Appendix A – 2023-27 Upper Turtle Lake Aquatic Plant Management Discussion

During the 2010 early-season CLP surveys, CLP was present throughout the lake, but it was not acting overly invasive and appeared to be "just another plant species" in the lake's macrophyte community. In the summer survey from 2010, it was also noted that native species had recolonized most of the areas CLP occupied earlier in the growing season. In 2017, following the explosion in CLP density and distribution, this was no longer the case as water clarity was so poor that there was almost no regrowth on the outer edge of the littoral zone following CLP's late June senescence. This poor water clarity appeared to be creating a negative feedback loop as most plants in water >6ft deep were dying and turning black. Ultimately, as they rotted, these dying macrophytes were contributing more nutrients to the water column and thus producing even more algae leading to even poorer clarity.

One of the goals of the last APM Plan was to improve water quality, or at least prevent further negative changes that had presented themselves from 2010 to 2017. Water quality (water clarity, phosphorus level, and chlorophyll (algae) was at its worst in 2017 possibly due in part to the amount of CLP in the system at the time.

In a 2012 investigative report from the Minnesota Pollution Control Agency and MN-DNR, the authors found that results from literature and 11 sentinel lakes where curly-leaf pondweed is present and monitored suggest the relationships between curly-leaf senescence and water quality vary substantially among lakes. The post-senescence decreases in water clarity are most pronounced in shallow lakes with minimal native vegetation. In these lakes, abundant growth of curly-leaf is followed by severe algal blooms. However, in shallow lakes with abundant native vegetation, the post-senescence decreases in water clarity are muted (Heiskary & Valley, 2012). This latter statement describes what was seen by the Aquatic Plant Surveyor during the 2010 survey work. Then in 2017, the first statement about severe algae blooms following abundant growth CLP was true. The Aquatic Plant Surveyor stated that in 2017, a shift in the aquatic plant community was evident from rooted species that need at least fair water clarity toward species that can tolerate poor clarity, favor high suspended nutrient levels, and exploit disturbance.

CLP management that began in 2018 had the goal of not only reducing observable early season CLP growth but also the number of turions in the sediment that leads to increased CLP abundance. This in turn was expected to help restore native aquatic plants later in the season and lead to better water quality. Instead, it appears to have continued the trend toward poorer water quality, and reduced the native aquatic plant community even further. Following four years of aggressive active management that chemically treated more than 50 acres annually, CLP levels in the lake were sharply reduced, back to levels that were recorded in 2010. This part of the plan was successful. Turion density in the sediment was also significantly reduced. Unfortunately, the native aquatic plant community has not rebounded – at least not yet. White water lily, coontail, and duckweeds have increased, but several other, formerly common, native pondweed species – Flat-stem, Fries', and Small, all species susceptible to the same herbicide used to kill CLP have all but disappeared from the lake.

Because of this, it is recommended that the UTLD adopt management goals in the next five years that focus on small-scale control in the worst areas of the lake to relieve significant navigation impairment rather than a large-scale blanket treatment. No longer is it necessary to complete three or more successive years of large-scale management with the goal of restoring a more desirable balance of CLP and native aquatic vegetation. By taking a measured approach, collateral damage to beneficial aquatic plant species and the important habitat and water quality benefits they provide may be minimized. Even CLP, when kept at a minimum, provides value to a lake because it grows through the winter and spring when other plants are absent, supporting a source of food and habitat for fish and other aquatic creatures during these times

The ultimate goal of this plan is to maintain the usability of the lake and to improve habitat and water quality through limited aquatic plant management.

CLP Management

A scenario-based approach to CLP management is recommended over the next five years. A scenario-based approach means that any amount of CLP may be managed in the lake; however, the management actions implemented will be dictated by the conditions that exist in the lake at any given time. Not all CLP needs to be removed from the lake, but efforts should be made to keep it from again having a negative impact on the lake. To do this, a combination of manual/physical removal, mechanical harvesting (including DASH), and chemical control methods are recommended for UTL. As such, the following monitoring and control activities have been outlined:

1) CLP will be monitored by volunteers and resource professionals every year.
   a. Pre-management surveys will be completed annually as soon as CLP begins to make an appearance in an effort to judge the severity of seasonal growth.
   b. Early summer CLP bedmapping will be completed annually in early to mid-June in an effort to track its expansion or decline.
2) Areas of CLP with sparse, isolated plants can and should be hand pulled or raked by volunteers in shallow water (≈ 5 feet) around docks and along shorelines.
   a. Can be completed at any time during the CLP growing season
   b. Do not require a WDNR permit.
3) Snorkel, rake, and/or scuba diver removal of CLP can and should take place in areas with isolated plants, small clumps, or small beds of plants where practical and if resources are available.
   a. Would likely be contracted by the UTLD
   b. Can be completed at any time during the CLP growing season
   c. Do not require a WDNR permit.
4) Diver-assisted Suction Harvest or DASH can be used in place of or in combination with snorkel, rake, and/or scuba diver removal of CLP where practical and if resources are available. DASH may allow larger areas of CLP to be managed without the use of herbicides.
   a. Would likely be contracted by the UTLD
   b. Can be completed at any time prior to when turions are set
   c. DASH requires a WDNR Mechanical Harvesting permit.
5) Mechanical harvesting (small or large-scale) can be used when there is too much CLP to manage effectively with DASH, there is not enough CLP to warrant the use of herbicides, and/or individual areas recommended for CLP management do not reach the required 5 acres.
   a. Would likely be contracted by the UTLD
      i. Unless the UTLD were to purchase their own small or large-scale harvester
   b. Should be completed when CLP has reached or is near peak growth, but prior to when turions are set
   c. Requires a WDNR Mechanical Harvesting permit
6) Application of aquatic herbicides can be used in any area under the following guidelines
   a. Requires a WDNR Chemical Application permit
   b. Herbicides must be applied by a licensed Applicator
   c. Conditions exist that are likely to make other management alternatives less effective
      i. Bed size and density of CLP in the area
      ii. Location of the area in relation to lake access and usability
      iii. Bottom substrate, water depth, and/or clarity are prohibitive
      iv. Limited or unavailable access to contracted diver, DASH, or mechanical harvesting services
      v. Limited financial resources
      vi. Less than a majority constituent support for a proposed management action.

d. One-time herbicide application
    i. Proposed chemical treatment areas are at least 5.0 acres in size.
    ii. Liquid endothall (Aquathol K) is used at 1-3 ppm
    iii. Single or combined area treatments >9 acres (5% of the littoral zone) will be considered large-scale
        1. Whole-lake herbicide concentration should be calculated based on the proposed application rate.
        2. Pre (prior year) and post (year of and/or year after) treatment aquatic plant surveys should be considered.
        3. Herbicide concentration testing should be considered

e. *****Split (back to back) herbicide application
    i. Proposed chemical treatment areas are between 3.0 and 5.0 acres in size
    ii. May also be applicable when treatment areas >5.0 acres are long and narrow
    iii. Liquid endothall (Aquathol K) is used at 3 ppm
        1. Half (1.5ppm) is applied during the first treatment
        2. The remaining half (1.5ppm) is applied between 8-24 hours later
    iv. Treatments >9 acres (5% of the littoral zone) will be considered large-scale
        1. Whole-lake herbicide concentration should be calculated based on the proposed application rate.
        2. Pre (prior year) and post (year of and/or year after) treatment aquatic plant surveys should be considered.
        3. Herbicide concentration testing should be considered.

    ***Split applications are subject to annual WDNR approval regardless of inclusion in an approved APM Plan.**

Many of the management actions outlined for CLP would also be effective for the management of Eurasian watermilfoil should it be found in UTL over the next five years. A different herbicide would be used; likely ProcellaCOR or a liquid 2,4D based herbicide. Annual management decisions for CLP (or EWM) will always be based on the level of infestation, current understanding of management alternatives, resources available, what is acceptable to the constituency, and what the WDNR will approve.