

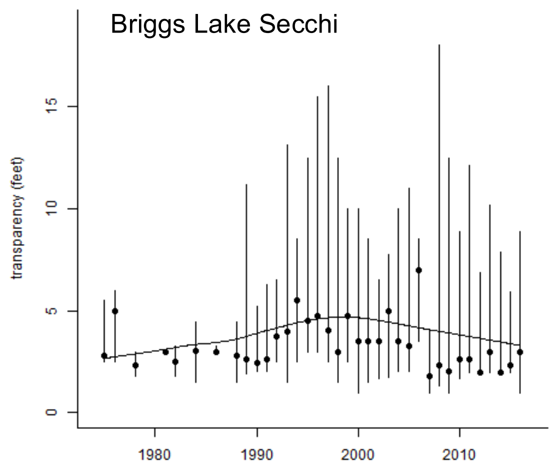
(2) Point-Intercept Plant Survey: TLID should consider conducting point-intercept plant surveys roughly every 3-5 years to document the diversity and abundance of native plants throughout the lake and track changes in the plant community.

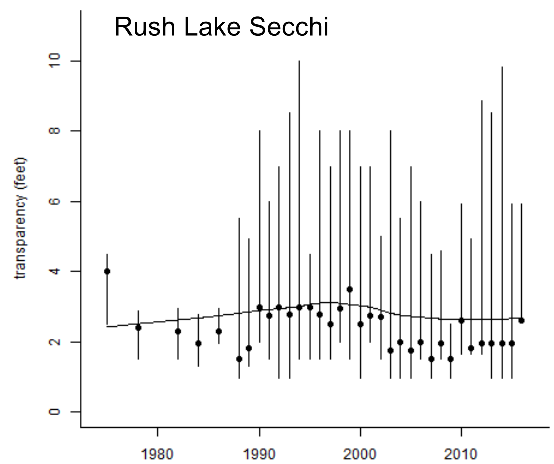
Nuisance Native Plant Management Timeline



6 – Low Water Clarity: Context

Description of Problem:
Water clarity is generally low in all three lakes (all listed as impaired), but is particularly bad in Rush Lake. Over the past 35 years, water clarity has remained fairly stable, with no clear trend of increasing or decreasing (see plots below from the MPCA website). The low water clarity in the lakes is predominantly due to planktonic algae that is fed by the high level of nutrients in the water. The Mississippi River (St. Cloud) Watershed TMDL provides an excellent summary of water clarity in the lakes, contributing factors, and proposed actions to increase water clarity.





Contributing Factors:

(1) Substantial portions of watershed dominated by agriculture
(2) Turf fertilizers, soil erosion, and failing septic systems in shoreland areas
(3) Fertile sediments, summer lake stratification and a large wind exposure (Briggs Lake) favor internal recycling of phosphorus during summer months
(4) Resuspension of lake sediment by wind, waves, carp, and motorboats
(5) Curlyleaf pondweed die-off releases phosphorus that may contribute to algae growth
(6) Any future infestation by zebra mussels would likely increase water clarity dramatically, but would have other undesirable impacts on the lake

Possible Side-Effects of Management:

On Plants:

(1) Low water clarity reduces the penetration of light into the water, limiting the depth to which plants can grow. Conversely, increases in water clarity can allow plants to expand into deeper areas of a lake. Any substantial changes in water clarity would likely have an effect on the extent of plant beds in the lake. TLID should familiarize themselves with the concept of shallow lake ecology and stable states (see supporting materials)
(2) If water clarity improves, and invasive CLP and EWM are not controlled, it is likely that these invasives would rapidly expand into deeper areas of the lakes. This could lead to a substantial increase in the proportion of the lake impaired by surface-matted plants.

On Fish Population:

(1) Water clarity can affect which fish do well in a lake. Visual predators like pike, walleye, and bass do better in clearer water, whereas bottom feeders like carp and bullhead tend to dominate in murky lakes.

6 – Low Water Clarity: Management

Management Goals:

(1) Reduce the severity and frequency of planktonic algae blooms
(2) Minimize the potential for sediment resuspension by wind, carp, and motorboats

Note: The Mississippi River (St. Cloud) Watershed TMDL (2015) provides an excellent analysis of the factors affecting water clarity in the Briggs Chain. The TMDL focuses primarily on making changes in the watershed. The options listed below represent items that could be implemented or supported by TLID on a more local scale (directly to the lakes and shoreline properties). These items complement the watershed actions highlighted in the TMDL.

Potential Management Actions:

(4) Reduce Nutrient Inflow to Lake: (see TMDL for larger scale options)
   - **a. Promote Responsible Lawn-Care Practices:** P-free fertilizer, no fertilizing right before a rain, seed or sod areas of bare dirt to reduce soil erosion, keep grass clippings and leaves off of streets.
   - **b. Promote Shoreline Buffers:** Vegetated buffers have much deeper roots than turf grass and can intercept nutrient runoff from nearshore areas. Check with Sherburne County SWCD to see if there are assistance grants available for establishing buffers.
   - **c. Promote Septic System Maintenance:** The TMDL states that there are just under 400 subsurface sewage treatment systems (SSTS) around the Briggs Chain and estimates that between 10% and 35% are failing, leading to increase nutrient inflow to the lakes.

(5) Reduce Internal Phosphorus Cycling
   - **a. Sediment Phosphorus Inactivation:** Large-scale application of alum or similar compound to reduce phosphorus release from sediments. This would be very expensive and would not reduce the substantial amount of external nutrient inflow from the watershed. However, if the nutrient load from the watershed is reduced substantially in the future, this option should be considered.
   - **b. Curlyleaf Pondweed Control:** The die-off of CLP in the late spring can release phosphorus that can fuel algae growth and reduce water clarity. Control of CLP in the early spring when the shoots are small can limit this release of phosphorus, and long-term reductions in CLP abundance may lead to some reduction of planktonic algae growth in the later spring.

(6) Reduce Sediment Resuspension
   - a. **Protect/Promote Native Plants** in shallow areas to anchor sediments
   - b. **Limit Motorboat Speed** to slow-no-wake in shallow areas with soft sediments
   - c. **Add Flow Velicocity Dissipators** to any large stormwater inflow pipes
   - d. **Reduce Common Carp** abundance

(7) Do nothing: Without action, the water clarity in the lakes will likely remain the same or degrade further. We do not recommend this option. Other organizations are working to improve water quality in the Briggs Chain, but TLID should remain engaged with agencies and stakeholders to ensure that these plans are pursued, funded, and implemented.

Monitoring:

(1) Document Impairment: TLID should ensure that water clarity and chemistry data are being collected, and consider collecting secchi transparency readings as a part of the Citizen Lakes Monitoring program at the MPCA.

7 – Protecting & Promoting Native Plants: Context

Description of Problem:
The Briggs Chain of Lakes currently has areas with desirable submersed, floating, and emergent native plants that should be maintained. These areas provide habitat for fish and wildlife, anchor sediments, and protect shorelines from erosion. However, low water clarity, carp, invasive aquatic plants, and motorboat wake pose a threat to these native plant beds. In addition, aggressive management of CLP and EWM with herbicides can also impact native plants in the vicinity of the treated plots.

Contributing Factors:
- **(1)** Expansion of CLP ands EWM – displaces native plants
- **(2)** Aggressive management of CLP and EWM – may also harm native plants in vicinity
- **(3)** Invasive Common Carp – uproot native aquatic plants while foraging for food
- **(4)** Low Water Clarity – limits the depth to which plants can grow and may favor invasive plants that are more able to grow to the surface where light is abundant.
- **(5)** Motorboat Prop-Scour and Wake can destroy sensitive beds of native plants

Possible Side-Effects of Management:

On Plants:
- **(1)** Protecting native plant beds will increase the quantity and quality of native plant beds
- **(2)** Abundant and diverse native plants are more resilient to disturbance and may slow the expansion of invasive plants within the lakes

On Fish Population:
- **(1)** Abundant and diverse native plants will provide high quality habitat that will be capable of supporting a wider range of fish sizes and species by providing spawning areas, feeding and hiding areas for small/newly-hatched fish, and hunting grounds for predator fish.

On Water Clarity:
- **(1)** Diverse native plant communities help to anchor lake sediments, compete with algae for nutrients, and provide hiding places for zooplankton that graze on algae.

7 – Protecting & Promoting Native Plants: Management

Management Goals:
- **(1)** Protect area of floating/emergent plants in area of channel between Briggs and Julia
- **(2)** Promote greater native plant diversity throughout Rush Lake
- **(3)** Limit damage to native plants throughout the chain when managing CLP and EWM
- **(4)** Educate lakeshore homeowners about the benefits of the native plants in the lake and on shores

Potential Management Actions:
- **(1)** Maintain placement and visibility of slow-no-wake buoys
- **(2)** Transplant native plants from Briggs and Julia into Rush Lake
- **(3)** Promote native shoreline plantings with education and possible funding assistance
- **(4)** Work with your consultant and applicator to minimize herbicide damage to natives

Monitoring: Conduct lake-wide point-intercept vegetation surveys every 5 years

8 – Invasive Common Carp: Context

Description of Problem:
The DNR has documented the presence of commmon carp in the Briggs Chain, but the level of infestation by carp is not well documented. Research by the University of Minnesota suggests that abundant plants can persist in carp-infested lakes when carp density is kept below 25 lbs per acre. However, when carp density reaches about 90 lbs/acre, the carp can severely reduce plants in a lake and have major impacts on water clarity and fish habitat (paper included in supporting materials). Furthermore, the same researchers have found that abundant bluegill populations suppress carp populations by eating their eggs (see paper in supporting materials).

Based upon the amount of plants found in Briggs Lake and Julia Lake, it appears that the carp population is fairly low (below 25 lbs/acre). However, if TLID notices a substantial decrease in the abundance of plants in the future, this may be an indicator that the carp population has increased and may require management.

Contributing Factors:

(1) Abundant bluegill population likely devouring carp eggs and keeping the carp population in check (see publications in the supporting materials).

Possible Side-Effects of Management:

On Plants:

(1) If the carp population is reduced, native plants may become more abundant and widespread in the chain of lakes. Conversely, if the carp population increases in the future, the abundance of desirable native plants may be severely reduced.

On Fish Population:

(1) Carp can destroy native plant beds and stir up lake sediments. These impact reduce the availability of quality habitat for native fishes, reduce water clarity, and can favor a shift away from visual predator fish (northern, musky, bass) and toward more abundant bottom feeders (bullhead).

On Water Clarity:

(1) If the carp population is reduced, there may be some increase in water clarity. Conversely, if carp increase in the future, they would likely decrease water clarity by removing plants, stirring up lake sediments, and mobilizing sediment nutrients that would fuel algae growth.

8 – Invasive Common Carp: Management

<u>Management Goals:</u>

(1) Maintain low abundance of carp in the chain of lakes (below 25 lbs/acre)
(2) Maintain abundant bluegill population by protecting habitat and preventing winterkill in any attached ponds

<u>Potential Management Actions:</u>

(1) **Winter carp removal (netting):** The current carp density does not appear to warrant removal. If carp impacts become more evident, this option should be considered.
(2) **Prevent bluegill winterkill** by tracking winter oxygen levels and aerating if necessary
(3) **Do nothing:** Without action, the carp population will likely remain the same or increase.