1.0 INTRODUCTION

The Tomahawk Lake System is a drainage system in Oneida County and are designated as a Statewide AIS Source Water (Figure 1.0-1). Tomahawk Lake and Little Tomahawk Lake are designated as Outstanding Resource Waters (ORW) by the Wisconsin Department of Natural Resources (WDNR). Over 900 waterfront parcels exist on these lakes and the system is an integral part of Oneida County's tourism trade.

Figure 1.0-1. Tomahawk Lake, Oneida County, Wisconsin.

The primary citizen-based organization leading management activities on the Tomahawk System is the Tomahawk Lake Association (TLA). EWM was first documented in 2003, with the TLA being formed in 2005 to lead management efforts towards this species.

1.1 Historic EWM Management & Planning

During 2021-2022, the TLA created an updated *Aquatic Plant Management* (APM) Plan. While this project was focused on revisiting the TLA's aquatic plant management-related goals and actions, the document also incorporates aspects of shoreland condition and lake stewardship. The *APM Plan* was accepted by the WDNR in December 2022.

The *APM Plan* outlined several management goals, with specific actions outlined to assist with reaching each goal. In regards to EWM management, the TLA's defined goal is to:

Actively manage EWM to keep the population from negatively impacting recreation, navigation, and aesthetics

In order to reach this objective, the TLA has developed a multi-pronged approach as part of this Integrated Pest Management (IPM) Program.

- ***Mechanical Harvesting*** will be the primary EWM management tool. Much of the EWM footprint of EWM in the Tomahawk Lake System is in offshore and exposed areas where herbicide treatment may not be particularly effective. Therefore, seasonal relief through mechanical harvesting was chosen as the primary EWM management tool to minimize impediments of lake users.
- ***Herbicide Treatment*** will be integrated into the IPM Program after trials document its effectiveness. The first trial occured in spring 2023, occurring in areas of high likelihood of success and areas that are less compatible for mechanical harvesting, as they contain shallow water and/or docks and other obstacles.
- ***Hand-Harvesting*** using HCS/DASH will be reserved for requesting riparian at a local scale. The costs of the action will be the responsibility of the requesting riparian, with assistance on permitting from the TLA.

The TLA received an AIS control grant to fund mechanical harvesting and associated monitoring/planning in 2022-2023 (ACEI-293-22). A second phase of the mechanical harvesting trial was funded for 2024-2025 (ACEI-337-24). This report satisfies the first report deliverable of the latest 2-year mechanical harvesting project.

The TLA also secured a grant to fund a 2023 trial herbicide treatment (ACEI-312-23). Remaining funds from that grant were applied towards the 2024 herbicide treatment program. These projects were designed to dovetail together with this report satisfying deliverables for mechanical harvesting and herbicide treatment grants.

1.2 2024 EWM Management Strategy

IPM Strategy: Mechanical Harvesting

Areas targeted for mechanical harvesting include areas within high riparian footprint and areas of local importance for recreation. Since 2022, the TLA has worked with Onterra and Aquatic Plant Management LLC to create a mechanical harvesting strategy based off the most recent late-season EWM mapping survey, with attention to the development of a prioritization and efficiency strategy. The final 2024 strategy is shown on Map 1.

The 2024 mechanical harvesting strategy was planned to largely mirror the 2023 strategy, also having several modifications to the work areas based on proposed herbicide management and other factors influencing the prioritization of sites. An intentional aspect of the harvesting plan was to conduct significant amounts of harvesting time in late-summer/early-fall as a means of achieving EWM nuisance reductions with potential benefits extending into the following spring.

IPM Strategy: Herbicide Spot Treatment

The mechanical harvesting contractor noted that the biggest obstacle to productivity was a few select colonies required a large amount of effort both for harvesting and for off-loading times. In order to make the mechanical harvesting program more productive, the TLA investigated adding herbicide management into their Integrated Pest Management (IPM) Program.

During a joint meeting with the TLA, the Minocqua-Kawaguesaga Lakes Protection Association (MKLPA), the WDNR lakes and fisheries departments, and Onterra (represents both the TLA and MKLPA) in mid-December 2023, discussions about possibly targeting Clearwater Bay (sometimes referred to as Echo Bay) and Pickerel Bay with aquatic herbicides in spring 2024 occurred. The WDNR conveyed that they still opposed the treatment of Pickerel Bay, which was denied in 2023, but would be amenable to targeting Clearwater Bay in 2024. The TLA submitted a permit application to target dense EWM populations in Clearwater Bay, with approval occurring on May 15, 2024 (Map 2).

1.3 Pretreatment Confirmation and Refinement Survey

On June 5, an Onterra field survey crew completed the Pretreatment Confirmation and Refinement Survey within the single permitted 2024 treatment area on Tomahawk Lake. The main objective of the survey was to collect quantitative data within the site to document pretreatment native aquatic plant populations. Other tasks were to confirm active growth of EWM, evaluate the average depth of the site, and record pH and water temperatures. Water temperatures were 65-67°F throughout the water column, and pH was 7.9 at mid depth in the treatment area. The EWM population was largely present in the same areas documented in past mapping surveys and was green with plenty of active growth (Photograph 1.3-1).

Photograph 1.3-1. EWM observed during 2024 Pre-Treatment Survey on Tomahawk Lake. Photo credit Onterra.

During this Pretreatment Survey, it was noted that in addition to the strong EWM populations that were noted, there was also confirmed presence of numerous native aquatic plants such as common waterweed, muskgrasses, variable-leaf pondweed, small pondweed, and flat-stem pondweed. It was also observed that there were numerous, large "blobs" of bright green filamentous algae in this area of the lake. No changes were recommended for the treatment strategy and treatment area extent. Map 2 displays the final strategy including the dosing on the embedded table.

Based upon information from WDNR fisheries and UW Trout Lake Station researchers, peak walleye spawning activity was estimated to have occured during the last week of April. Onterra extrapolated as to when walleye were likely to be largely past their most vulnerable life stages to extended exposure auxin use rates (Figure 1.3-1). With this information, the treatment was scheduled to occur after June 15, 2024 and avoid the entire larval walleye life stage.

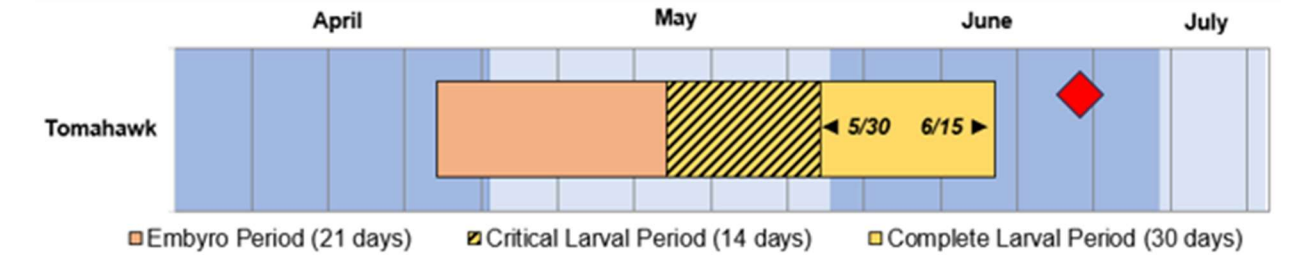


Figure 1.3-1. Sensitive stages of walleye to auxin herbicide exposure. Treatment date of 6/20/2024 shown as red diamond.

2.0 2024 AQUATIC PLANT MANAGEMENT ACTIVITIES

Herbicide Treatment:

The ProcellaCOR herbicide application were completed by Aquatic Plant Management, LLC on June 20, 2024. The application was completed without issue and with ideal conditions present including modest winds of less than 2 mph. Details of the herbicide application are shown on page 7 of Appendix A.

Mechanical Harvesting:

The mechanical harvesting operations that took place during 2024 were similar to the 2023 program. During this third year of the program, approximately 90 days of mechanical harvesting occurred removing almost 110,000 cubic feet of EWM. More details can be found in Appendix A.

Hand Harvesting/Diver Assisted Suction Harvest (DASH):

Five riparian property owners utilized the DASH program during 2024 with the focus on removing EWM from near private piers, swim areas, and boat lifts. In total, 423 cubic feet of EWM was harvested through the use of DASH during 2024. Additional details of the 2024 DASH operations are available within Appendix A.

3.0 2024 AQUATIC PLANT MONITORING RESULTS

It is important to note that two types of aquatic plant surveys are discussed in the subsequent materials: 1) point-intercept surveys (Photograph 3.0-1) and 2) EWM mapping surveys (Photograph 3.0-2). Overall, each survey has its strengths and weaknesses, which is why both are utilized in different ways as part of this project.

Photograph 3.0-1. Point-intercept survey on a WI lake. Photo credit Onterra.

Photo 3.0-2. EWM/HWM mapping survey on a Wisconsin lake. Photo credit Onterra.

The point-intercept survey provides a standardized way to gain quantitative information about a lake's aquatic plant population through visiting predetermined locations and using a rake sampler to identify all the plants at each location (Photograph 3.0-1). The survey methodology allows comparisons to be made over time, as well as between lakes. The point-intercept survey can be applied at various scales. The point-intercept survey is most often applied at the whole-lake scale. The whole-lake point-intercept survey has been conducted Tomahawk Lake in 2007, 2014, and 2021.

If a smaller area is being studied, a modified and finer-scale point-intercept sampling grid may be needed to produce a sufficient number of sampling points for comparison purposes. The subsample point-intercept survey methodology is often applied over management areas such as herbicide application sites. This type of sampling is used within this project as a part of the mechanical harvesting and herbicide spot treatment pre/post monitoring.

While the point-intercept survey is a valuable tool to understand the overall plant population of a lake, it does not offer a full account (census) of where a particular species exists in the lake. During the EWM mapping survey, the entire littoral area of the lake is surveyed through visual observations from the boat (Photograph 3.0-2). Field crews supplement the visual survey by deploying a submersible camera along with periodically doing rake tows. The EWM population is mapped using sub-meter GPS technology by using either 1) point-based or 2) area-based methodologies. Large colonies >40 feet in diameter are mapped using polygons (areas) and are qualitatively attributed a density rating based upon a five-tiered scale from *highly scattered* to *surface matting*. Point-based techniques were applied to EWM locations that were considered as *small plant colonies* (<40 feet in diameter), *clumps of plants*, or *single or few plants*.

3.1 Herbicide Concentration Monitoring

The herbicide concentration monitoring plan associated with the treatment was developed by Onterra and the WDNR, with the intent of gaining sufficient data to aid in understanding the concentrations of florpyrauxifen-benzyl and florpyrauxifen acid that were achieved in the hours and days after treatment. A copy of the final herbicide concentration monitoring plan is included as Appendix B. Samples were collected at two total sites following treatment – one within the application area, and one outside the application area; both within Clearwater Bay. The Sample Plan included 8 total sampling intervals spanning from 3 hours after treatment (HAT) to 21 days after treatment (DAT) (Appendix A). Samples were collected by a local volunteer member of the TLA. Samples were successfully collected, stored, and shipped to EPL Bio Analytical Services in Niantic Illinois for analysis.

The EPL Lab reports the concentration in parts per billion (ppb) of the initial parent active ingredient in ProcellaCOR (florpyrauxifen-benzyl – [FPB]), as well as an acid metabolite (florpyrauxifen acid) which is the immediate by-product that it breaks down into. Florpyrauxifen acid (FP acid) has been shown to persist in the lake longer than the active ingredient. This chemical metabolite is reported to have activity as an herbicide on aquatic plants, albeit to a lower degree than the active ingredient.

Figure 3.1-1 displays the concentrations of FPB (top frame) and florpyrauxifen acid (bottom frame) from the monitoring locations. Note that the y-axis differs between the two graphs so that the data can be more easily. For reference, the dosing rate of 5.0 PDU (prescription dosing units)/acre-ft equates to approximately 9.6 ppb of FPB. Calculations indicated that if the herbicide applied to A-24 evenly distributed within Clearwater Bay, it would have a concentration of slightly over 4 ppb.

The active ingredient (FPB) was higher within the application area (TL1) compared to the untreated core of Clearwater Bay (TL2) until about 2 DAT when the concentrations became more similar (top frame, Figure 3.1-1). Concentrations of FPB from TL2 were below detection limits by 4 DAT, and both sites by 7 DAT.

The acid metabolite concentrations (FP acid) increased during the early sampling intervals as it was converting from FPB. Concentrations of FP acid peaked in the herbicide application site (TL1) and sustained at about 0.8 ppb between 1 and 4 DAT. Concentrations in both sites were similar to or lower than detection limits by 7 DAT.

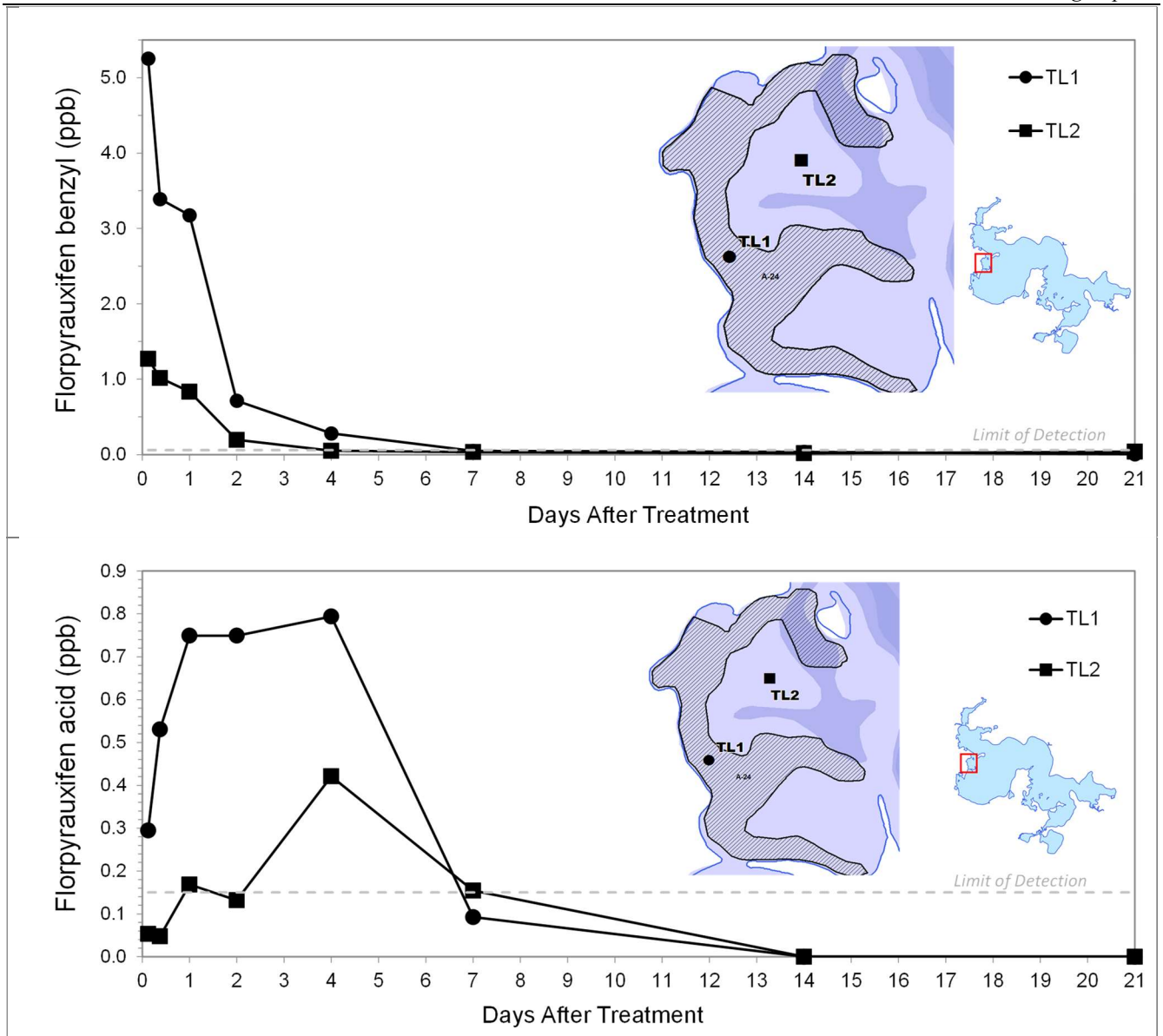


Figure 3.1-1. Florpyrauxifen-benzyl (top) and Florpyrauxifen acid (bottom) concentrations following a 2024 ProcellaCOR herbicide treatment in Tomahawk Lake.

Figure 3.1-2 displays the concentrations of FPB and FP acid within the application areas of 2023 (Site C-23) and 2024 (Site A-24). The solid lines show the active ingredient (FPB), with higher concentrations observed during the 2024 treatment. The 2024 site was more protected and contained than the 2023 site, limiting herbicide dissipation. By approximately 4 DAT, both treatment events had active ingredient concentrations nearing the lower limit of detection.

The FP acid concentrations (dotted lines) from the two treatment events mirrored a similar trend to the active ingredient. The FP concentrations were higher and sustained longer in 2024 compared to 2023. Continued aquatic plant monitoring will help understand if these are meaningful differences in herbicide concentrations.

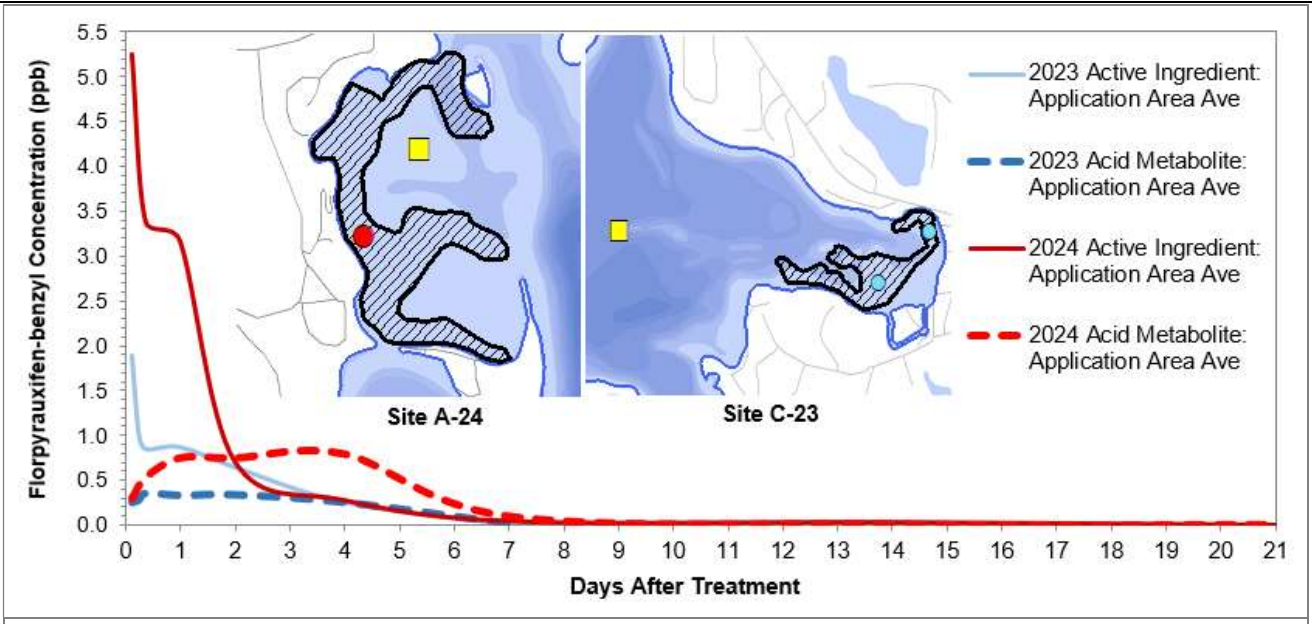


Figure 3.1-2. Florpyrauxifen-benzyl and acid concentrations after the 2023 and 2024 treatments in Tomahawk Lake. Herbicide application area shown in black hashed area.

3.2 Subsample Point-Intercept Survey

Mechanical Harvesting Sites

A quantitative monitoring plan was created for this project in which a total of 342 sub-sample point-intercept sampling locations were contained within six of the mechanical harvest areas and 45 were placed within an un-targeted control site (Map 3). The quantitative assessment would be completed through the comparison of the sub point-intercept survey from June 2022 (*prior to harvesting*) to annual late-summer post mechanical harvesting survey points. This will allow an understanding of how native and non-native plant populations are impacted by the mechanical harvesting effort. It is acknowledged that the timing of the first survey in this dataset was such that some native species may not have fully emerged from winter dormancy and may be underrepresented. Wild celery (*Vallisneria americana*) is amongst the species likely underrepresented in a June survey, while almost any other species including EWM, would also be expected to increase in occurrence as the growing season progresses beyond the month of June.

The results of the entire aquatic plant populations within each of the five harvested sites and the control site are shown in the subsequent figures. It can be noted that site M-22 results are not shown as there was an herbicide treatment within an area that affects the M-22 site, making the data incomparable to other mechanical harvesting sites.

Control Site: Within the control site, the occurrence of EWM increased between June 2022 and August 2023, and then decreased in August 2024. Both of the August occurrences were statistically greater than the June 2022 survey (Figure 3.2-1). The occurrence of southern naiad was statistically higher than the June 2022 survey in the September and both of the August surveys, and wild celery was also statistically higher in September 2022 and August 2023, but not in August 2024. Common waterweed showed a statistically valid decrease in occurrence in the control site when comparing the August 2024 survey to the June 2022 survey.

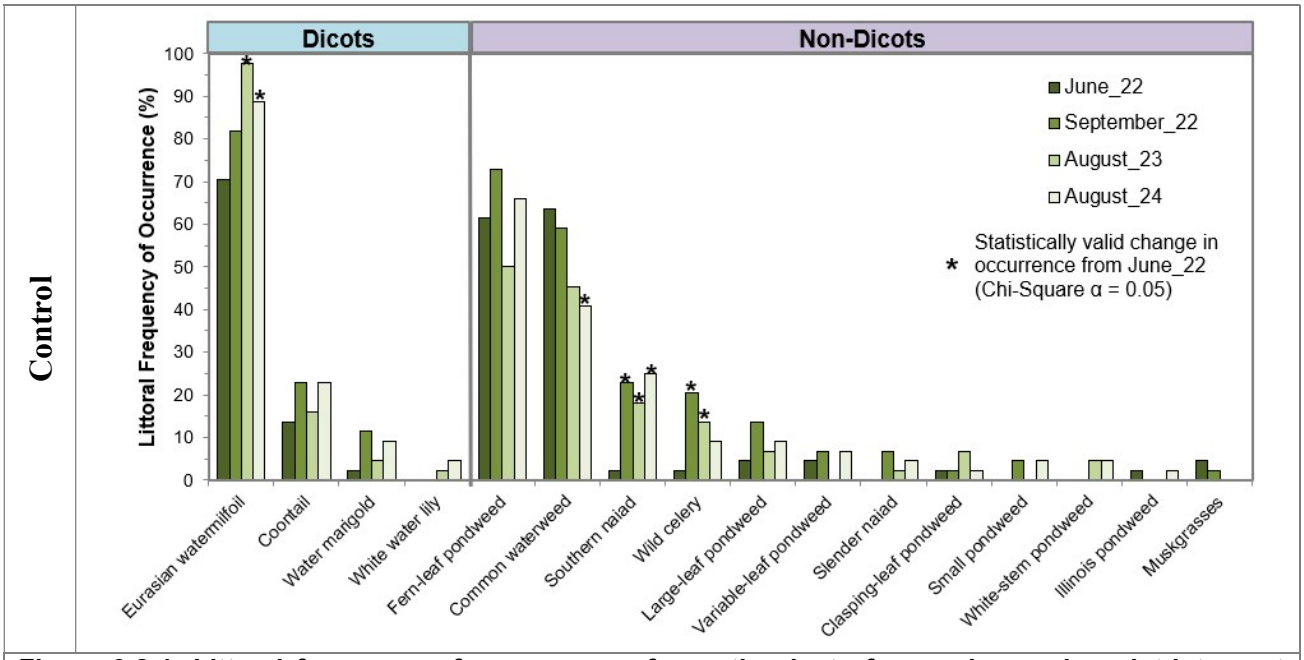


Figure 3.2-1. Littoral frequency of occurrence of aquatic plants from sub-sample point-intercept survey in Control Site in Tomahawk Lake. n=45.

Site AB-22: Within site AB-22, six native aquatic plant species showed statistically valid increases in occurrence compared to the pre-harvesting survey conducted in June 2022 (Figure 3.2-2). The occurrence of EWM was not statistically different during the study period with all surveys indicating an occurrence of over 70%. Northern watermilfoil was the only species that showed a statistically valid decrease in occurrence when comparing the August 2024 survey to the June 2022 survey.

Site AH-22: From site AH-22, the only native species that showed a statistically valid decrease in occurrence during the period of study was northern watermilfoil. Only one native species showed a statistically valid increase from June 2022 to August 2024, being slender naiad. The occurrence of EWM did not statistically increase or decrease during the period of study (Figure 3.2-2).

Site I-22: In site I-22, there were no native plants that showed statistically valid decreases or increases in occurrence from June 2022 to August 2024. The occurrence of EWM remained above 90% in each survey (Figure3.2-2).

Sites: AC-22 & AE-22: Both of these sites were formally part of the Mechanical Harvesting sites, but were not displayed this year due to them being directly within and around the 2024 PrecellaCOR™ spot treatment site A-24. The data from these two sites is described later in this section under the Site A-24 section.

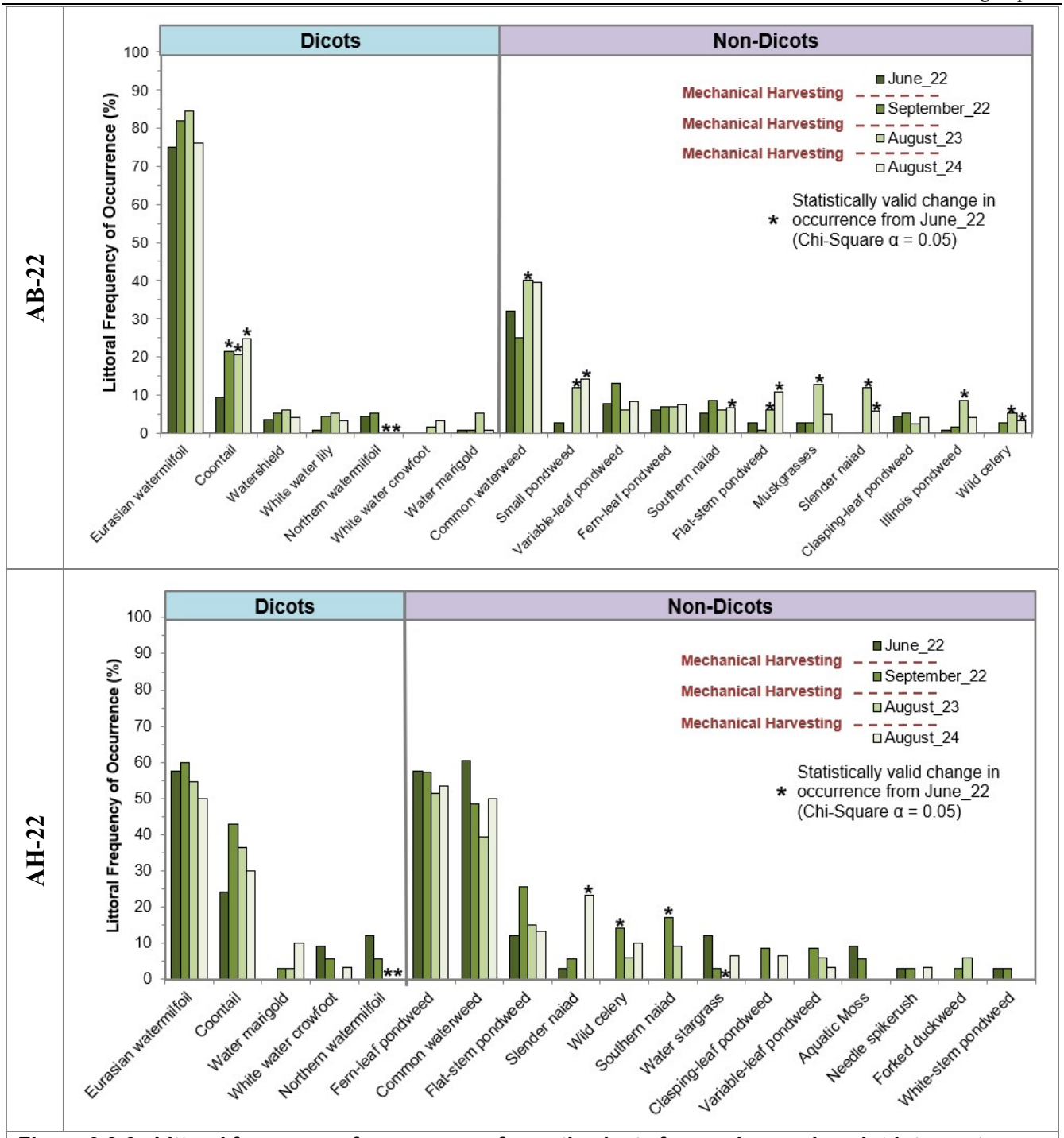


Figure 3.2-2. Littoral frequency of occurrence of aquatic plants from sub-sample point-intercept survey in Tomahawk Lake. AB-22 n=125, AH-22 n=35.

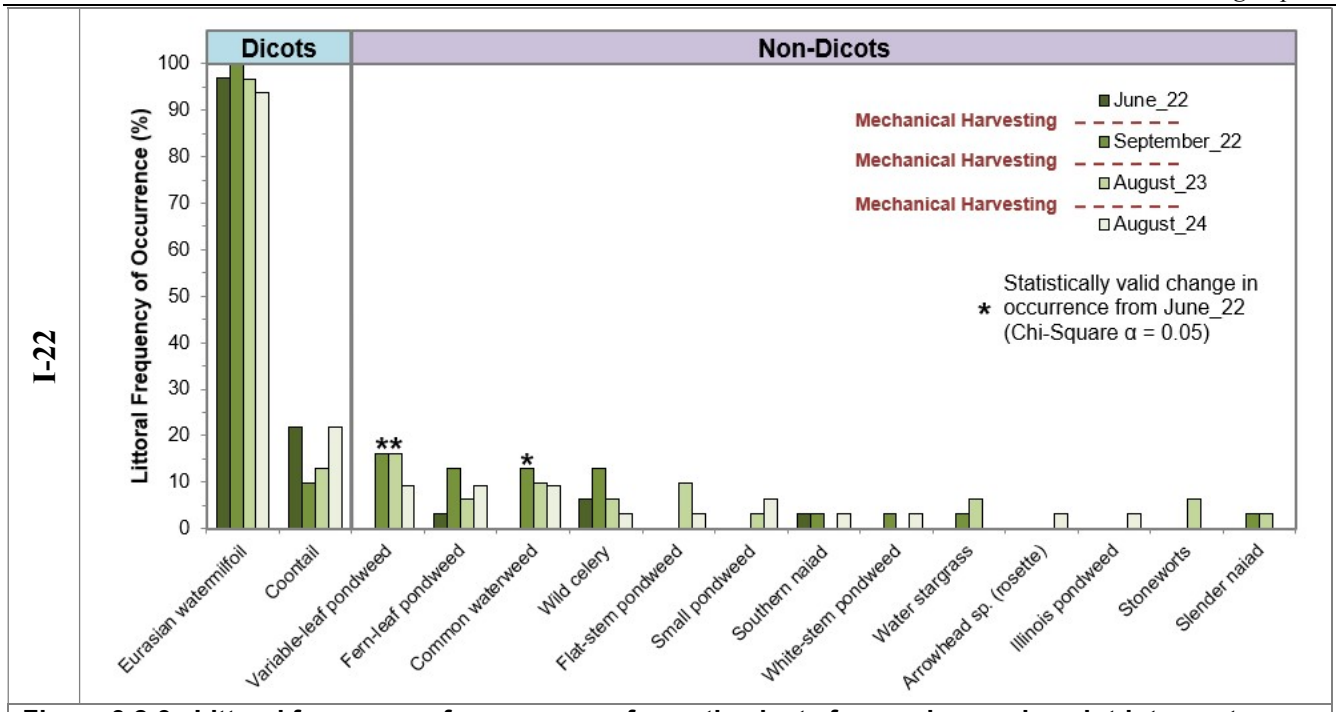


Figure 3.2-3. Littoral frequency of occurrence of aquatic plants from sub-sample point-intercept survey in site I-22 in Tomahawk Lake. n=32

Figure 3.2-4 explores the total rake fullness ratings and littoral frequency of occurrence of EWM from each of the mechanical harvesting sites. The control site indicated an increasing trend in EWM occurrence from June 2022 to August 2023 and then a slight decline in August 2024, with a fairly consistent ratio of each of the three rake fullness ratings. Site AB-22 showed consistent total rake fullness ratings in each survey with approximately the same ratio of each rake fullness rating and largely mirrored the control site. This site saw 40.8 hours of mechanical harvesting during the summer of 2024.

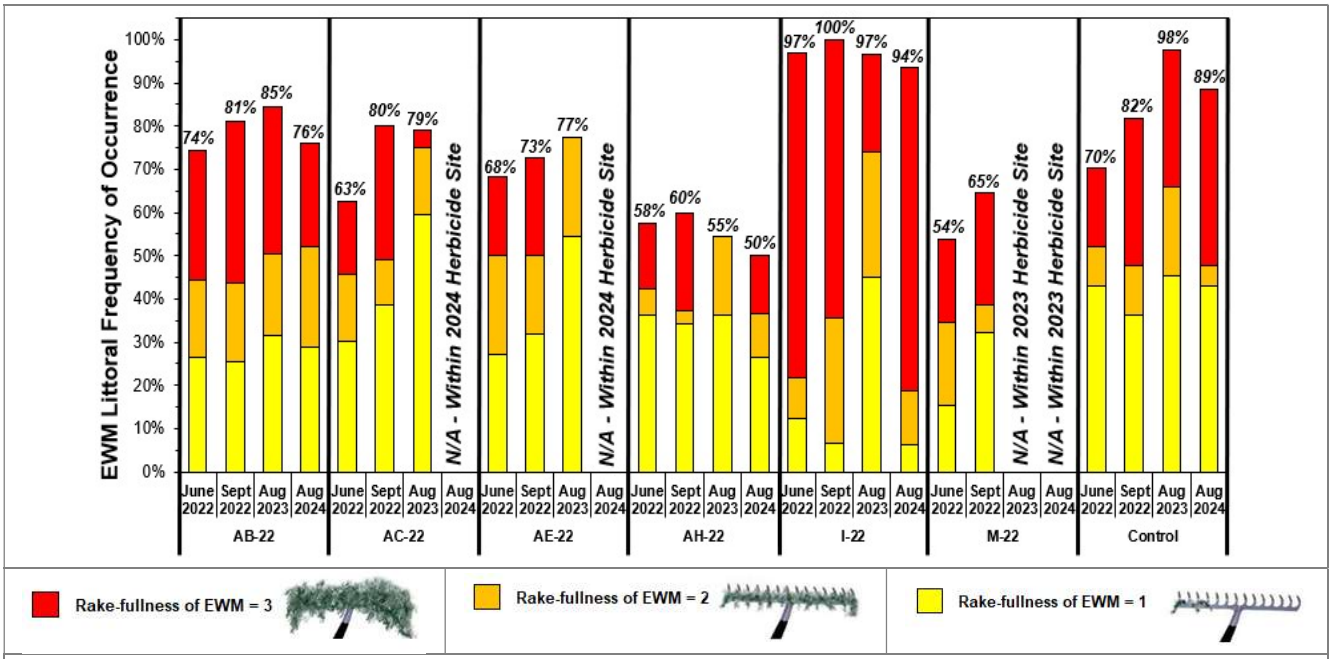


Figure 3.2-4. Littoral frequency of occurrence of EWM from sub-sample point-intercept survey in Tomahawk Lake.

Interestingly sites AH-22 and I-22 showed fewer rake fullness ratings of 3 in the August 2023 survey as compared to the September 2022 survey, but saw an increase in rake fullness ratings of 3 in the August 2024 Survey. This would indicate that EWM biomass may have rebounded in these sites in 2024, despite seeing a decrease in EWM biomass the year prior. Site M-22 was not assessed in the same manner during 2024 as the site was located within the direct 2023 herbicide application area. Sites AE-22 and AC-22 were also not assessed in the same manner during 2024, as they were located within the direct 2024 herbicide application area.

ProcellaCOR Herbicide Treatment Site C-23

The quantitative monitoring plan associated with the 2023 ProcellaCOR treatment site consists of replicate subsample point-intercept surveys collected before (June 2023) and after (September 2023) treatment, as well as the following year after treatment (August 2024). A total of 100 sampling locations were included in the study with a spacing of 25 meters apart. All points were located within the direct herbicide application area (Figure 3.2-5). The *pretreatment survey* documented EWM on 46/100 points or 46%. EWM was present at one sampling location in the post *year of treatment* survey (Aug 2023), representing a statistically valid 97.8% decrease in occurrence. EWM was located at 7 points in the *year after treatment* survey (Aug 2023), which represents a statistically valid 84.8% decrease in occurrence from June 2023 to August 2024.

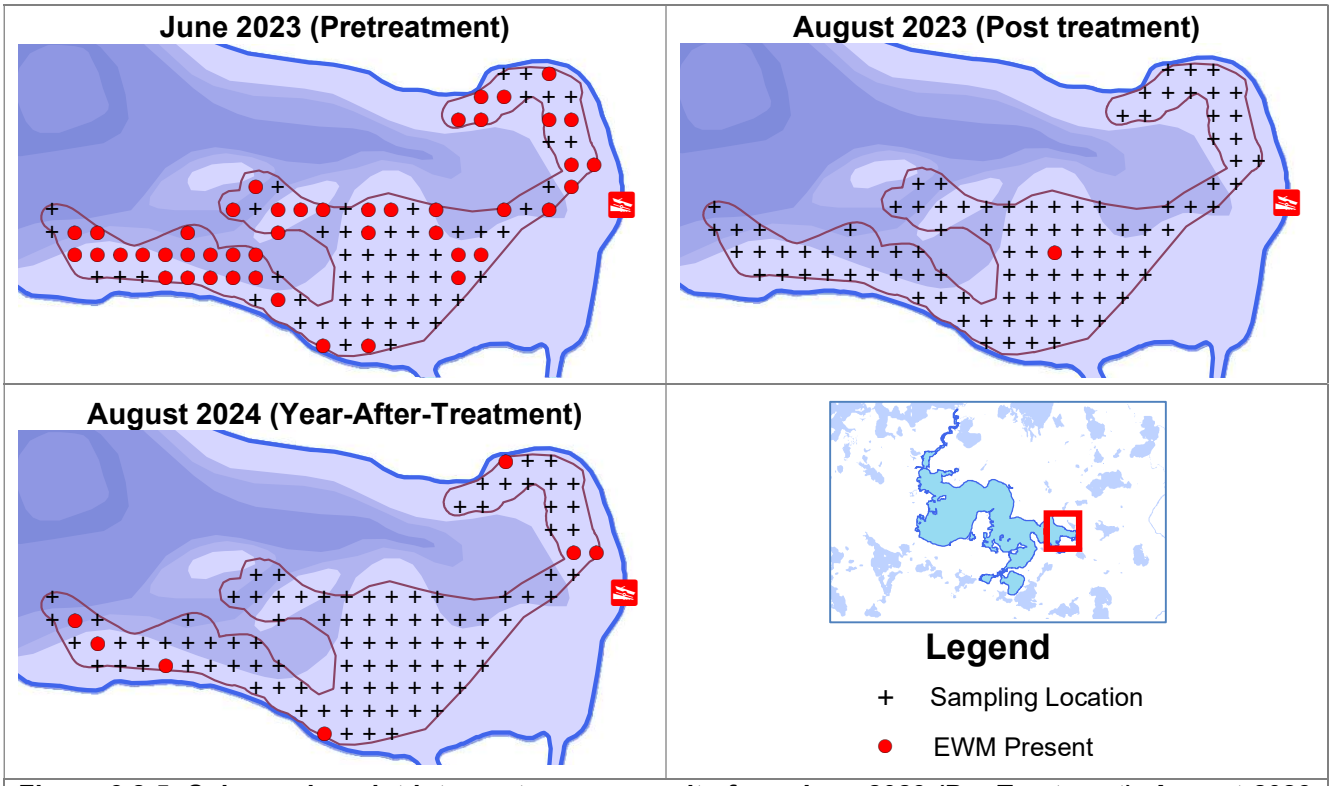


Figure 3.2-5. Subsample point-intercept survey results from June 2023 (Pre-Treatment), August 2023 (Post treatment), and August 2024 (Year-After-Treatment). Herbicide application area displayed in light purple outline.

Four native species exhibited a statistically valid decrease in occurrence between the two surveys, while one species showed a valid increase and most species did not have a significant change in occurrence (Figure 3.2-6). The occurrence of coontail was reduced by 87.2% and water marigold was reduced by

100%. Both of these species have shown to be susceptible to ProcellaCOR treatments. The occurrence of fern-leaf pondweed was reduced by 23.2%, which was a statistically valid decrease. Fern-leaf pondweed was still very common within the site in the post treatment survey with an occurrence of 53%. Forked duckweed is a free-floating species that is a little bigger than a thumb-nail, which becomes entangled on plants in the middle of the water column. Forked duckweed showed a statistically valid 81.8% decline in occurrence between the two surveys, perhaps as a function of the reduced EWM "substrate" upon which it gets entangled on. Fern-leaf pondweed and forked duckweed are not known to be particularly sensitive to ProcellaCOR treatments, although continued studies will help better understand aquatic plant response to this chemical.

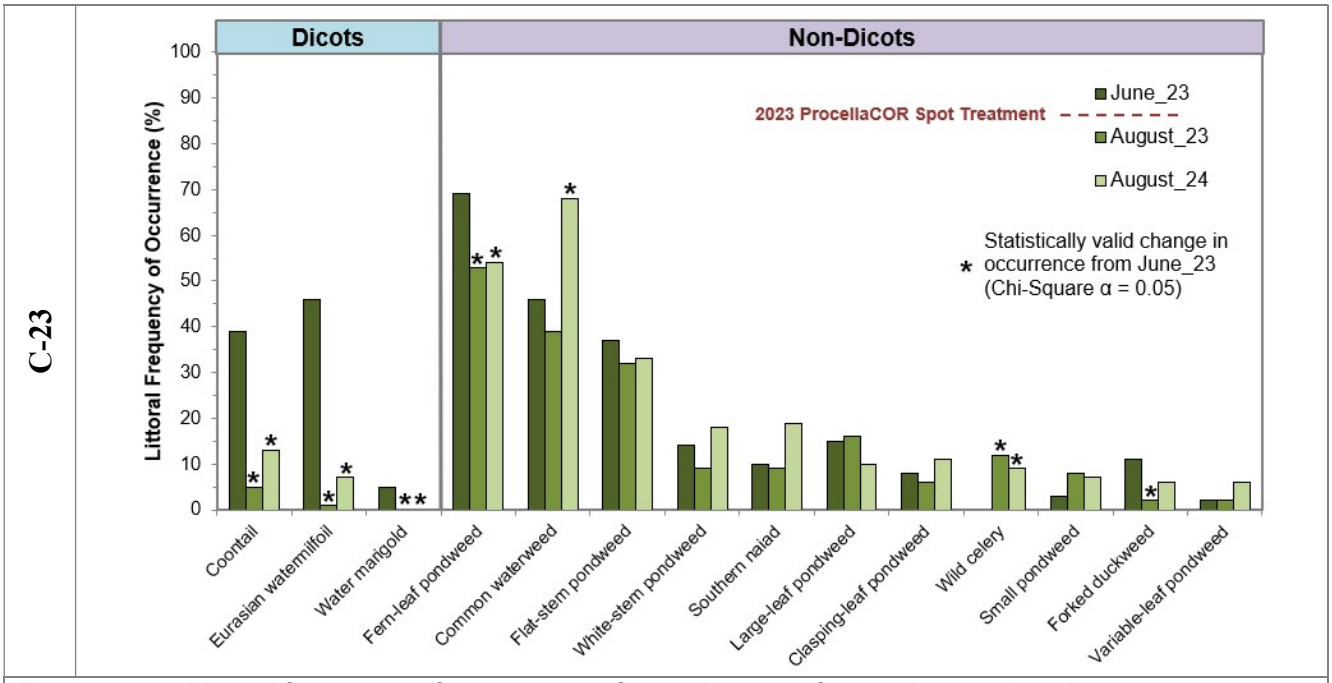


Figure 3.2-6. Littoral frequency of occurrence of aquatic plants from sub-sample point-intercept survey in site C-23 in Tomahawk Lake.

ProcellaCOR Herbicide Treatment Site A-24

The quantitative monitoring plan associated with the 2024 ProcellaCOR treatment site consists of replicate subsample point-intercept surveys collected before (June 2024) and after (September 2024) treatment. A total of 119 sampling locations were included in the study with a spacing of 25 meters apart. These locations were previously mechanical harvesting sites AC-22 and AE-22, and are now classified as site A-24. 50 points were located within the direct herbicide application area (Figure 3.2-7), with the remaining 69 points located close to the direct herbicide application area. The *pretreatment survey* (Aug 2023) documented EWM on 93/119 points or 78%. EWM was present at 4 points in the post *year of treatment* survey (Aug 2024), representing a statistically valid 95.7% decrease in occurrence. It is important to note that no EWM was found post treatment within the application area or within Clearwater Bay.

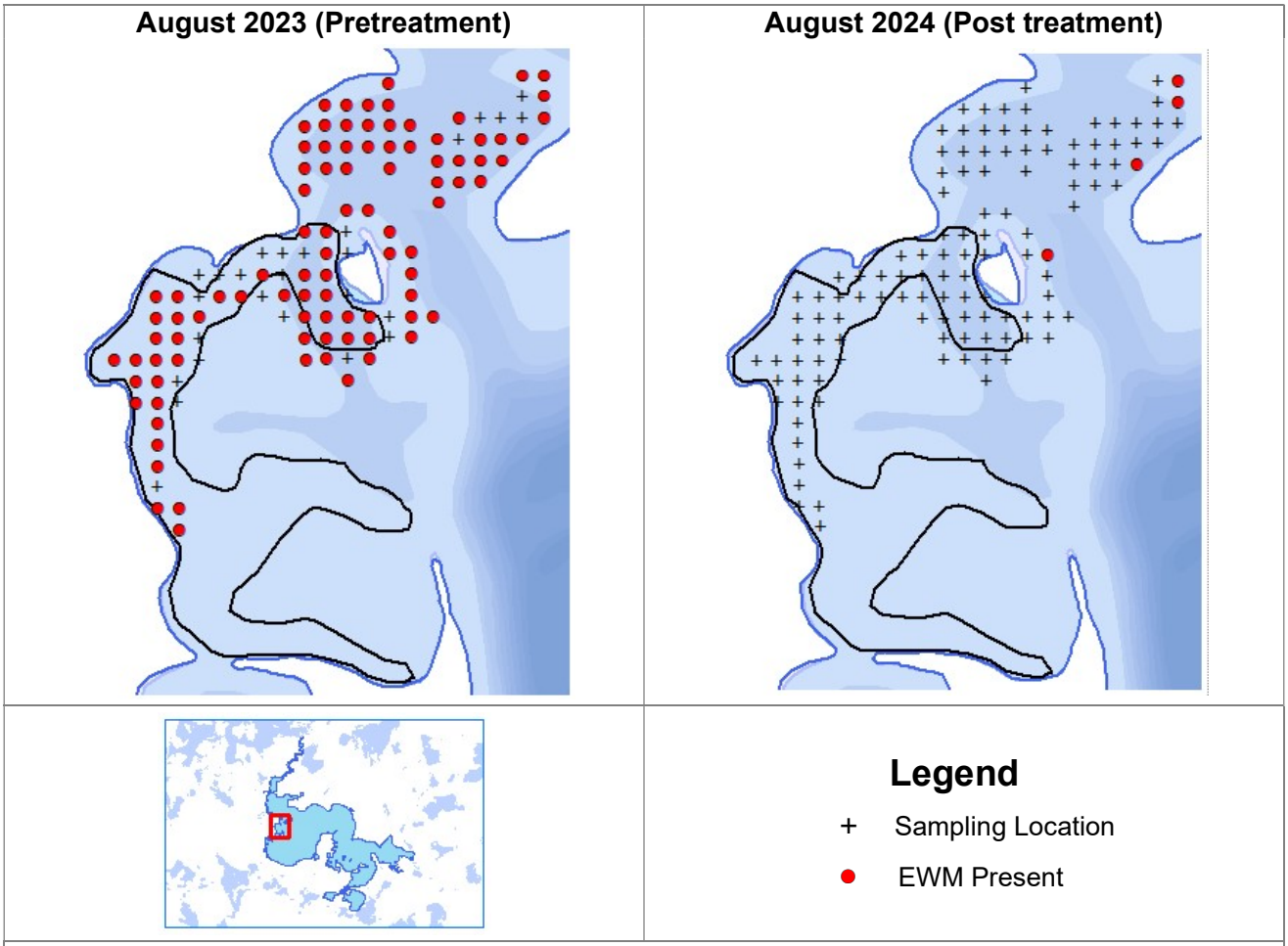


Figure 3.2-7. EWM population before (2023) and after (2024) a ProcellaCOR herbicide treatment in Tomahawk Lake. Herbicide application area displayed in black outline.

This LFOO data is compiled from the two mechanical harvesting sites (AC-22 & AE-22) that were combined to represent the A-24 treatment site. Two native species exhibited a statistically valid increase in occurrence between the two surveys, while Eurasian watermilfoil showed a valid decrease and most species did not have a significant change in occurrence (Figure 3.2-8). The occurrence of EWM was reduced by 95.7%, immediately following a treatment. The occurrence of wild celery was increased by 122.2% and slender naiad was increased by 5 fold (500%). All other native plant species did not display any statistically valid increases or decreases in occurrence following the treatment

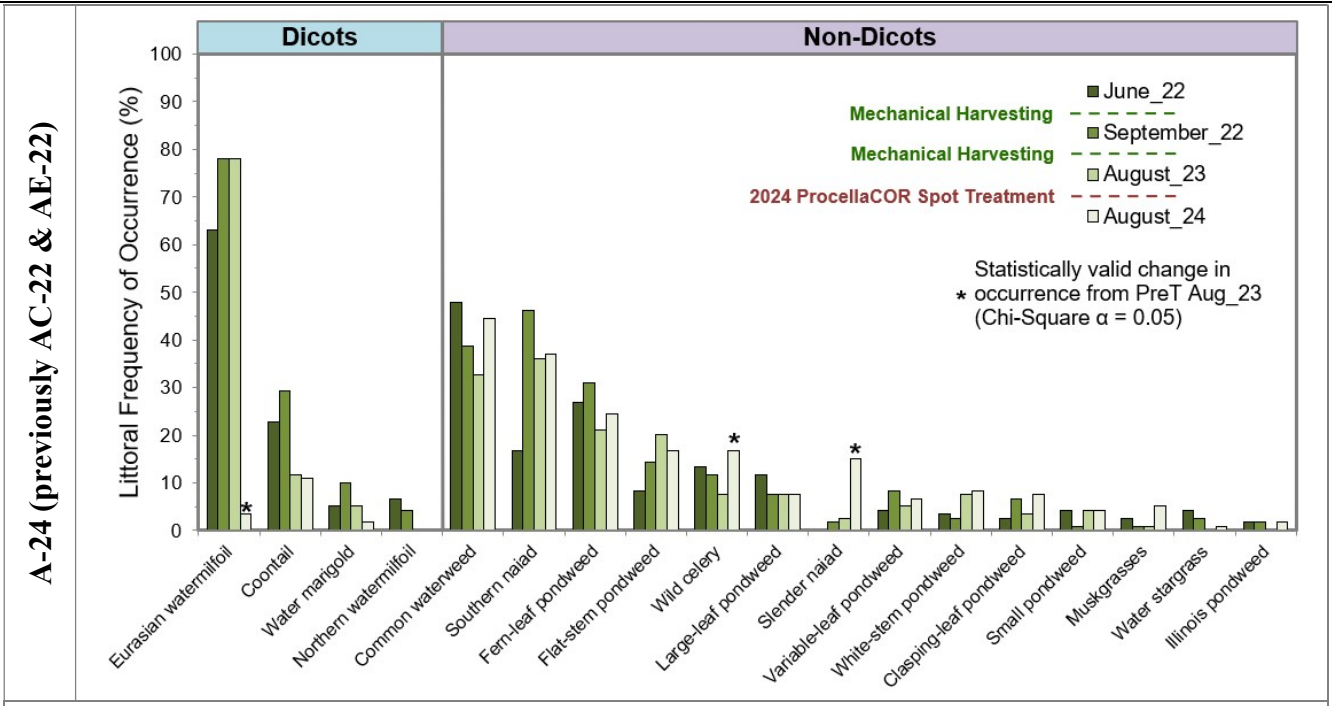


Figure 3.2-8. Littoral frequency of occurrence of aquatic plants from sub-sample point-intercept survey in and around site A-24 in Tomahawk Lake. This data comes from the previous mechanical harvesting sites AC-22 & AE-22.

3.3 Late-Summer EWM Mapping Survey

Onterra ecologists have conducted a Late-Summer EWM Mapping Survey on the system in both 2021 and 2023. While Onterra did not conduct a system-wide EWM mapping survey in 2024, a focused EWM mapping survey was conducted on treatment sites C-23 and A-24. The findings within those two sites are described and displayed below in their own respective sub-sections. It can be noted that Onterra will again be conducting a system-wide Late-Summer EWM Mapping Survey again in 2025.

ProcellaCOR Herbicide Treatment Site C-23

The 2023 ProcellaCOR treatment resulted in a substantial decrease in the EWM population within the application area with relatively few *single plants* present in the northern end of the site in the post treatment survey (August 2023) (Figure 3.3-1). Reductions in EWM were observed during the *year of treatment* extending to nearby adjacent areas of the targeted bay.

The *year after treatment* monitoring indicates some EWM rebound especially in the near-shore areas of this bay. These EWM colonies consisted of *highly scattered* and *scattered* densities and continue to be well below pretreatment levels. As outlined in the TLA's *APM Plan* (Dec 2022), the goal of the herbicide treatment program is to have EWM reductions for at least three summers post treatment. Continued EWM rebound is anticipated in 2025 and the late-season EWM mapping survey will determine if the overarching control objectives will be met from this treatment.

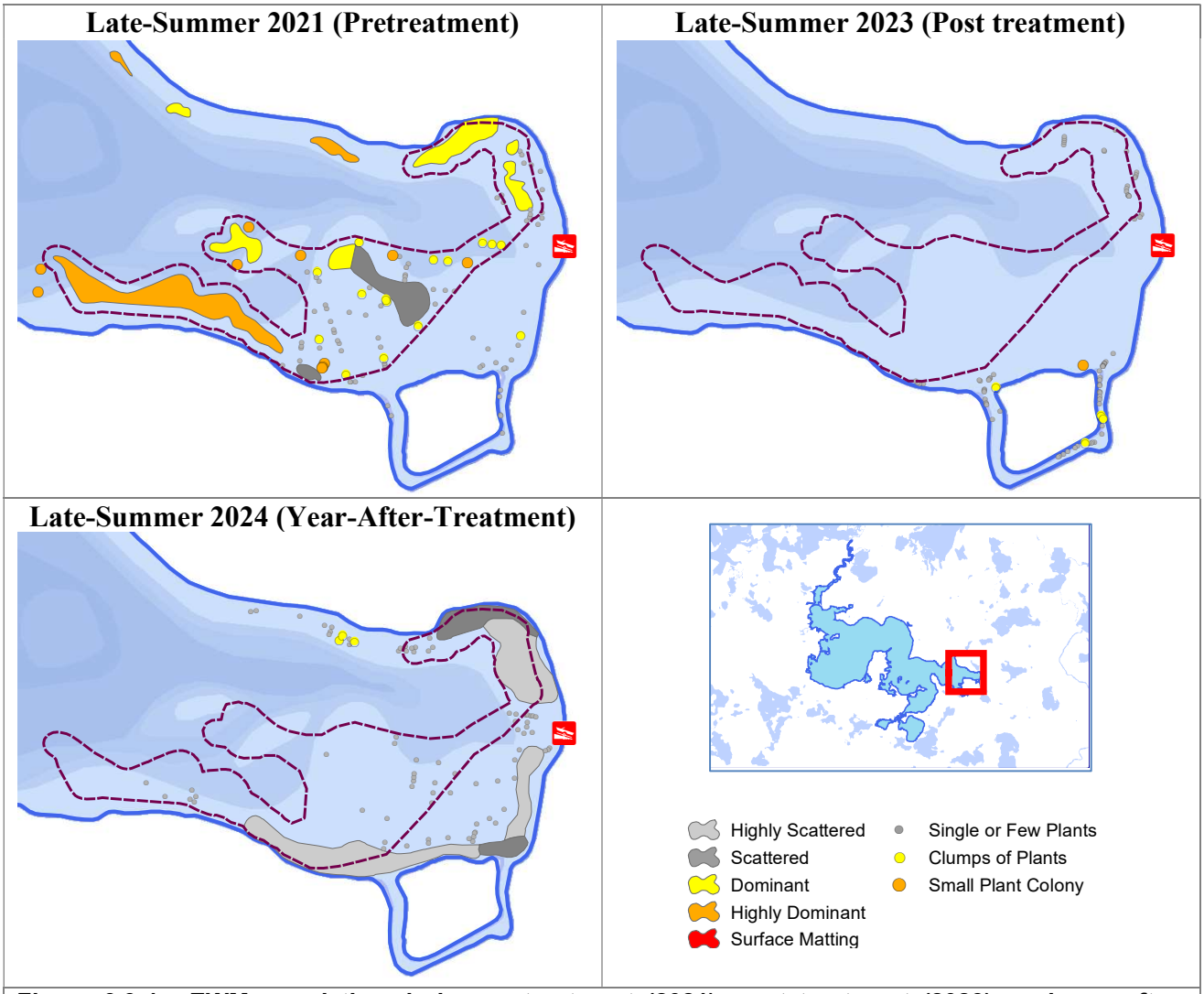


Figure 3.3-1. EWM population during pretreatment (2021), post treatment (2023), and year-after-treatment (2024) of a ProcellaCOR herbicide treatment in Tomahawk Lake. Herbicide application area displayed in dashed purple outline.

ProcellaCOR Herbicide Treatment Site A-24

The 2024 ProcellaCOR treatment resulted in a substantial decrease in the EWM population within the application area with relatively few *single plants* present in shallow areas on the southern end of the site, as well as along the northern extents of the site in the post treatment survey (August 2024) (Figure 3.3-2). Adjacent areas of EWM reductions were observed, especially to the north of Clearwater Bay between the mainland and Olmstead Island.

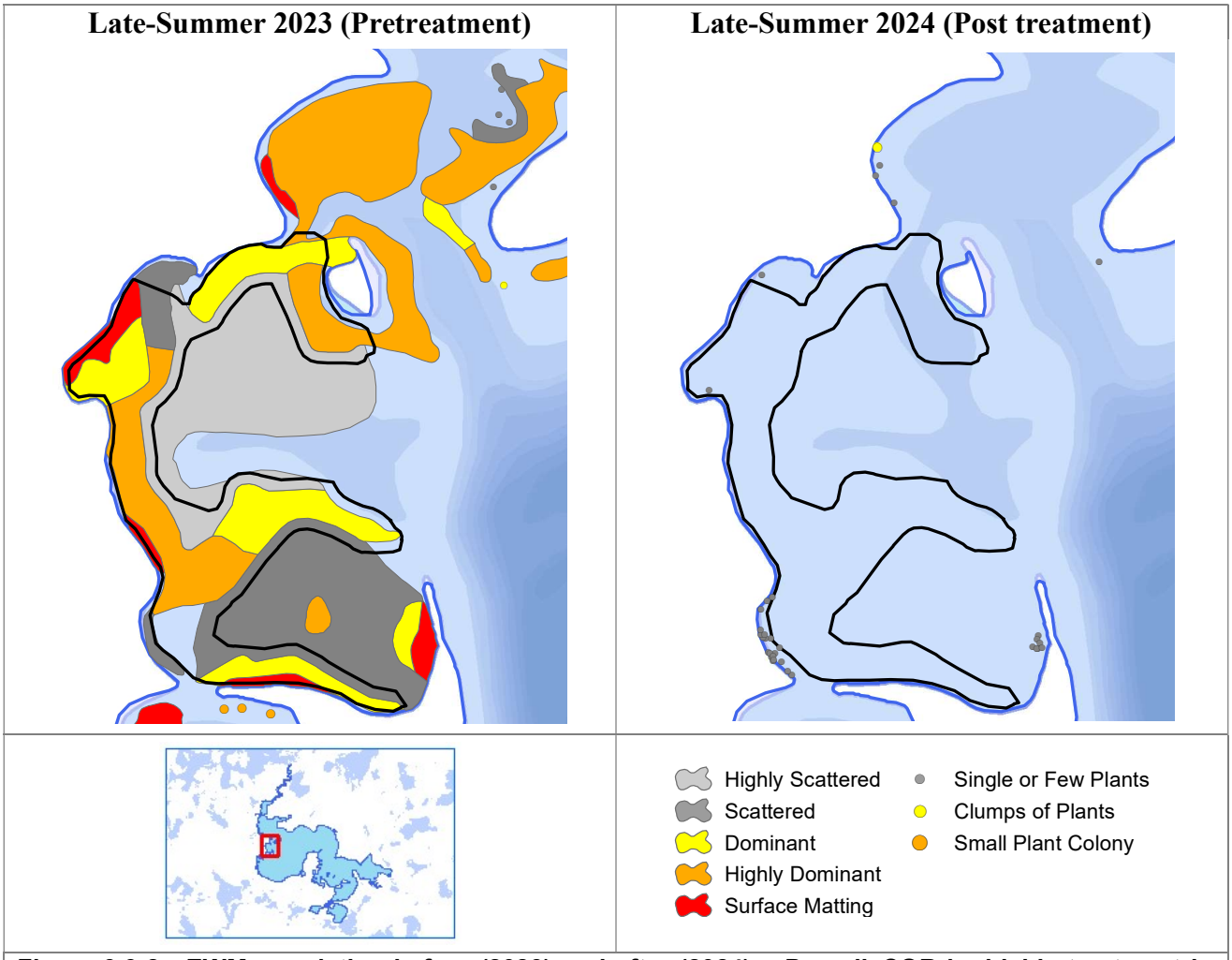


Figure 3.3-2. EWM population before (2023) and after (2024) a ProcellaCOR herbicide treatment in Tomahawk Lake. Herbicide application area displayed in black outline.

3.4 EWM Regrowth Monitoring

A pilot program was initiated in 2021, where volunteers were provided a 6-ft graduated PVC pipe to measure the distance from the top of the EWM plants to the surface of the lake. During this project, volunteers would collect data from multiple predefined sites per harvesting plot at different time intervals. The logistics of implementing this monitoring were challenging for the TLA. Recently cut plants were difficult to measure, especially those that were cut to 6 feet deep.

Ultimately, the data that was collected in 2022 allowed an understanding of EWM re-growth over time at five locations in roughly mid-July. The data indicate that EWM grew an average of just over a foot a week. Additional efforts in 2023 were aimed at gathering more overall data, perhaps allowing the ability to query aspects such as time of year, impacts of multiple cut events, etc. There were two sites that were monitored in 2023. One was removed due to being near the 2023 ProcellaCOR treatment area, and the other showed progressive growth of EWM over the course of the summer.

In 2024, APM (Aquatic Plant Management) was contracted to conduct the next stage of EWM regrowth monitoring within Tomahawk Lake. APM conducted surveys at seven different sites to track how far below the water's surface the tops of EWM plants were. These sites were checked at seven different times, from early June to early September, spanning a total of 95 days. Each site had the distance from the tops of the EWM plants to the water's surface measured each time, unless either a harvesting event occurred between that data collection and the previous one, the EWM had reached the water's surface, or if no EWM was present at the time of data collection. At the end of the summer, it was found that overall, between all seven sites, EWM regrew an average of 0.64 inches per day (Appendix A– Page 26).

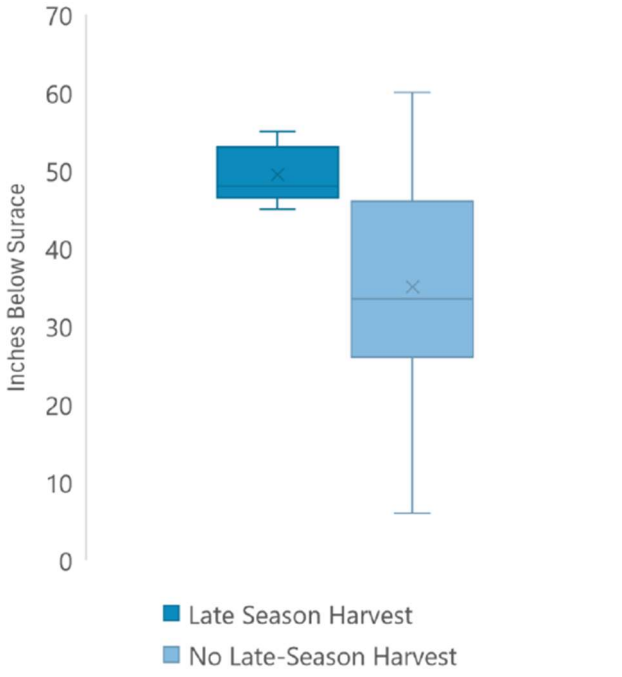


Figure 3.4-1. EWM Regrowth Monitoring accessing late-season harvesting. Figure extracted from APM, LLC EWM Removal Report – Appendix A

An additional component of the EWM regrowth monitoring was to assess the role of late-season mechanical harvesting on plant heights within the lake. Through this monitoring, the data indicates that EWM colonies were about 14.4 inches lower in the water column in areas that were mechanically harvesting late in the previous season compared to sites that were only harvesting during the traditional mechanical harvesting window (June-September).

3.5 Mechanical Harvesting Nutrient Content Analysis

When plants are removed from a lake as part of a mechanical harvesting program, nutrients are also removed. The nutrient composition of extracted plants varies greatly by species, but also can vary by productivity of the lake and time of year. Very little information exists about the quantity of nutrients (largely focused on phosphorus) that are removed from targeted EWM removal in northern WI. Other studies have looked at eutrophic systems in southern WI with much different ecological parameters than exist in Tomahawk Lake.

Four replicate plant grab samples were collected during the 2024 mechanical harvesting locations at four distinct time periods. The samples were processed and shipped to the UW Soils & Forage Analysis Laboratory in Madison for analysis, including dry weight, total nitrogen, and total phosphorus. At this time, two of the four intervals have been analyzed. The results of the percent dry matter and percent phosphorus concentration in dried samples of were averaged and used within the subsequent extrapolation calculations. Percent dry matter and phosphorus content coefficients from three literature sources are also discussed below.

Aquatic Plant Management LLC visited a certified scale to determine that 500 cubic feet of harvesting plant material, largely consisting of EWM, weighed 4,820 lbs or roughly 9.64 lbs/cubic ft. Using the total annual harvesting plant material estimates, Figure 3.4-2 estimates the amount of phosphorus

removed from mechanical harvesting during 2022-2024 using three literature examples and the preliminary coefficients from Tomahawk Lake.

Based upon this preliminary data, between roughly 250 and 300 lbs of phosphorus are removed annually as part of the mechanical harvesting operations on Tomahawk Lake. The coefficients from the preliminary 2024 study on Tomahawk Lake are within the range of other literature examples, even though the target plants on Tomahawk Lake are mostly EWM compared to a wider range of aquatic plants in the other examples.

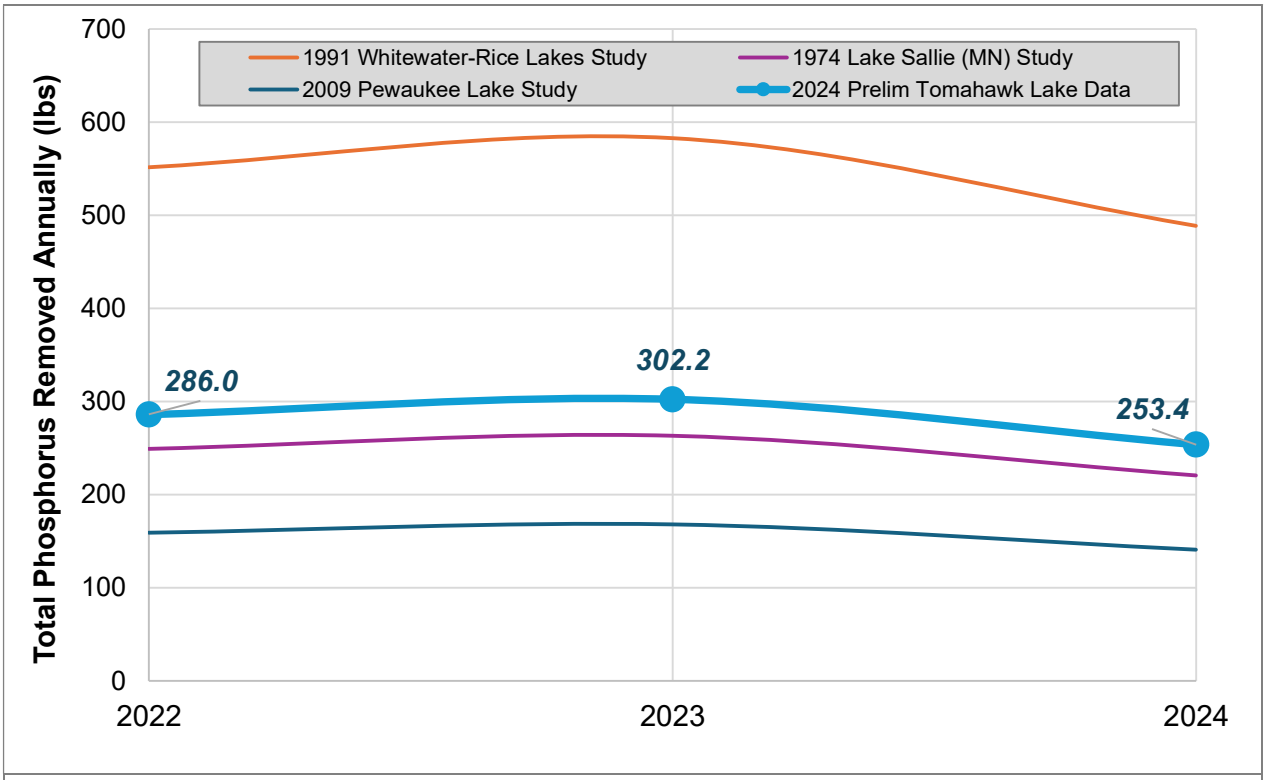


Figure 3.5-1. Potential phosphorus removed by mechanical harvesting. Total phosphorus content in vegetated material using preliminary data from Tomahawk Lake, a 2009 study on Pewaukee Lake, WI (Ebeling et al. 2011), a 1991 study on Whitewater-Rice Lakes, WI (Goddard and Field 1994), and Lake Sallie, MN (Peterson et al. 1974).

It is important to note that the source of phosphorus in aquatic plants comes from a combination of 1) uptake from the water column and 2) root-mined from the sediments, depending on the type of plants removed. Phosphorus from rooted plants like EWM largely originate from legacy phosphorus in the sediment. Therefore, the phosphorus removed from mechanical harvesting originates largely from internal legacy nutrient sources that has accumulated in the lake since its creation 12,000 years ago.

Comparing the amount of nutrients being removed to the annual nutrient load from the watershed is misleading. This is because the nutrients that are entering the lake, especially those being loaded during the growing season, are the nutrients that are controlling phytoplankton growth and water clarity. The nutrients being utilized by rooted vegetation, the vegetation that is often being targeted by mechanical harvesting, arrived at the lake earlier and are not impacting the current growing season water quality to a significant extent. There are exceptions, but overall, the removal of rooted plant biomass does not improve the lake's water quality, in the year it was harvested even if the nutrient content of the plants is

greater than the annual external load. In order for the mechanical harvesting to have an impact on water quality, the bulk of each year's growth would have to be harvested from the lake and that process would need to be repeated dozens or possibly hundreds of years to substantially deplete the nutrient content built up over time in the sediment.

4.0 CONCLUSIONS & DISCUSSION

Positive strides have been made since 2022 towards meeting the TLA's EWM management goal of keeping the EWM population from negatively impacting recreation, navigation, and aesthetics. The mechanical harvesting project is not attempting to manage the overall EWM population of the system, but to restore at least a large portion of use and aesthetics of the lake. The TLA feels that the three-year trial project has provided evidence that this plan is meeting many of their goals, but this strategy has not been implemented long enough to fully understand the longer term implications of the program. The TLA is also testing late-season harvesting to understand if greater reductions in EWM impacts can be achieved than simply short-term nuisance relief.

The purpose of the 2023-2024 herbicide treatment program was to remove EWM in heavily-used locations that the TLA was spending a lot of time mechanical harvesting. Without the need for mechanical harvesting in these areas, the TLA can direct those harvesting efforts elsewhere and be overall more productive at reducing recreation impediments system-wide. The results of the herbicide treatments appear highly successful to date, but continued monitoring in 2025 and beyond is warranted to fully evaluate these management events. The TLA understands the importance of continued dialogue with the WDNR lakes and fisheries program as it relates to their future EWM management program, especially when herbicide treatments are being discussed.

4.1 2025 EWM Management & Monitoring Strategy

Mechanical Harvesting Program:

It is currently unclear the amount of mechanical harvesting required to alleviate the nuisance conditions caused by EWM, so one of the goals is quantifying the length of impact that mechanical harvesting can have. It is highly likely that the TLA will have to fully fund their mechanical harvesting program in 2026 and beyond without grant funds, so understanding that level of mechanical harvesting needed to reach goals is important when setting annual budgets and conducting fundraising efforts.

The TLA is encouraged by the preliminary results of the late-season mechanical harvesting program. EWM plant height appears to be much lower in areas where late-season mechanical harvesting took place. This allowed the TLA in 2024 to postpone harvesting these areas early in the season, focusing their efforts on other areas of need. By approximately the same time the TLA completes cutting of all non-late-season harvesting areas, the areas that underwent late-season harvesting have grown back to the surface and are needed to be targeted to maintain navigation. As part of the TLA's evolved Integrated Pest Management Strategy, this allows management goals to be met for all areas by spreading out the timing of need.

Herbicide Spot-Treatment:

The TLA continues to be interested in making their mechanical harvesting program more efficient by integrating herbicide management of key areas into their overall plan. During a joint meeting with the TLA, the MKLPA, the WDNR lakes and fisheries departments, and Onterra in early February 2025, discussions about targeting multiple additional areas with aquatic herbicides in 2025 occurred.

Map 3 shows the preliminary treatment design which includes direct application to four sites to tallying 40.5 acres. A-25 targets the southwestern end of Sunflower Bay, an area with a substantial amount of riparian concerns as well as being a high-use travel corridor to Little Tomahawk Lake and Mude Lake. Due to the undeterminable amount and direction of flow in this confluence, the WDNR raised concerns about efficacy of this management strategy. While Onterra acknowledges those concerns, it is believed that a more aggressive dose of 8 prescription dosing units (PDU) per acre-ft is likely to overcome anticipated dilution factors.

B-25 targets a large area of dense EWM in and around Echo Bay. Targeting this site would have the largest benefit to the TLA, as mechanical harvesting this area took approximately 50 hours of effort in 2024 plus the extended amount of time traveling to and offloading from this area.

C-25 and D-25 are somewhat smaller herbicide treatment sites in highly contained bays of the lake. These areas have high riparian footprints and are difficult for the mechanical harvesting logistics due to the proximity of docks.

Pretreatment Confirmation and Refinement Survey

Onterra ecologists will conduct a *Pretreatment Confirmation and Refinement Survey* prior to the early-season herbicide application to verify application area extents and inspect the condition of the EWM colonies targeted for treatment through the use of a combination of surface surveys, rake tows, and submersible video monitoring. This approximately late-May/early-June meander-based survey would investigate for EWM colonial expansion, growth stage of the EWM (and native plants), application area specifies (e.g. average depth & extents), and other aspects that could warrant a modification to the treatment plan. Water temperature and pH data would be collected during the survey to assist with projecting ideal treatment timing. During this visit, Onterra staff would provide supplies and training to volunteers for conducting herbicide concentration monitoring.

Following the *Pretreatment Confirmation & Refinement Survey*, an email-style report with map(s) of the survey results and finalized treatment plan would be provided to the TLA, WDNR, and other project partners for review prior to the treatment. Spatial data would be provided to the herbicide applicator in appropriate format. The chosen contractor, in conjunction with the TLA, will be responsible for completing appropriate permit-related documentation and deliverables to the WDNR. As occurred during prior years, Onterra would work with fisheries managers to predict when sensitive fish species of concern, like walleye, have outgrown their most-sensitive life stage to herbicide exposure. Therefore, this treatment is likely to occur in mid- to late-June 2025.

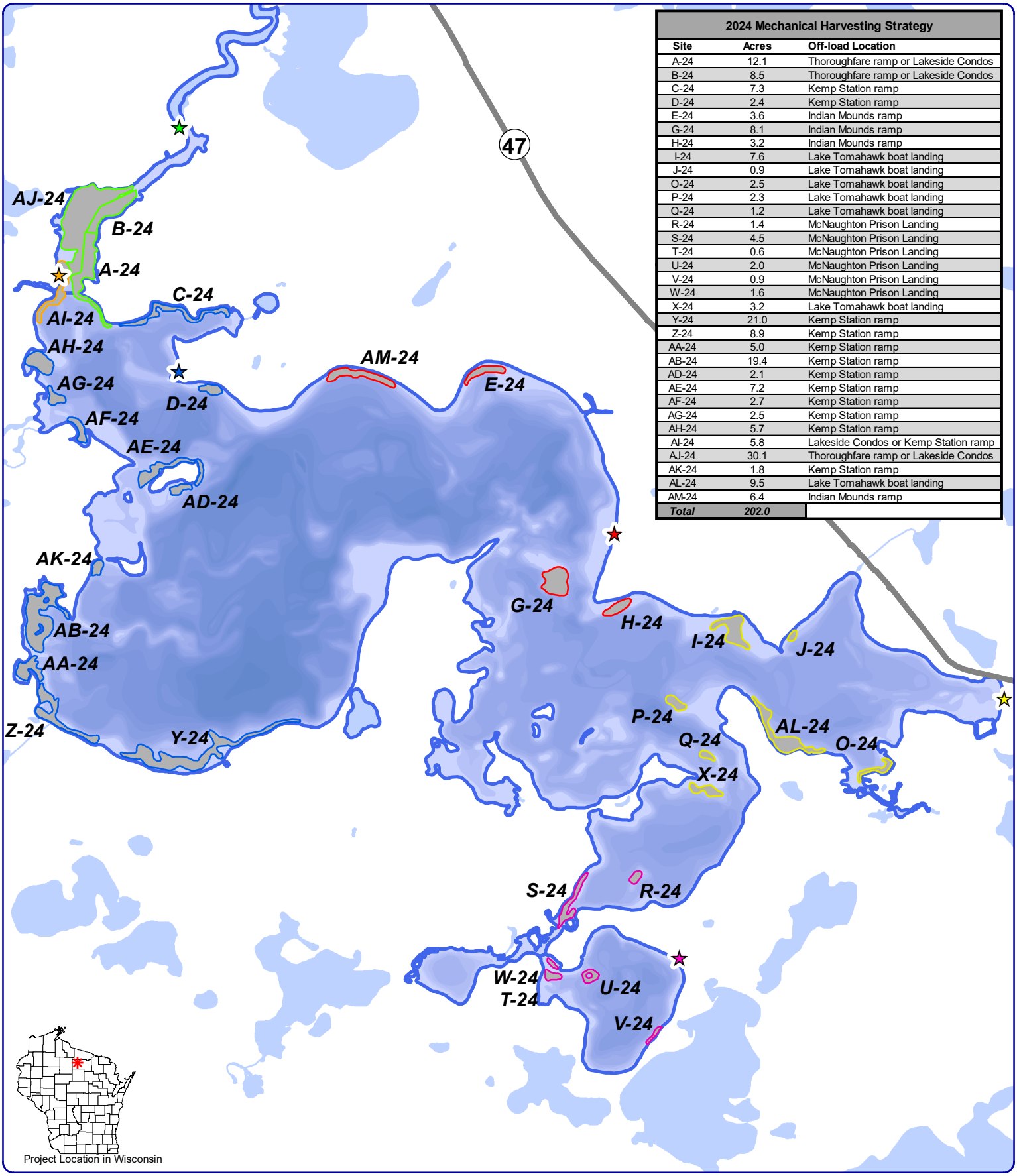
Herbicide Concentration Monitoring

TLA volunteers would conduct herbicide concentration monitoring during the hours/days following treatment following a sampling regime that will be created through collaborative efforts of the WDNR and Onterra. Samples would be collected at specified time intervals and locations within and outside a subset of the application areas. Sample collection would be focused on understanding the quantity and longevity of the herbicide active ingredient and the acid metabolite (primary degradation product). Properly preserved samples would be overnight-delivered to the Wisconsin State Lab of Hygiene where the herbicide analysis will be conducted in 2025.

Aquatic Plant Monitoring

A Late-Season EWM Mapping Survey will be conducted towards the end of the growing season during the 2025 to produce the mapping data to document a census of the EWM population within the system at the perceived peak growth stage. Comparing these data to previous surveys will help lake stakeholders understand management outcomes, including the extent and longevity of the EWM impacts within Tomahawk Lake. The EWM mapping data are also valuable to direct mechanical harvesting operations.

Quantitative monitoring will occur in B-25 and D-25, as these areas are both being monitored as part of the mechanical harvesting program. Therefore the point-intercept subsample data for these sites collected during August 2024 will serve as the pretreatment dataset, and will be compared to replicate data collected during the late-summer of 2025 (*year of treatment*). *Year after treatment* monitoring of the 2024 treatment site would also be conducted in the late-summer of 2025.



2024 Mechanical Harvesting Strategy		
Site	**Acres**	**Off-load Location**
A-24	12.1	Thoroughfare ramp or Lakeside Condos
B-24	8.5	Thoroughfare ramp or Lakeside Condos
C-24	7.3	Kemp Station ramp
D-24	2.4	Kemp Station ramp
E-24	3.6	Indian Mounds ramp
G-24	8.1	Indian Mounds ramp
H-24	3.2	Indian Mounds ramp
I-24	7.6	Lake Tomahawk boat landing
J-24	0.9	Lake Tomahawk boat landing
O-24	2.5	Lake Tomahawk boat landing
P-24	2.3	Lake Tomahawk boat landing
Q-24	1.2	Lake Tomahawk boat landing
R-24	1.4	McNaughton Prison Landing
S-24	4.5	McNaughton Prison Landing
T-24	0.6	McNaughton Prison Landing
U-24	2.0	McNaughton Prison Landing
V-24	0.9	McNaughton Prison Landing
W-24	1.6	McNaughton Prison Landing
X-24	3.2	Lake Tomahawk boat landing
Y-24	21.0	Kemp Station ramp
Z-24	8.9	Kemp Station ramp
AA-24	5.0	Kemp Station ramp
AB-24	19.4	Kemp Station ramp
AD-24	2.1	Kemp Station ramp
AE-24	7.2	Kemp Station ramp
AF-24	2.7	Kemp Station ramp
AG-24	2.5	Kemp Station ramp
AH-24	5.7	Kemp Station ramp
AI-24	5.8	Lakeside Condos or Kemp Station ramp
AJ-24	30.1	Thoroughfare ramp or Lakeside Condos
AK-24	1.8	Kemp Station ramp
AL-24	9.5	Lake Tomahawk boat landing
AM-24	6.4	Indian Mounds ramp
Total	*202.0*	

N
W E
S

1,500
Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Aquatic Plants: Onterra, 2023
Map Date: October 23, 2023 - EJH

Legend

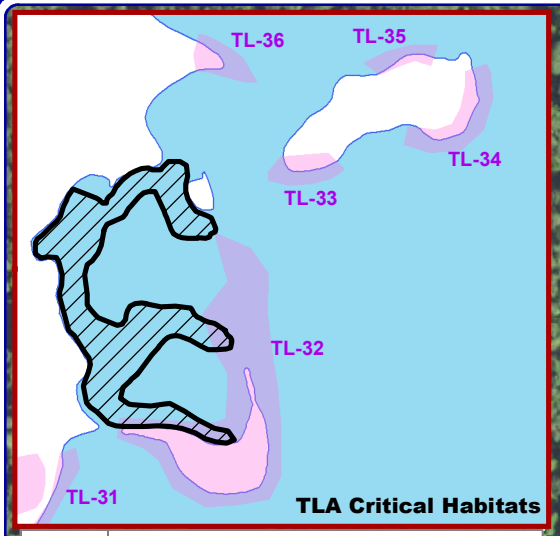
Mechanical Harvest Sites - Off-load Locations

- Indian Mounds Ramp
- Kemps Station Ramp
- Lake Tomahawk Ramp
- Lakeside Condos or Kemps Station Ramp
- McNaughton Prison Ramp
- Thoroughfare Ramp or Lakeside Condos

Map 1

Tomahawk System
Oneida County, Wisconsin

2024 Mechanical Harvest Plan v1



TL-31	Rock/gravel bar- fisheries value
TL-32	Extensive offshore rock bar - fish & wildlife value
TL-33	Rock/gravel bar - fish & wildlife value
TL-34	Rock/gravel bar - fish & wildlife value
TL-35	Rock/gravel bar - fish & wildlife value
TL-36	Rock/gravel bar- fisheries value

Preliminary 2024 Treatment Strategy
ProcellaCOR Treatment in Clearwater Bay

Site	Acres	Avg Depth (ft)	Volume (acre-ft)	PDU Rate (per acre-ft)	PDU Total
A-24	17.3	7.5	129.8	5.0	649
Total	**17.3**		129.8		649

Treat Acres	Treat Area to AOPI	*Potential AOPI Conc.* PDU/acre-ft of AOPI	PPB of AOPI
17.3	44.5%	2.16	4.15

N W E S

410
Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR
Aquatic Plants: Onterra, 2023
Orthophtography: NAIP, 2020
Map Date: October 12, 2023 JMB

Legend

Eurasian watermilfoil (September 18-20, 2023)

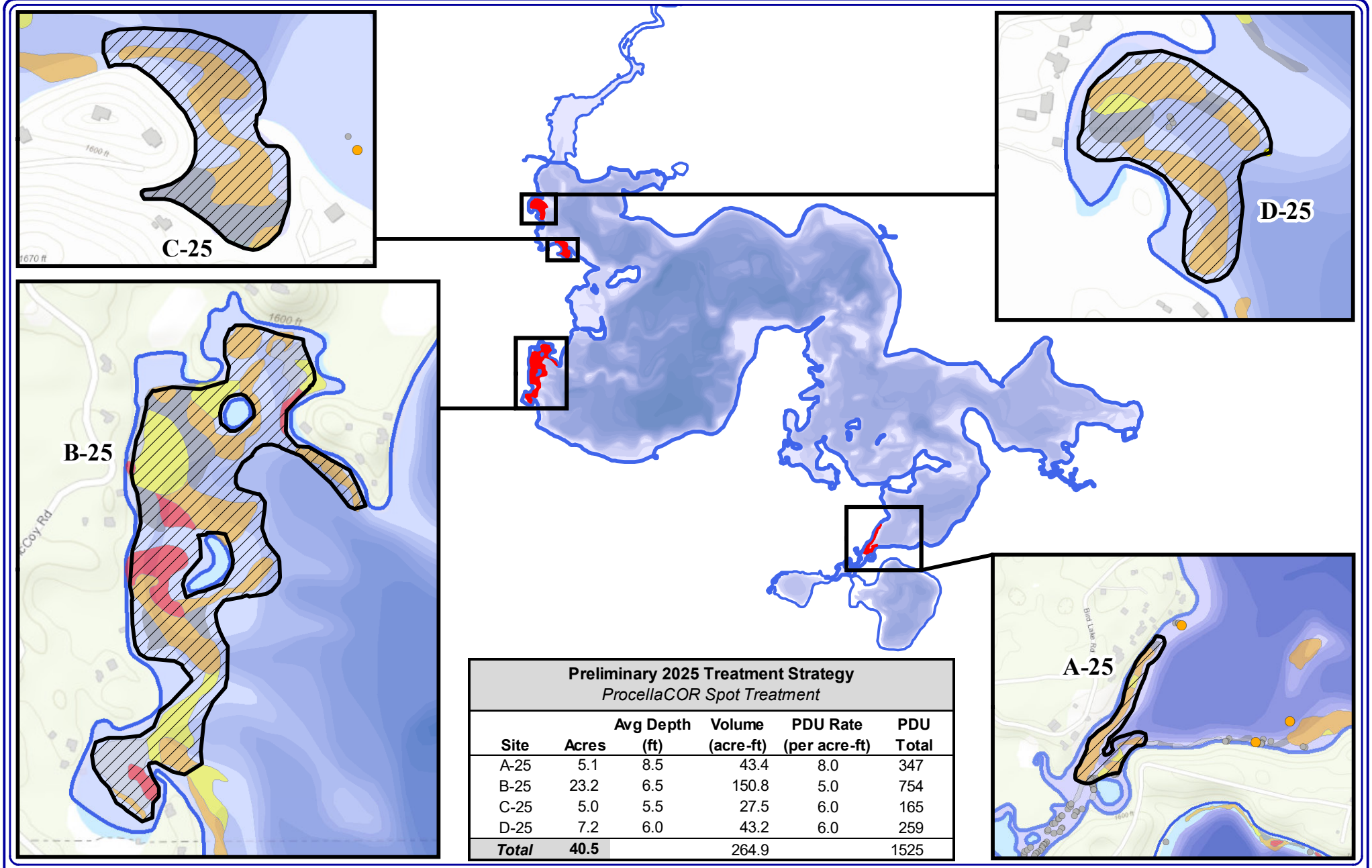
- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2024 Preliminary Applicaiton Area
- Clearwater Bay - Area of Potential Impact (AOPI)

Map 2

Tomahawk Lake

Oneida Co, Wisconsin

Preliminary 2024 EWM Treatment Strategy v2



Preliminary 2025 Treatment Strategy
ProcellaCOR Spot Treatment

Site	Acres	Avg Depth (ft)	Volume (acre-ft)	PDU Rate (per acre-ft)	PDU Total
A-25	5.1	8.5	43.4	8.0	347
B-25	23.2	6.5	150.8	5.0	754
C-25	5.0	5.5	27.5	6.0	165
D-25	7.2	6.0	43.2	6.0	259
Total	**40.5**		264.9		1525

5,100
Feet

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Aquatic Plants: Onterra, 2023
Orthophtography: NAIP, 2022
Map Date: February 20, 2025 - EJH


Project Location in Wisconsin

Legend

Eurasian watermilfoil (September 18-20, 2023)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2025 Prelim Herbicide Application Area

Map 3
Tomahawk Lake
Oneida Co, Wisconsin

Preliminary 2025 EWM Herbicide Treatment Areas v2

A

APPENDIX A

Tomahawk Lake EWM Management Report 2024 – *Aquatic Plant Management LLC.*

- **2024 Mechanical Harvesting Results**
- **2024 Riparian DASH Results**
- **2024 ProcellaCOR Treatment Results**
- **2024 Preharvest Plant Height Mapping**
- **2024 Tomahawk Lake Supplemental Data**

EST. 2013

AQUATIC PLANT MANAGEMENT

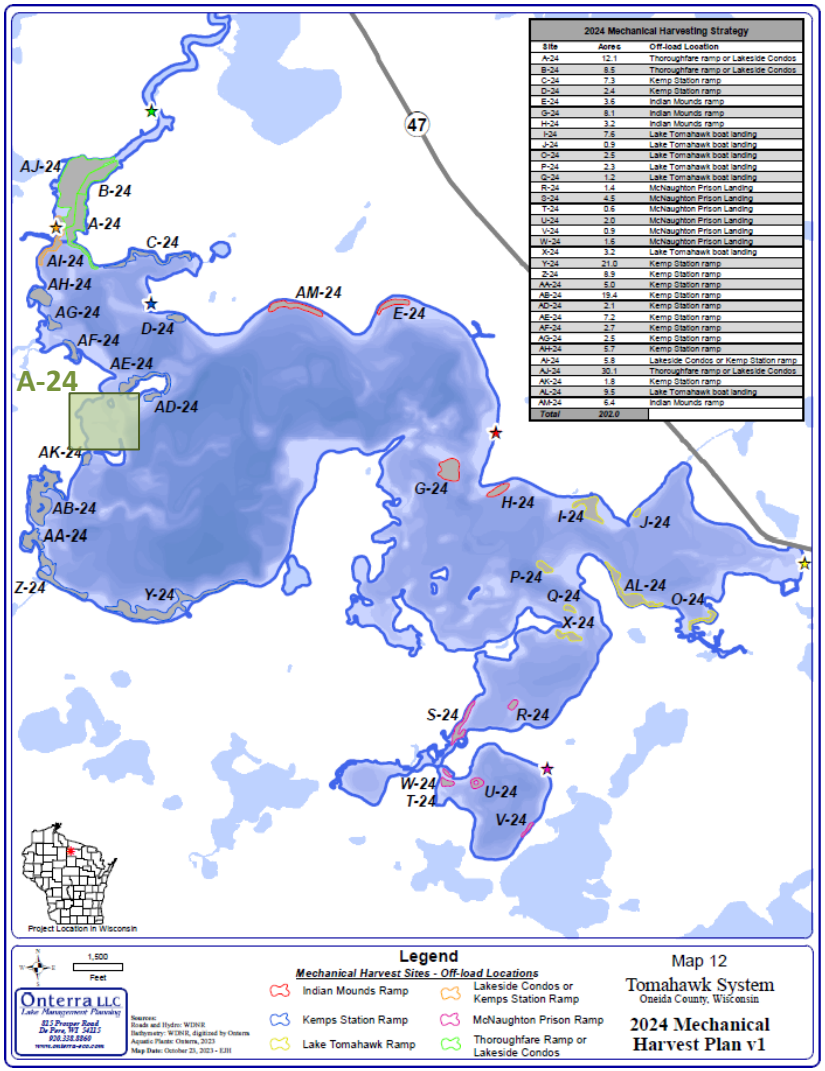
Tomahawk Lake
EWM Management Report 2024

PO Box 1134 Minocqua, WI 54548

Executive Summary

- Tomahawk Lake in Oneida County, WI has an extensive population of Eurasian Watermilfoil (EWM) covering **200+ acres**
- To address the EWM population, the Tomahawk Lake Association (TLA) and Aquatic Plant Management (APM) partnered on a **multi-year program of mechanical harvesting, diver assisted suction harvesting (DASH), and herbicide control**
- In the first year of the program, APM completed
  - ~90 days of mechanical harvesting, removing ~123K cubic feet of EWM from 36 prioritized sites throughout the lake
  - DASH at 10 different locations, removing 810 cubic feet for TLA members who received a discounted DASH rate through the program
- In the second year of the program, APM completed:
  - ~94.5 days of mechanical harvesting, removing ~130K cubic feet of EWM from 39 prioritized sites throughout the lake
  - DASH at 10 different locations, removing 897 cubic feet for TLA members who received a discounted DASH rate through the program
  - Herbicide (ProcellaCOR) treatment of 14.5 acres of EWM near the Lake Tomahawk boat landing
- In the third year of the program, APM completed:
  - ~90 days of mechanical harvesting, removing ~109K cubic feet of EWM from 37 prioritized sites throughout the lake
  - DASH at 5 different locations, removing 423 cubic feet for TLA members who received a discounted DASH rate through the program
  - Herbicide (ProcellaCOR) treatment of 17.3 acres of EWM south of Olmstead Island
  - Seven plant height mapping surveys to inform harvesting prioritization and execution
  - 6 days of fragment collection services coordinated with riparians who requested the service
- In total, APM has **removed ~364K cubic feet** of EWM from Tomahawk Lake over the past three years

2024 EWM Management Approach



Mechanical Harvesting Approach

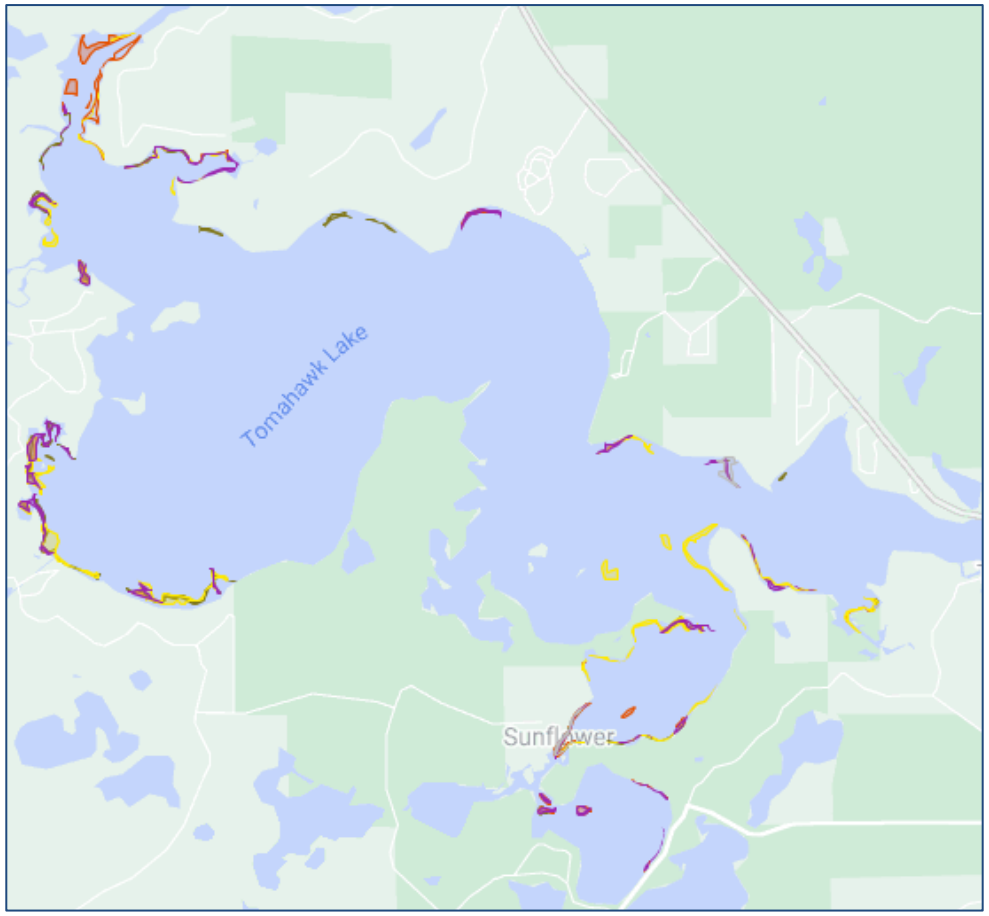
- Continue past year's approach of harvesting total colonies that are impacting recreation and navigation
- Leverage EWM plant mapping surveys to prioritize day to day harvester operations
- Focus on late season harvest for overall EWM reduction, giving native plants a chance in Spring 2025

ProcellaCOR Spot Treatment

- WDNR approved a single site (**A-24**) near Olmstead Island that historically was high priority and time-consuming mechanical harvest site in prior years
- On Thursday, June 20th, APM **treated 17.3 acres at site A-24 with 649 PDUs** (Prescribed Dosage Unit) of ProcellaCOR

Source: 10.31.2023 Survey by Onterra LLC;
Site Prioritization by TLA & APM

2024 Mechanical Harvesting Results



Area	2022	2023	2024	More (Less) vs '23
Indian Mounds	2,740	3,650	6,300	2,650
Lake Tomahawk	35,027	21,630	32,900	11,270
Southeast	2,866	14,050	21,775	7,725
East Total	**40,633**	**39,330**	**60,975**	**21,645**
Kemp	19,787	15,867	14,490	(1,377)
Lakeside	10,938	12,700	6,830	(5,870)
Olmstead	25,212	39,703	280	(39,423)
Southwest	26,064	22,200	26,725	4,525
West Total	**82,001**	**90,470**	**48,325**	**(42,145)**
Grand Total	**122,634**	**129,800**	**109,300**	**(20,500)**

Legend Jun Jul Aug Sep Oct

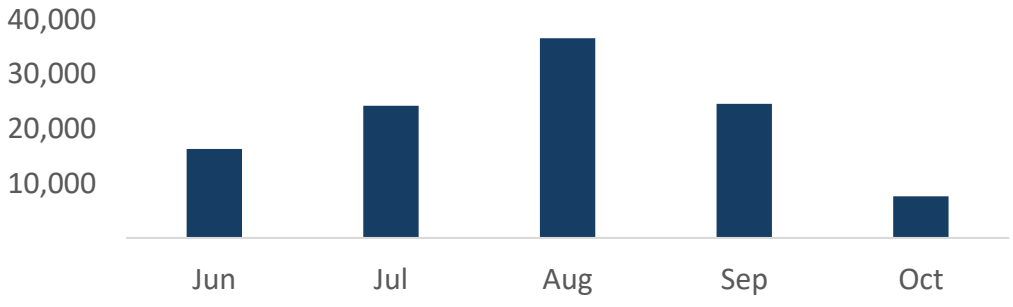
Source: APM Harvest Records June – October 2024

Summarized Harvesting Results

Mechanical Harvesting Commentary

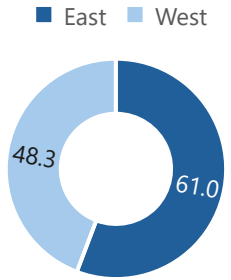
- APM was able to remove 109K cubic feet of EWM from 37 different sites across the lake
- Compared to prior years, APM spent more time and removed more biomass from the eastern side of the lake
- APM conducted 20.4 days of 'late season' harvesting after 9/15 at 21 different sites and removed 28.3K cubic feet of EWM
- The main hinderance to productivity was the distance between some of the large, dense beds in the southwest and southeast portions of the lake
- The past two herbicide treatments were in locations closer to primary offload points which contributed to less overall EWM being removed compared to prior years (i.e., 2024 sites had more travel time)

Harvest by Month



	Jun	Jul	Aug	Sep	Oct
Days[1]	13.3	19.0	33.7	20.1	4.0
# of Sites	18	18	20	22	3

Harvest by Lake Section



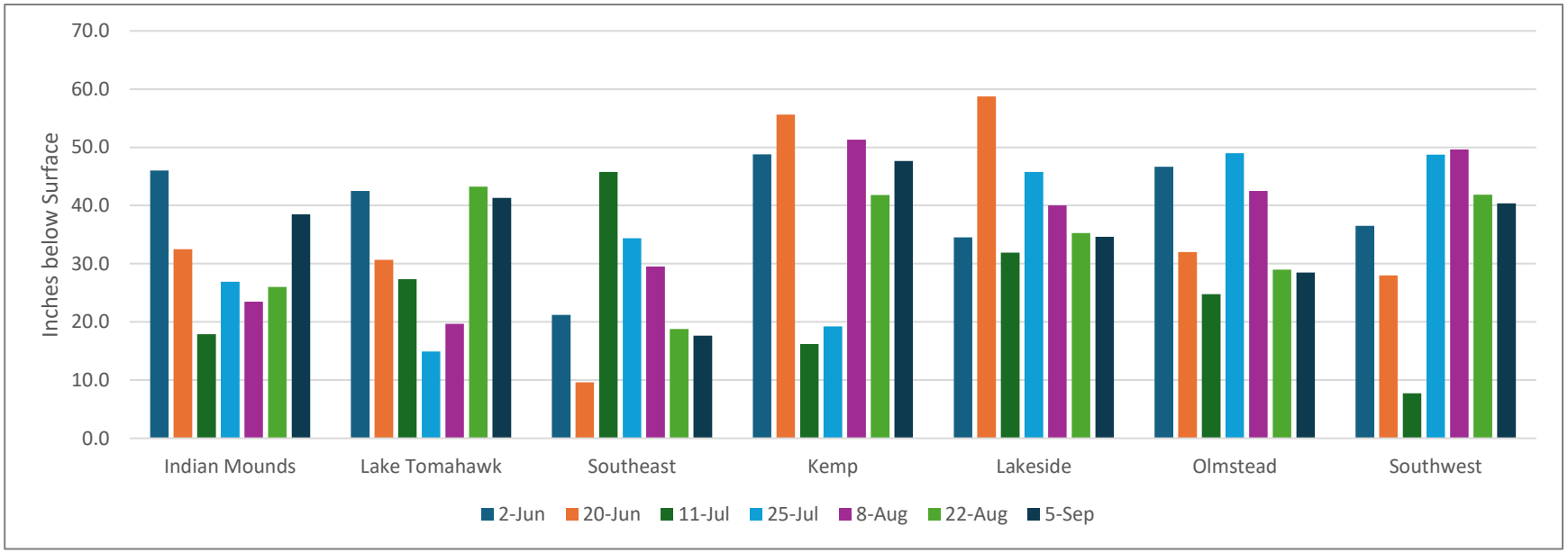
- **East**: Main offload location at Lake Tomahawk Landing
- **West**: Main offload location at Kemp Station

Source: APM Harvest Records June – October 2024
1) Day corresponds to 8 hours of harvesting; some dates included up to 14 hours of harvesting

EWM Plant Height Mapping

Plant Height Mapping Highlights

- APM conducted 7 different surveys to track the EWM distance from the tops of the plants to the surface of the water
- The harvester operator used this information to prioritize cutting activities / locations to where the biggest nuisance areas on the lake were throughout the course of the summer
- Overall, APM was able to keep average plant heights ~33 inches below the surface over the course of the summer

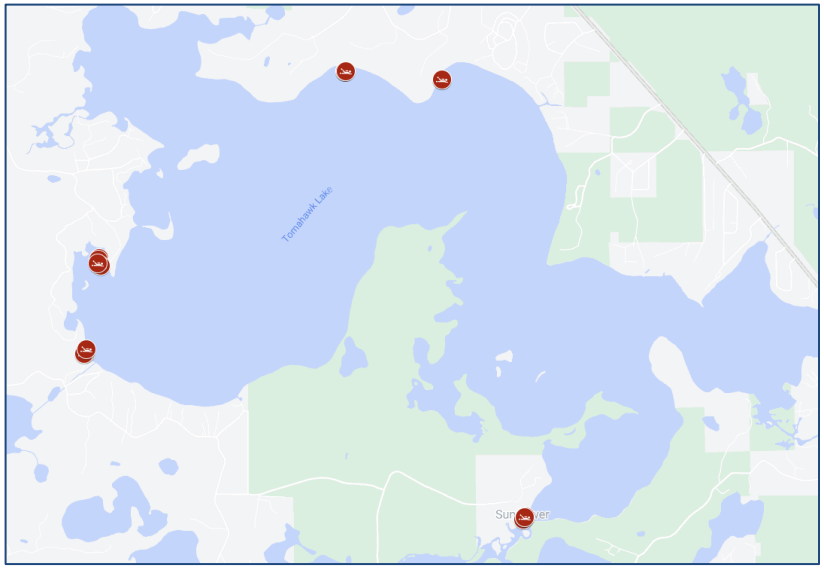


Riparian DASH Harvest Results

Diver Assisted Suction Harvesting Commentary

- 5 TLA members took advantage of the discounted DASH program to remove EWM from in and around their piers, boat lifts, and swim areas
- In total, APM was able to remove 423 cubic feet during 6 days at 5 different riparian sites

Location	# of Dives	Underwater Time	AIS Removed (Cubic Feet)
Riparian #1	4	6.0	40.0
Riparian #2	5	13.5	186.5
Riparian #3	5	6.3	64.0
Riparian #4	3	5.9	57.5
Riparian #5	2	6.8	75.0
Grand Total	**19**	**38.5**	**423.0**



Source: APM DASH Records June – September 2024

June 20th ProcellaCOR Treatment Recap

Herbicide Treatment Commentary

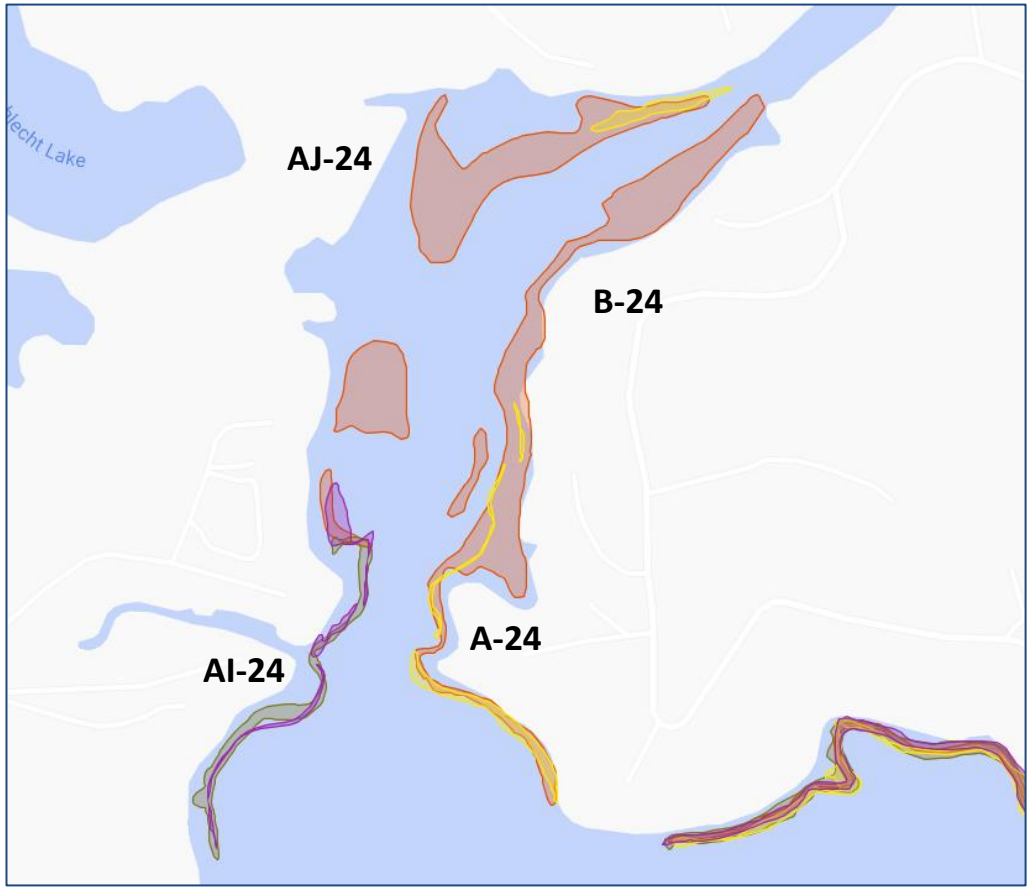
- Onterra LLC completed pre-treatment survey on June 5th, confirming a treatment plan of 649 PDUs
- On June 20th, 2024, APM completed a treatment of 17.3 acres
- Conditions were ideal for the herbicide spot treatment, with a recorded northeast wind speed of 1.9 MPH, starting at 5:36 AM and ending at 8:12 AM
- Water temperature was 66.2 degree with an ambient air temperature of 56.9 degrees

Next Steps

- TLA and APM plan to create a 2025+ prioritization strategy prior to the start of the management season. Factors to consider include spring survey results, grant funding and budget, management goals, and TLA member feedback
- There will be a continued focus on saving planned harvest days for the late season (Sep-Oct)
- Fragment collection services will be a priority in 2025 allowing TLA members to sign up for APM to collect EWM fragments at certain intervals throughout the course of the summer
- APM is investing to install two outboard motors on the harvester to increase the travel speed between sites / offload and improve overall harvest efficiency
- TLA should continue to consider other management options (e.g., herbicides) for the densest beds that have high traffic so the harvesting can maximize time in other areas

Mechanical Harvesting Maps

Mechanical Harvesting Results | Lakeside



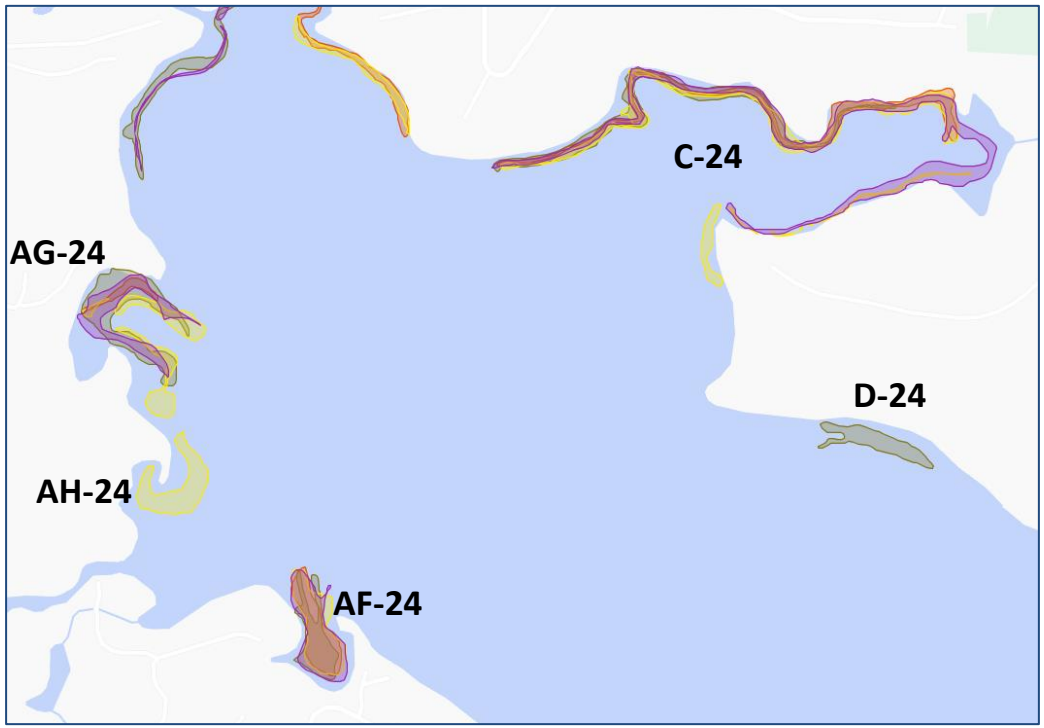
Legend Jun Jul Aug Sep Oct

Source: APM Harvest Records June – October 2024

Harvest Details by Site

Site Name	CF Removed (K)	Treatment Hours	# of Cuts
AJ-24	2.8	13.2	7
B-24	2.2	8.1	6
A-24	1.1	6.4	4
AI-24	0.8	4.2	3
Total	**6.8**	**31.9**	**20**
% of Lake Total	**6.2%**	**9.6%**	**6.6%**

Mechanical Harvesting Results | Kemp



Source: APM Harvest Records June – October 2024

Harvest Details by Site

Site Name	CF Removed (K)	Treatment Hours	# of Cuts
C-24	6.7	28.6	20
AF-24	3.1	12.2	10
AH-24	2.3	9.5	8
D-24	1.6	2.9	4
AG-24	0.9	4.0	3
Total	**14.5**	**57.2**	**45**
% of Lake Total	**13.3%**	**17.2%**	**15.0%**

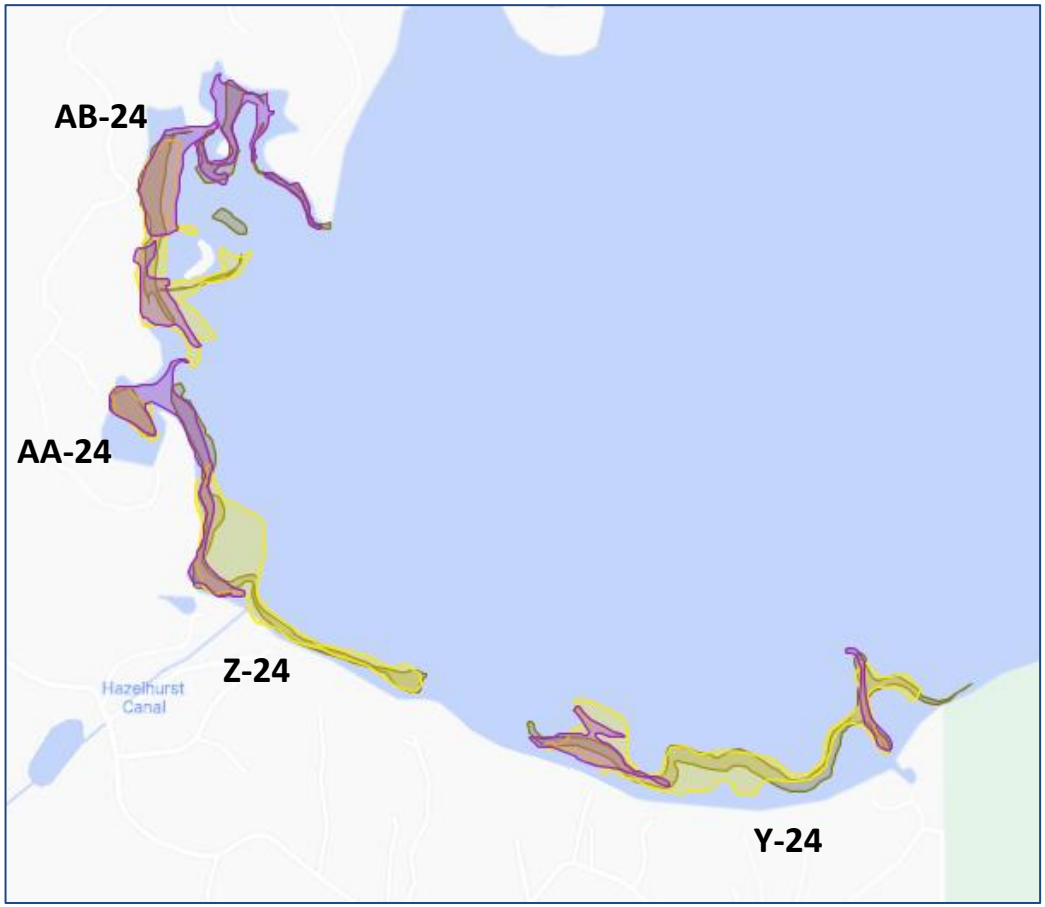
Mechanical Harvesting Results | Olmstead

Source: APM Harvest Records June – October 2024

Harvest Details by Site

Site Name	CF Removed (K)	Treatment Hours	# of Cuts
AD-24	0.3	2.2	2
Total	**0.3**	**2.2**	**2**
% of Lake Total	**0.3%**	**0.6%**	**0.7%**

Mechanical Harvesting Results | Southwest



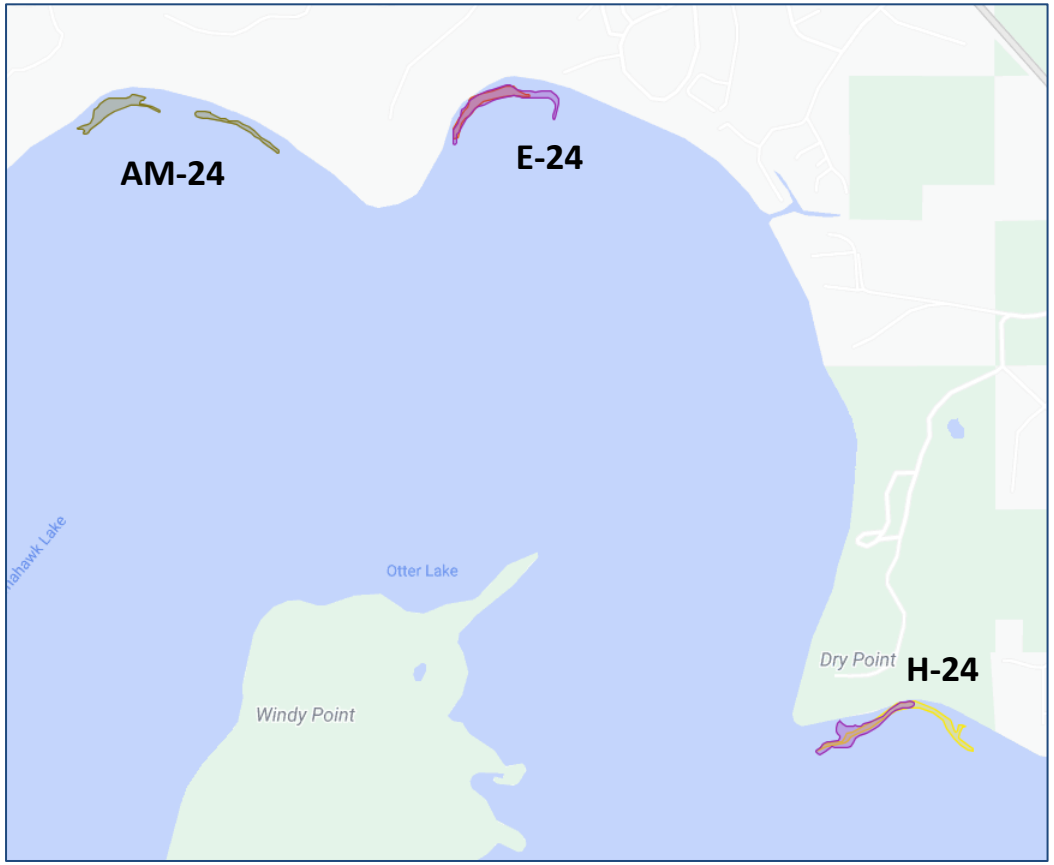
Legend Jun Jul Aug Sep Oct

Source: APM Harvest Records June – October 2024

Harvest Details by Site

Site Name	CF Removed (K)	Treatment Hours	# of Cuts
Y-24	12.8	34.4	32
AB-24	9.6	40.8	24
Z-24	2.4	8.2	6
AA-24	2.0	7.0	5
Total	**26.7**	**90.4**	**67**
% of Lake Total	**24.5%**	**27.1%**	**22.3%**

Mechanical Harvesting Results | Indian Mounds



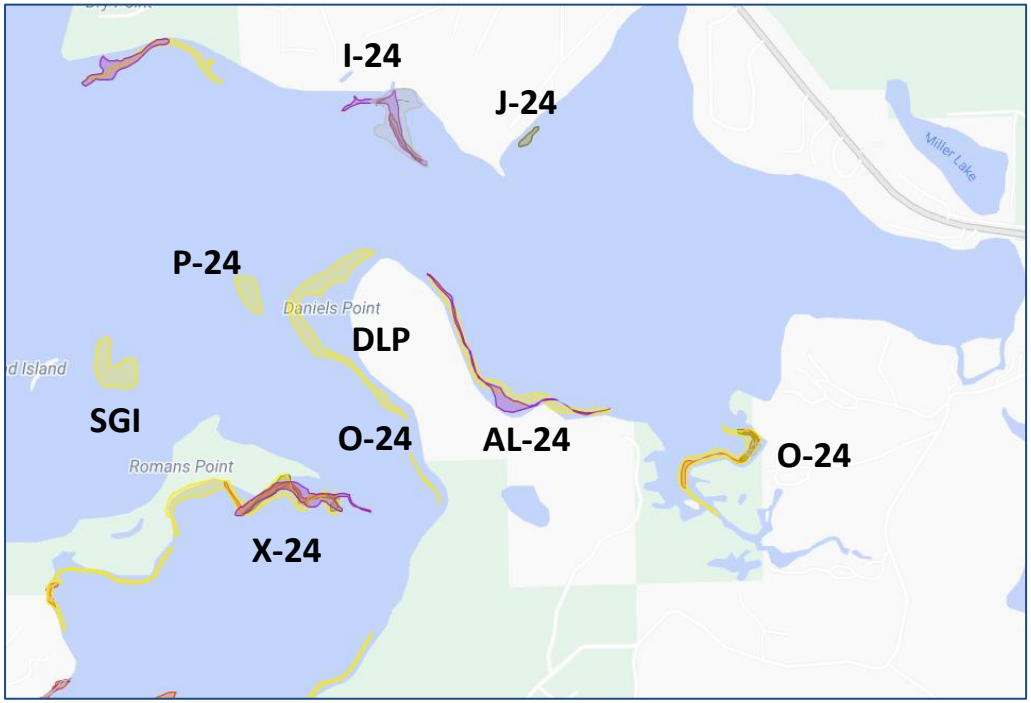
Harvest Details by Site

Site Name	CF Removed (K)	Treatment Hours	# of Cuts
E-24	2.8	7.0	7
H-24	2.3	5.5	6
AM-24	1.2	3.2	3
Total	**6.3**	**15.6**	**16**
% of Lake Total	**5.8%**	**4.7%**	**5.3%**

Legend Jun Jul Aug Sep Oct

Source: APM Harvest Records June – October 2024

Mechanical Harvesting Results | Lake Tomahawk

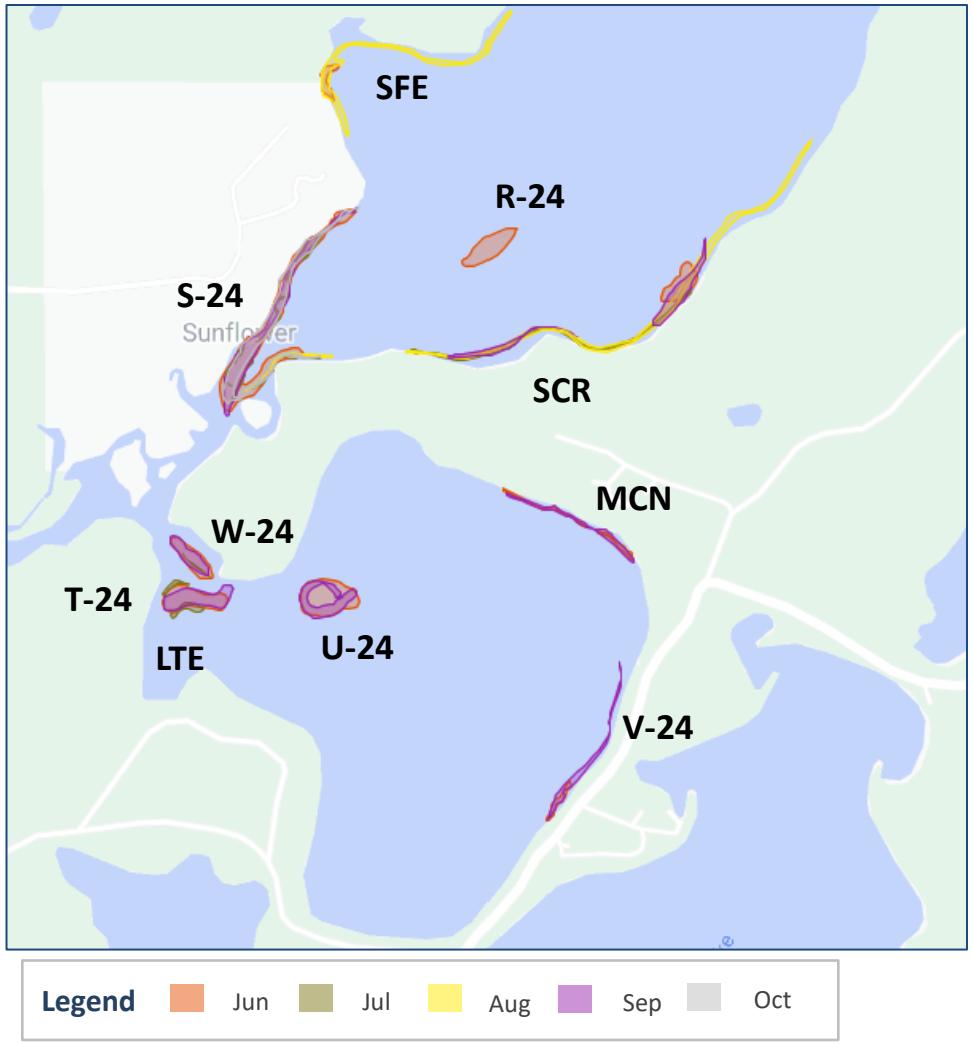


Source: APM Harvest Records June – October 2024

Harvest Details by Site

Site Name	CF Removed (K)	Treatment Hours	# of Cuts
X-24	13.5	29.1	34
I-24	7.1	12.9	19
DLP	4.0	10.0	10
AL-24	2.0	6.1	5
P-24	1.6	7.8	4
O-24	1.5	8.6	6
J-24	0.2	1.5	2
SGI	2.6	6.8	7
Q-24	0.4	5.3	2
Total	**32.9**	**87.9**	**89**
% of Lake Total	**30.1%**	**26.4%**	**29.6%**

Mechanical Harvesting Results | Southeast



Source: APM Harvest Records June – October 2024

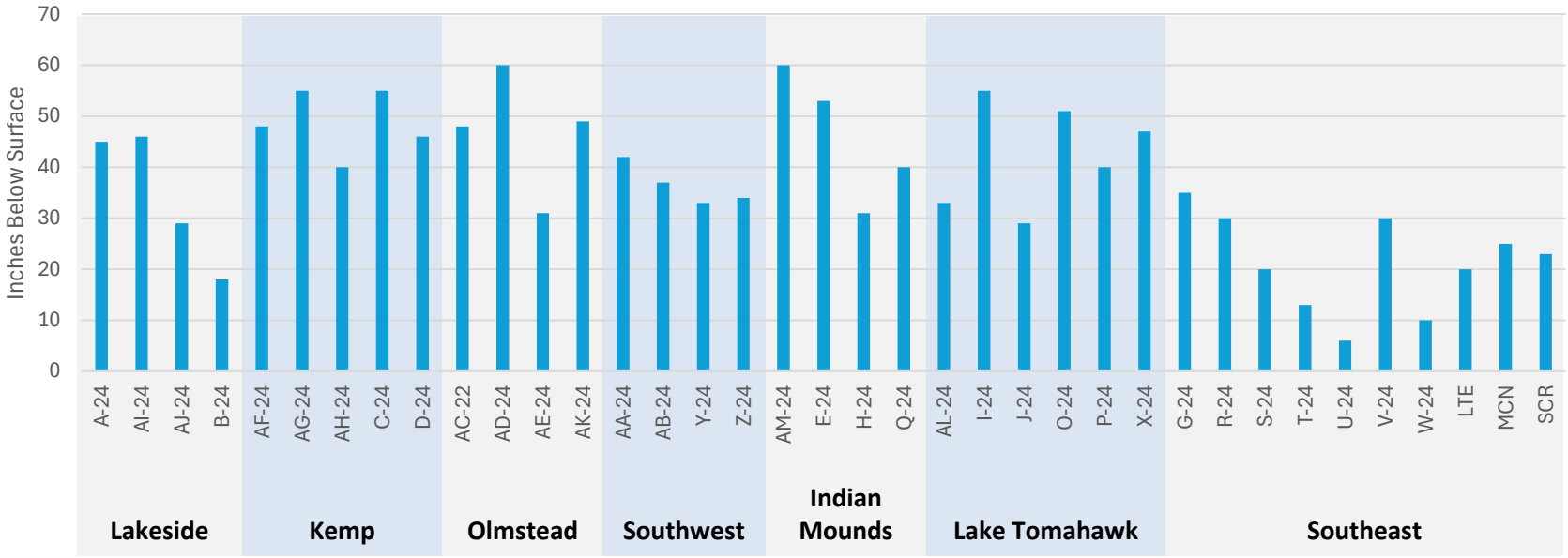
Harvest Details by Site

Site Name	CF Removed (K)	Treatment Hours	# of Cuts
S-24	5.7	16.4	16
U-24	3.6	4.2	10
SCR	3.1	6.2	8
SFE	2.8	5.8	7
T-24	2.8	6.8	8
W-24	1.1	2.0	4
LTE	0.8	1.2	2
R-24	0.7	2.2	2
V-24	0.6	2.0	2
MCN	0.6	0.6	2
BLR	0.1	0.6	1
Total	**21.8**	**48.1**	**62**
% of Lake Total	**19.9%**	**14.4%**	**20.6%**

Appendix – Preharvest Plant Height Mapping

Pre-Harvest EWM Survey Results

Distance of Plants from Surface by Site



Methodology

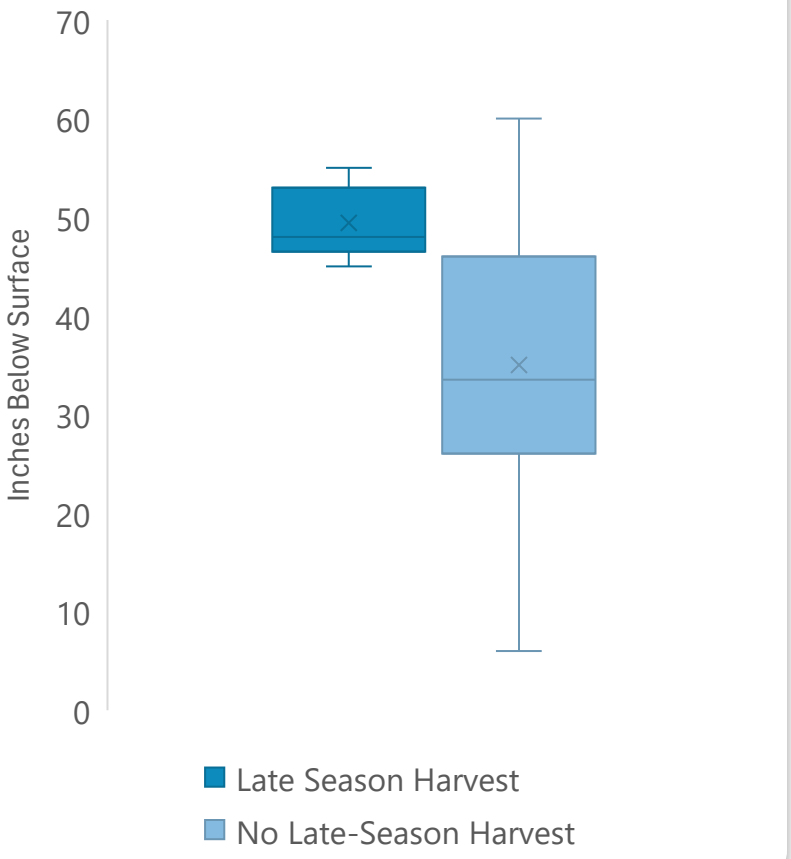
- APM surveyed all sites on June 2nd and measured each site's average distance of the top of the EWM plants to the surface by inserting a measuring tool and touching the top of the plants
- Conditions were ideal for the survey; sunny with 0-5 mph winds

Early Season Harvest Recommendations

- We recommend starting with sites located in the Lakeside and Southeast section of the lakes
- Plants were nearly topping out at the entrance to Little Lake Tomahawk, boat traffic was causing fragmentation near Lakeside

Late Season Harvest Site Analysis

Late Season Harvest Plant Height Comparison



Key Takeaways

- Average distance from the surface to the tops of EWM plants for sites that were a part of **late season harvests averaged 49.4 inches from the surface** versus **35.0 inches for sites not harvested late season**
- Late season harvesting seems to have an **average impact of 14.4 inches (~1.2 feet)** on following season plant growth
- At all sites **EWM was the dominant plant species** evident
- **Additional surveys will be conducted** to measure impact of harvesting on EWM plant distance from the surface and **inform the ongoing harvest strategy** throughout 2024

Aerial Photo - Lakeside

AJ-24: Plants are approaching the surface in a widespread, highly dominant colony in a high traffic area of the lake

B-24: Algae blooms embedded in EWM clumps, some near-surface matting nearby riparian piers

Distance from Surface Methodology

Used measuring tool to take multiple measurements across the colony / harvest zone and take the average of plant heights

EST. 2013

AQUATIC PLANT MANAGEMENT

Tomahawk Lake Supplemental Data

Tomahawk Lake, Oneida County

EWM Sample Collection

Tomahawk Lake, Oneida County

Overview
Samples of biomass taken and shipped to UW Madison for testing

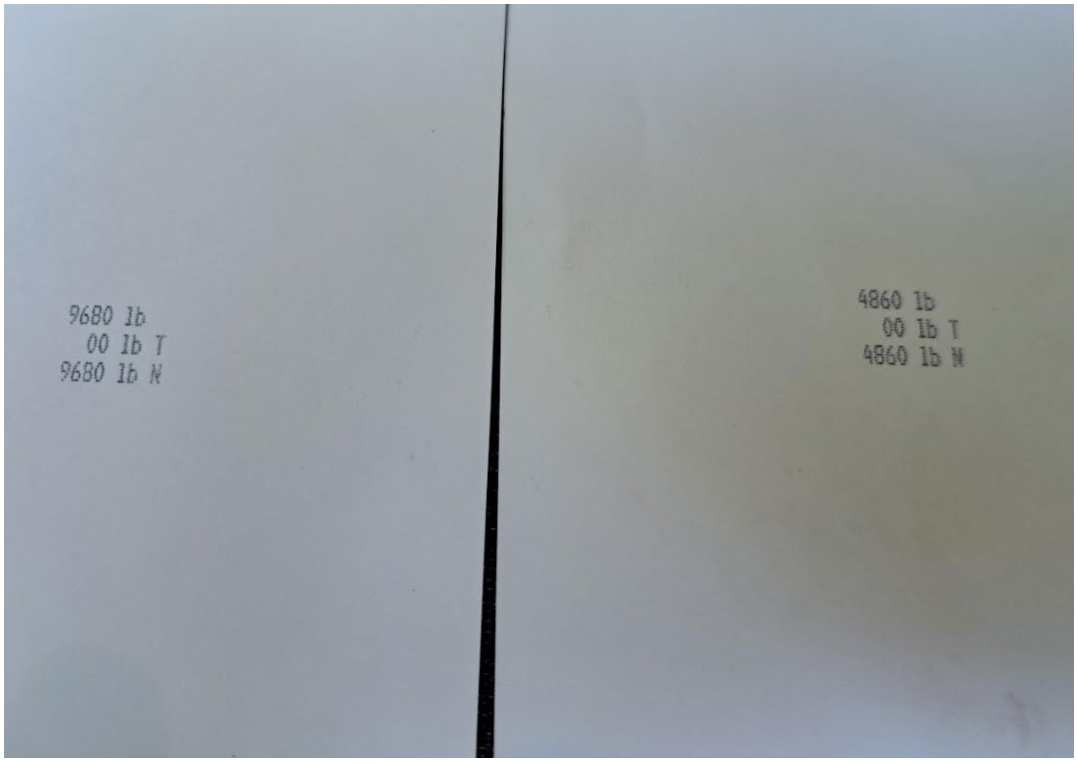
Sample Date	Site Name	Sample ID	Shipment Tracking
19-Jun	AJ-24	AJ-24_20240619_1	SP001100031722428295
19-Jun	AJ-24	AJ-24_20240619_2	SP001100031722428295
19-Jun	B-24	B-24_20240619_1	SP001100031722428295
19-Jun	C-24	C-24_20240619_1	SP001100031722428295
17-Jul	Z-24	Z-24_20240717_1	SP001100031992415457
17-Jul	Z-24	Z-24_20240717_2	SP001100031992415457
17-Jul	AM-24	AM-24_20240717_1	SP001100031992415457
17-Jul	AM-24	AM-24_20240717_2	SP001100031992415457
22-Aug	X-24	X-24_20240822_1	SP001100032352436728
22-Aug	X-24	X-24_20240822_2	SP001100032352436728
22-Aug	AL-24	AL-24_20240822_1	SP001100032352436728
22-Aug	AL-24	AL-24_20240822_2	SP001100032352436728
5-Nov	G-24	G-24_20241105_1	SP0011000300259030
5-Nov	G-24	G-24_20241105_2	SP0011000300259030
5-Nov	H-24	H-24_20241105_1	SP0011000300259030
5-Nov	H-24	H-24_20241105_2	SP0011000300259030

EWM Weight Conversion

Tomahawk Lake, Oneida County

Overview
Load of EWM brought to weigh station and weighed before and after on 9/24/2024 for purpose of understanding conversion of cubic feet to weight

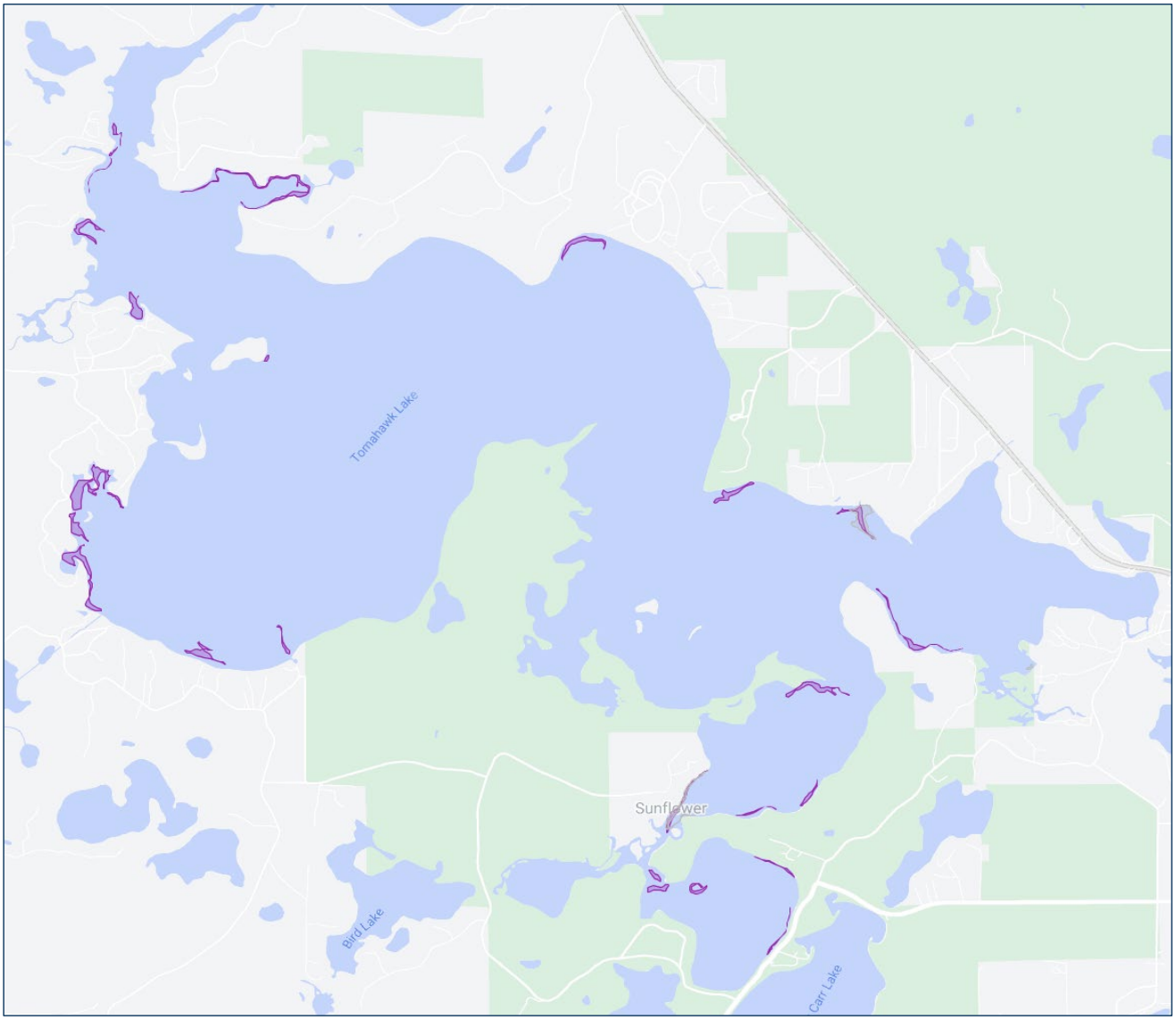
Cubic Feet	500
Weight (lbs) Before	9,680
Weight (lbs) After	4,860
Total EWM Weight	4,820
Lbs per Cubic Foot	9.64



Late Season Harvest Map

Tomahawk Lake, Oneida County

Overview
Map of only the harvest areas in the late season (September and October)



EWM Plant Height Survey & Analysis

Tomahawk Lake, Oneida County

Overview

APM conducted plant height surveys at 33 harvest areas, measuring the distance of the EWM plant to the surface. Two GPS points within each site were measured at 7 different dates.

Sample Points	*Harvest Areas*
66	*33*

Growth Rate Exclusion Logic

1) If a cut happened between surveys
2) If plants are at surface (i.e., <3 inches)
3) if no plants are visible

	20-Jun	11-Jul	25-Jul	8-Aug	22-Aug	5-Sep	Total
# of Days Between Surveys	*18*	*21*	*14*	*14*	*14*	*14*	**95**
Average Inches / Day	0.68	1.35	0.83	0.35	0.69	0.15	**0.64**
# of Valid Comparisons	*48*	*27*	*29*	*31*	*37*	*38*	***210***

Name	Latitude	Longitude	Site
A-24-1	45.84700844	-89.6869035	A-24
A-24-2	45.8441657	-89.68833551	A-24
AA-24-1	45.81934298	-89.69285293	AA-24
AA-24-2	45.81864213	-89.69225486	AA-24
AB-24-1	45.82439701	-89.69145516	AB-24
AB-24-2	45.82143262	-89.69306662	AB-24
AD-24-1	45.83062053	-89.67917111	AD-24
AD-24-2	45.83093974	-89.67791252	AD-24
AE-24-1	45.83141728	-89.68159092	AE-24
AE-24-2	45.83228338	-89.67979311	AE-24
AF-24-1	45.83501898	-89.68812234	AF-24
AF-24-2	45.83429454	-89.68799088	AF-24
AG-24-1	45.83744822	-89.69099792	AG-24
AG-24-2	45.83688943	-89.69021149	AG-24
AH-24-1	45.83978677	-89.69199033	AH-24
AH-24-2	45.83962103	-89.69287457	AH-24
AI-24-1	45.8451148	-89.689324	AI-24
AI-24-2	45.8433985	-89.69008874	AI-24
AJ-24-1	45.8496359	-89.68735003	AJ-24
AJ-24-2	45.84778675	-89.68905725	AJ-24
AK-24-1	45.82583647	-89.68646427	AK-24
AK-24-2	45.82545468	-89.68658356	AK-24
AL-24-1	45.8155851	-89.62323695	AL-24
AL-24-2	45.81344963	-89.6207813	AL-24
AM-24-1	45.83841924	-89.66367566	AM-24
AM-24-2	45.83791841	-89.65903238	AM-24
B-24-1	45.85020044	-89.68288725	B-24
B-24-2	45.84900635	-89.68492385	B-24
C-24-1	45.84241198	-89.68106628	C-24
C-24-2	45.84216526	-89.67779281	C-24
D-24-1	45.83743694	-89.67639516	D-24
D-24-2	45.83730459	-89.67526603	D-24
E-24-1	45.83836775	-89.65074646	E-24
E-24-2	45.83866554	-89.64821891	E-24
G-24-1	45.82491497	-89.64229267	G-24
G-24-2	45.82377364	-89.64237908	G-24
H-24-1	45.8226468	-89.63706779	H-24
H-24-2	45.82319636	-89.63607935	H-24
I-24-1	45.82183369	-89.62597487	I-24
I-24-2	45.82073416	-89.62612567	I-24
J-24-1	45.82074551	-89.6206284	J-24
J-24-2	45.82096735	-89.62026677	J-24
O-24-1	45.81249789	-89.61170183	O-24
O-24-2	45.81186404	-89.61224262	O-24
P-24-1	45.81669167	-89.63215182	P-24
P-24-2	45.81617685	-89.63132126	P-24
Q-24-1	45.81301336	-89.62907652	Q-24
Q-24-2	45.81282021	-89.62836897	Q-24
R-24-1	45.80500652	-89.63531256	R-24
R-24-2	45.80467455	-89.63584192	R-24
S-24-1	45.804562	-89.64076322	S-24
S-24-2	45.80283481	-89.64240087	S-24
T-24-1	45.79933691	-89.64381155	T-24
T-24-2	45.79909155	-89.64354766	T-24
U-24-1	45.79826682	-89.63933205	U-24
U-24-2	45.79806978	-89.64022277	U-24
V-24-1	45.79469441	-89.63340561	V-24
V-24-2	45.79396086	-89.63431164	V-24
W-24-1	45.79811021	-89.64393972	W-24
W-24-2	45.79814359	-89.64296398	W-24
X-24-1	45.81061172	-89.6298313	X-24
X-24-2	45.8103862	-89.6281393	X-24
Y-24-1	45.81313013	-89.68229224	Y-24
Y-24-2	45.81232437	-89.67717951	Y-24
Z-24-1	45.81705973	-89.69180557	Z-24
Z-24-2	45.81531095	-89.69070887	Z-24

Distance From Surface (Inches)						
2-Jun	20-Jun	11-Jul	25-Jul	8-Aug	22-Aug	5-Sep
45	67	29	51	44	41	40
45	70	30	55	46	41	40
42	33	14	57	49	43	41
42	31	33	55	48	42	41
37	30	0	58	48	48	47
37	24	5	54	49	37	36
60	46	24	45	38	23	22
60	44	31	40	32	20	21
31	20	Not Visible	Not Visible	Not Visible	Not Visible	Not Visible
31	20	Not Visible	Not Visible	Not Visible	Not Visible	Not Visible
48	68	24	15	8	5	62
48	67	24	15	34	24	62
55	47	28	17	66	56	Not Visible
55	39	12	8	66	56	Not Visible
40	67	8	1	58	43	34
40	70	12	1	60	49	43
46	31	39	54	50	44	44
46	38	22	57	50	43	43
29	65	23	52	48	39	38
29	64	14	46	40	38	38
49	36	24	56	50	37	36
49	26	20	55	50	36	35
33	20	6	1	1	64	56
33	21	8	1	44	29	54
60	44	8	62	57	43	40
60	50	12	62	57	43	40
18	65	48	1	1	1	1
18	67	50	50	41	35	33
55	66	11	58	50	42	40
55	65	8	57	51	43	42
46	32	35	19	60	50	49
46	31	12	1	60	50	49
53	36	8	1	1	1	1
53	36	16	25	17	15	14
35	22	24	24	24	24	24
35	27	30	21	21	24	24
31	20	0	1	1	1	55
31	23	25	9	1	1	56
55	39	24	8	4	1	1
55	41	25	12	52	39	37
29	19	52	39	33	29	25
29	17	52	39	33	28	22
51	42	54	24	17	64	56
51	38	32	20	17	64	56
40	26	10	1	1	65	64
40	28	11	1	1	65	64
40	26	45	37	37	52	52
40	24	29	18	17	52	50
30	19	60	50	43	30	29
30	16	54	43	41	29	29
20	3	47	33	31	19	16
20	4	42	28	25	12	11
13	0	27	18	14	1	1
13	0	50	32	25	11	5
6	0	54	42	36	20	19
6	0	55	40	35	20	19
30	20	50	41	34	24	22
30	15	38	22	10	6	5
10	0	52	39	36	21	21
10	0	58	48	38	22	22
47	38	10	1	1	45	40
47	37	44	32	32	26	21
33	24	0	55	49	37	36
33	28	0	58	52	44	42
34	27	0	1	55	48	46
34	26	10	52	47	36	34

Growth in Inches					
20-Jun	11-Jul	25-Jul	8-Aug	22-Aug	5-Sep
Exclude	Exclude	Exclude	Exclude	3	1
Exclude	Exclude	Exclude	Exclude	5	1
9	19	Exclude	Exclude	6	2
11	Exclude	Exclude	Exclude	6	1
7	Exclude	Exclude	Exclude	Exclude	Exclude
13	19	Exclude	Exclude	Exclude	Exclude
14	22	Exclude	Exclude	15	Exclude
16	13	Exclude	Exclude	12	Exclude
11	Exclude	Exclude	Exclude	Exclude	Exclude
11	Exclude	Exclude	Exclude	Exclude	Exclude
Exclude	44	9	Exclude	3	Exclude
Exclude	43	9	Exclude	10	Exclude
8	19	11	Exclude	Exclude	Exclude
16	27	4	Exclude	Exclude	Exclude
Exclude	59	Exclude	Exclude	Exclude	9
Exclude	58	Exclude	Exclude	Exclude	6
15	Exclude	Exclude	4	6	Exclude
8	16	Exclude	7	7	Exclude
Exclude	42	Exclude	4	9	1
Exclude	50	Exclude	6	2	0
13	12	Exclude	6	13	1
23	6	Exclude	5	14	1
13	14	Exclude	Exclude	Exclude	Exclude
12	13	Exclude	Exclude	Exclude	Exclude
16	36	Exclude	5	14	3
10	38	Exclude	5	14	3
Exclude	17	Exclude	Exclude	Exclude	Exclude
Exclude	17	0	Exclude	6	2
Exclude	55	Exclude	Exclude	Exclude	Exclude
Exclude	57	Exclude	Exclude	Exclude	Exclude
14	Exclude	Exclude	Exclude	10	1
15	19	Exclude	Exclude	10	1
17	Exclude	Exclude	Exclude	Exclude	Exclude
17	Exclude	Exclude	8	2	1
13	Exclude	0	0	0	0
8	Exclude	9	0	Exclude	0
11	Exclude	Exclude	Exclude	Exclude	Exclude
8	Exclude	16	Exclude	Exclude	Exclude
16	Exclude	16	4	Exclude	Exclude
14	Exclude	13	Exclude	13	2
10	Exclude	13	6	Exclude	4
12	Exclude	13	6	Exclude	6
9	Exclude	30	7	Exclude	8
13	Exclude	12	3	Exclude	8
14	16	Exclude	Exclude	Exclude	1
12	17	Exclude	Exclude	Exclude	1
14	Exclude	8	0	Exclude	0
16	Exclude	11	1	Exclude	2
11	Exclude	10	7	13	1
14	Exclude	11	2	12	0
17	Exclude	14	2	12	3
16	Exclude	14	3	13	1
Exclude	Exclude	9	4	Exclude	Exclude
Exclude	Exclude	18	7	14	6
Exclude	Exclude	12	6	16	1
Exclude	Exclude	15	5	15	1
10	Exclude	9	7	10	2
15	Exclude	16	12	4	1
Exclude	Exclude	13	3	15	0
Exclude	Exclude	10	10	16	0
9	Exclude	Exclude	Exclude	Exclude	Exclude
10	Exclude	12	Exclude	Exclude	Exclude
9	Exclude	Exclude	Exclude	12	Exclude
5	Exclude	Exclude	Exclude	8	Exclude
7	Exclude	Exclude	Exclude	7	Exclude
8	16	Exclude	5	11	Exclude

Rate per Day						
20-Jun	11-Jul	25-Jul	8-Aug	22-Aug	5-Sep	Average
				0.21	0.07	**0.14**
				0.36	0.07	**0.21**
0.50	0.90			0.43	0.14	**0.49**
0.61				0.43	0.07	**0.37**
0.39						**0.39**
0.72	0.90					**0.81**
0.78	1.05			1.07		**0.97**
0.89	0.62			0.86		**0.79**
0.61						**0.61**
0.61						**0.61**
	2.10	0.64		0.21		**0.98**
	2.05	0.64		0.71		**1.13**
0.44	0.90	0.79				**0.71**
0.89	1.29	0.29				**0.82**
	2.81				0.64	**1.73**
	2.76				0.43	**1.60**
0.83			0.29	0.43		**0.52**
0.44	0.76		0.50	0.50		**0.55**
	2.00		0.29	0.64	0.07	**0.75**
	2.38		0.43	0.14	0.00	**0.74**
0.72	0.57		0.43	0.93	0.07	**0.54**
1.28	0.29		0.36	1.00	0.07	**0.60**
0.72	0.67					**0.69**
0.67	0.62					**0.64**
0.89	1.71		0.36	1.00	0.21	**0.83**
0.56	1.81		0.36	1.00	0.21	**0.79**
	0.81					**0.81**
	0.81	0.00		0.43	0.14	**0.35**
	2.62					**2.62**
	2.71					**2.71**
0.78				0.71	0.07	**0.52**
0.83	0.90			0.71	0.07	**0.63**
0.94						**0.94**
0.94			0.57	0.14	0.07	**0.43**
0.72		0.00	0.00	0.00	0.00	**0.14**
0.44		0.64	0.00		0.00	**0.27**
0.61						**0.61**
0.44		1.14				**0.79**
0.89		1.14	0.29			**0.77**
0.78		0.93		0.93	0.14	**0.69**
0.56		0.93	0.43		0.29	**0.55**
0.67		0.93	0.43		0.43	**0.61**
0.50		2.14	0.50		0.57	**0.93**
0.72		0.86	0.21		0.57	**0.59**
0.78	0.76				0.07	**0.54**
0.67	0.81				0.07	**0.52**
0.78		0.57	0.00		0.00	**0.34**
0.89		0.79	0.07		0.14	**0.47**
0.61		0.71	0.50	0.93	0.07	**0.57**
0.78		0.79	0.14	0.86	0.00	**0.51**
0.94		1.00	0.14	0.86	0.21	**0.63**
0.89		1.00	0.21	0.93	0.07	**0.62**
		0.64	0.29			**0.46**
		1.29	0.50	1.00	0.43	**0.80**
		0.86	0.43	1.14	0.07	**0.63**
		1.07	0.36	1.07	0.07	**0.64**
0.56		0.64	0.50	0.71	0.14	**0.51**
0.83		1.14	0.86	0.29	0.07	**0.64**
		0.93	0.21	1.07	0.00	**0.55**
		0.71	0.71	1.14	0.00	**0.64**
0.50						**0.50**
0.56		0.86				**0.71**
0.50				0.86		**0.68**
0.28				0.57		**0.42**
0.39				0.50		**0.44**
0.44	0.76		0.36	0.79		**0.59**

B

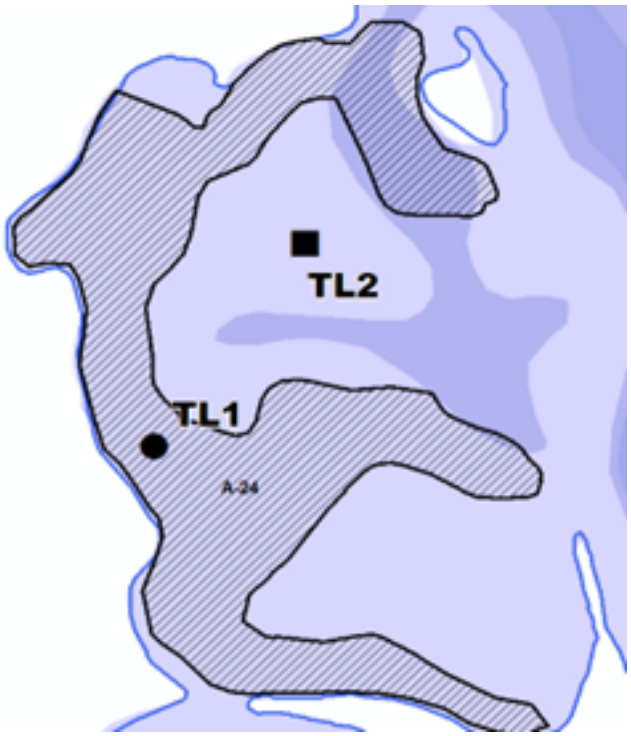
APPENDIX B

2024 Herbicide Concentration Monitoring Plan

Tomahawk Lake, Oneida County (WBIC: 1542700)
2024 Herbicide Sample Plan
Onterra, LLC

Tomahawk Lake located in Oneida County, is an approximately 3,462-acre drainage lake that has a maximum depth of 84 feet. Florpyrauxifen-benzyl (commercially as ProcellaCOR™) is proposed to be applied to the application area, A-24, on the west side of Tomahawk Lake: an area totaling 17.3 acres, in early-summer 2024, to control Eurasian watermilfoil. Herbicide concentration sampling will be conducted in order to monitor the herbicide concentrations in the hours and days following the application.

Water samples will need to be collected at the sites and depths listed below. Coordinates are in decimal degrees. Locations of each sampling site are displayed with green squares on the image below.



Tomahawk Lake Herbicide Sample Sites					
Site Label	**Site Description**	**Station ID**	**Latitude**	**Longitude**	**Sample Depth**
TL1	Application area A-24	10057561	45.827882	-89.68644	Integrated (0-6 feet)
TL2	Basin near area A-24	10057562	45.829261	-89.685048	Integrated (0-6 feet)

Please note that a single sample is to be collected before the treatment as a 'control' for the lab analysis. Please collect the pre-treatment sample from site TL1 at a time that is most convenient for the volunteer but as close to the treatment date as possible. After the herbicide application is completed, 16 additional samples will need to be collected at eight different time intervals throughout the project and are listed in the table below. Sample collection intervals are listed either as Hours After Treatment (HAT) or Days After Treatment (DAT). Direct communication between the water sample collector and the herbicide applicator is necessary to ensure the collector is prepared to begin three hours after treatment is completed. If a sample cannot be collected at

the interval listed below, please collect the sample as soon as reasonably possible and record the change.

Sampling Interval Matrix (X indicates sample to be collected)		
Interval	Application Area TL1	Untreated TL2
Pre-Treatment	X	
3 HAT	X	X
9 HAT	X	X
24 HAT	X	X
2 DAT	X	X
4 DAT	X	X
7 DAT	X	X
14 DAT	X	X
21 DAT	X	X
HAT = Hours After Treatment, DAT = Days After Treatment		

All water samples will be collected using a six-foot integrated sampler (Photo 1). A video tutorial demonstrating the proper sample collection methodology is available on Onterra's YouTube web page: click here

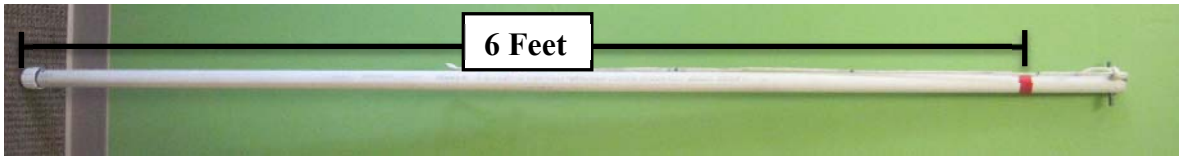


Photo 1. 6-foot Integrated sampling device constructed of PVC tubing.

Due to the extremely low concentrations being measured at the laboratory (<1 part per billion), **it is very important to thoroughly rinse the integrated sampler device and the custom mixing bottle with the water from each sampling site upon arrival at the site**. Water is collected by pushing the integrated sampler straight down to a depth of six feet; or in water shallower than six feet, down to approximately one foot above the bottom sediment. The sampler is brought to the surface and emptied into a customized mixing bottle by pushing open the stop valve at the end of the integrated sampler (Photo 2). Water should be poured from the custom mixing bottle to triple rinse the clear glass bottle. After the clear glass bottle is triple rinsed, it is to be filled for a fourth time with the water from the custom mixing bottle and then carefully poured into the brown glass bottle which has a preservative solution already inside (Photo 3).

Please use a fine-tipped permanent marker to record the date and time the sample is collected on the sticker label of the brown glass bottle. The final sample (in the brown bottle) as well as the emptied clear glass bottle should be carefully placed back within the bubble wrapped pouch to protect from accidental breakage.

While the samples are being collected, they should be kept cold and out of direct sunlight by keeping them in a small cooler on the boat. After collection, all samples should be stored in a refrigerator until shipping.

	
Photo 2. Emptying the water sample from the integrated sampler device into the custom mixing bottle.	**Photo 3. Clear glass mixing bottle and final brown glass bottle.**

Onterra will provide all of the necessary supplies to complete the sampling and provide training to the volunteer(s) collecting the samples. Onterra has a supply of handheld GPS units and integrated sampler devices available to loan out for the duration of the sampling upon request. All other materials, including sampling bottles with labels, a customized mixing bottle and necessary paperwork will be provided.

Please fill out the yellow highlighted fields on the Chain of Custody forms including:

- Sampler: (Volunteer Name)
- Client Sample ID: (example: T1, T2, or T3)
- Date sample is collected

Shipping Instructions

1) When all sampling is complete, make sure all sample vials are placed in bubble wrap within the provided soft cooler.
2) Put an ice pack into the soft cooler. This can also be a frozen water bottle (contained in an unlabeled zip lock bag). Do not place loose ice in the cooler.
3) Find a cardboard box that will fit the soft cooler for transport. If needed, pack empty space with packing material so the soft cooler is secure within the cardboard box.
4) Place the completed Chain of Custody forms in the cardboard box.
5) Only ship Monday - Thursday. The lab will not be open to receive the samples on a Saturday.
6) We recommend utilizing *FedEx Standard Overnight* so the samples can be received the next day by the lab before 4:30PM (when the lab closes).
7) Shipping costs are expected to be $150-$200 for next day delivery.
8) Ship the cardboard box containing the soft-sided cooler bag, water samples, and Chain of Custody forms to the address below:

EPL Bio Analytical Services
9095 W. Harristown Blvd.
Niantic, IL 62551