1.0 INTRODUCTION

North and South Twin Lakes, Vilas County, are approximate 2,788- and 642-acre drainage lakes, respectively. North Twin Lake flows into South Twin Lake, and South Twin Lake is drained via the Twin River flowing into Pioneer Lake (Figure 1.0-1). The outlet is controlled by a dam operated by the Wisconsin Valley Improvement Corporation (WVIC). Eurasian water milfoil (*Myriophyllum spicatum*; EWM) was first documented in this system in 2001.

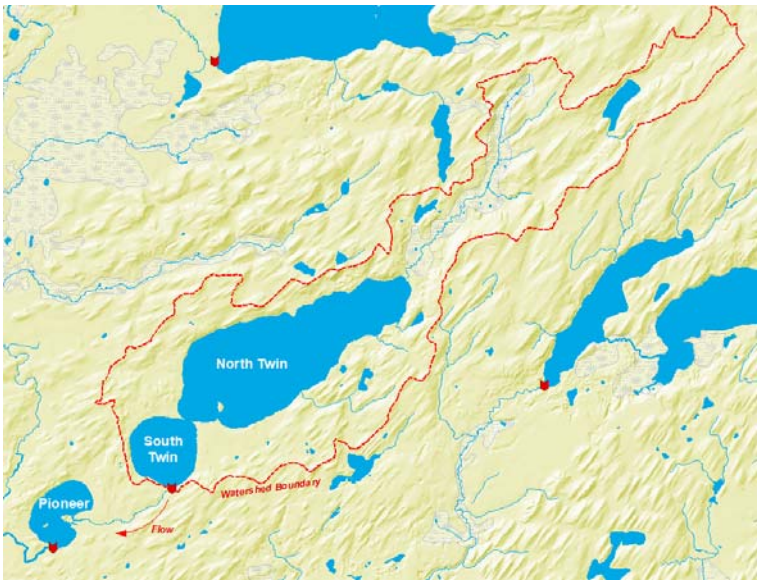


Figure 1.0-1 North & South Twin Lakes, Vilas County

The North and South Twin Lake Riparian Association (NSTLRA) was formed in 1995 and has been the primary management entity of the Twin Lakes. NSTLRA completed a Lake Management Plan in 2000 (Vilas County Land, Air, and Water Conservation Department) with a Phase II update being completed in 2006 (Onterra, LLC). Annual EWM Control & Monitoring Reports guided aquatic invasive species (AIS) management activities since 2007, with an update to the aquatic plant portion of the Lake Management Plan being completed in January of 2012.

With Onterra's assistance, a Wisconsin Department of Natural Resources (WDNR) AIS-Education, Prevention, and Planning Grant was secured in December 2015 by the NSTLRA to conduct an updated Comprehensive Lake Management Plan. The lake management planning process provided for a holistic understanding of the Twin Lakes ecosystem involving assessments of the aquatic plant community, water quality, watershed, shoreline condition, fisheries data integration, and stakeholder perceptions of the lakes. The *North and South Twin Lakes Comprehensive Management Plan* was finalized and approved by the WDNR in June 2018.

In November 2017, the North and South Twin Lake Protection and Rehabilitation District (NSTLPRD, Lake District) was formed and has taken the responsibility for carrying out the activities outlined within the Comprehensive Management Plan. The NSTLPRD received a series of grants to fund the active management (ACEI-223-19) and monitoring (AEPP-578-19) aspects of an aggressive 3-year EWM population suppression program. This report discusses the activities that occurred during the first year of the project.

2.0 SOUTH TWIN LAKE

Control Strategy Development

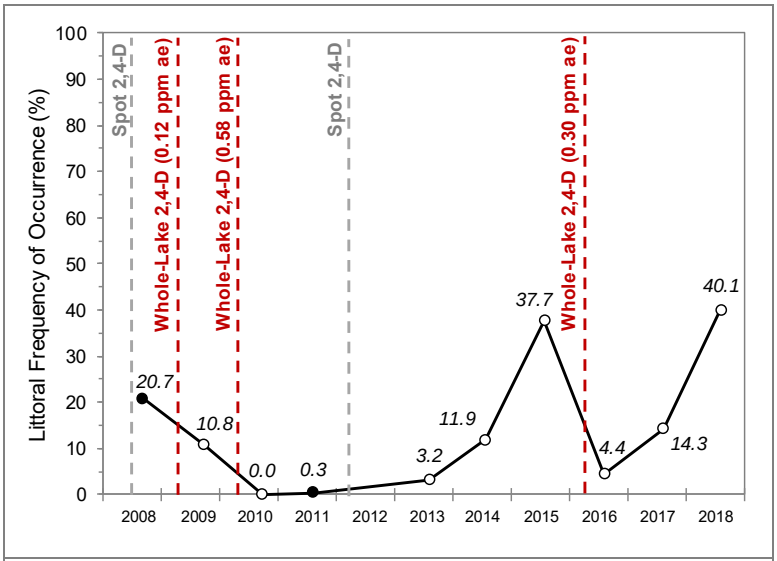


Figure 2.0-1. Littoral occurrence of EWM from South Twin Lake from 2008-2018. Open circle represents a statistically valid change from previous survey (Chi-square α = 0.05).

The District created an EWM population management goal for inclusion within *North and South Twin Lakes Comprehensive Management Plan* (June 2018), including a trigger for when an action would be considered for implementation. The District would initiate discussion, planning, and pretreatment stages of a whole-lake herbicide treatment when EWM populations measured from the point-intercept survey exceed 12% littoral frequency of occurrence (LFOO). This threshold was based upon coupling the South Twin Lake point-intercept data at these levels with the Late-Summer EWM Mapping Survey data. When EWM populations exceeded this approximate benchmark in the past, *highly dominant* and *surface matted* conditions started becoming apparent. The NSTLPRD has expressed their opinion that based on the past history of EWM LFOO increasing substantially in the year following this threshold being met (to 37.7% in 2015 and 40.1% in 2018), that consideration should be made for planning for herbicide treatment in the year after the 12% threshold is initially exceeded to reduce the impacts to native plants and riparian use of the lake that occur at higher EWM population levels. This threshold was exceeded in 2017 (14.3% EWM LFOO), resulting in the District investigating various large-scale herbicide control strategies in tandem with developing a lake management plan (Figure 2.0-1).

Ultimately the District's AIS Planning Committee elected to proceed with a whole-lake pelletized fluridone treatment in 2019. The risk assessment within *North and South Twin Lakes Comprehensive Management Plan* (June 2018) investigated native aquatic plant sensitivity and impact of other aquatic organisms and human health.

In conjunction with the whole-lake fluridone treatment on South Twin Lake, EWM mapping surveys and point-intercept surveys would be conducted the *year prior to treatment* (2018) and the *years after treatment* (2020 and 2021). Please note that surveys were not conducted during the *year of treatment* (2019), as the lake was in the process of active treatment.

Many lake groups initiate a whole-lake herbicide strategy with the intention of implementing smaller-scale control measures (herbicide spot treatments, hand-removal) when EWM/HWM begins rebounding. This is referred to as Integrated Pest Management (IPM). From its own experience, the Lake District understands that EWM population rebound is inevitable following a whole-lake treatment. The District developed a specific management action within its recently created *Comprehensive Management Plan* to "Develop Long-Term Contingency Strategy for Rebounding EWM Populations in South Twin Lake." When EWM rebound and survivorship is documented, the Lake District would enact an integrated pest management strategy consisting of follow-up control measures to ensure longevity of control.

Preferably, this would include hand-harvesting, potentially with diver assisted suction harvesting, or herbicide spot treatment.

Finalized Dosing Strategy for Initial Treatment

In order to finalize the dosing volume for the 2019 treatment, it was necessary to understand the volume of water in which the herbicide is expected to mix within. As the water warms, a thermal barrier develops in many lakes essentially separating the lake into an upper epilimnion with warmer water temperatures and a lower hypolimnion with cooler water temperatures. The transitional area separating the upper and lower portions of the water column or metalimnion. In recent years, it has become common for lake managers to predict the mixing volume of a lake based on the middle of the metalimnion, understanding that some amount of herbicide will be lost to the metalimnion.

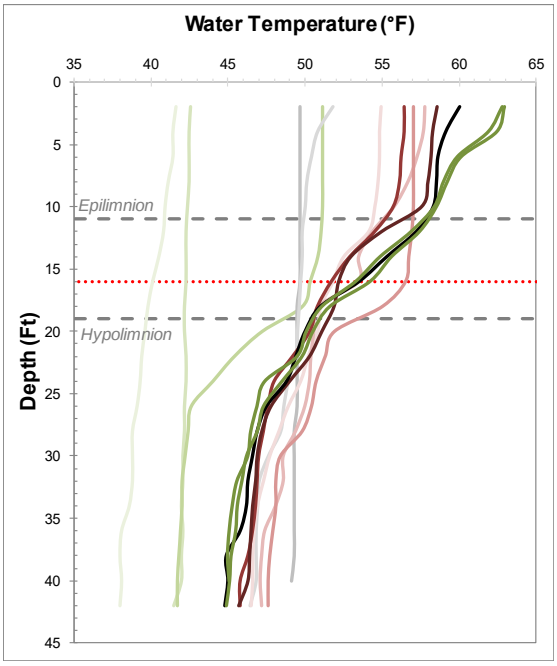


Figure 2.0-2. Pre-Treatment Temperature Profiles Collected on South Twin Lake. Data provided by NSTLPRD volunteers.

Volunteers from the NSTLPRD provided numerous temperature profiles in the days and weeks leading up to the large-scale herbicide treatment on South Twin Lake (Figure 2.0-2). During early-May, the lake was warming but not developing separate and stable strata. In early June, stratification parameters became more apparent. From analyzing the temperature profiles, the final dosing was based upon a mixing zone of the top 16 feet of the lake.

Map 1 displays the final large-scale herbicide treatment design and dosing strategy for South Twin Lake in 2019. The treatment includes application of pelletized fluridone (Sonar One ®, SePRO) over 178.8 acres of the littoral zone known to contain EWM. The initial herbicide treatment was conducted by Schmidt's Aquatic, LLC on June 9, 2019. The applicator reported a near-surface water temperature of approximately 67°F and southerly winds of 1-8 mph at the time of application. Shortly after the start of the treatment, the applicator experienced an equipment problem that involved a clogged hose. The issue was rectified and the treatment was continued and completed later in the day with no further issues. The WDNR was notified of the equipment issue and further documentation was included with the formal treatment record (Form 3200-111). It is not expected that this equipment issue would have any negative impact on the efficacy of the treatment strategy.

Bump Treatment Dosing Strategy

Temperature profiles collected before the treatment and at each herbicide concentration sampling interval indicate that the lake remained thermally stratified through mid-August when temperature profiles no longer were collected (Figure 2.0-3). Limnologists, scientists that study inland waters, understand thermal stratification as occurring when there is a change of 1°C within 1 meter. The closely spaced water temperature contours on the isotherm (Figure 2.0-3, left frame) indicate a thermal gradient separating the epilimnion and hypolimnion. This can also be observed on the temperature profiles (Figure 2.0-3, right frame), where uniform temperatures were observed in the upper portion of the water column before getting much colder in a short amount of depth.

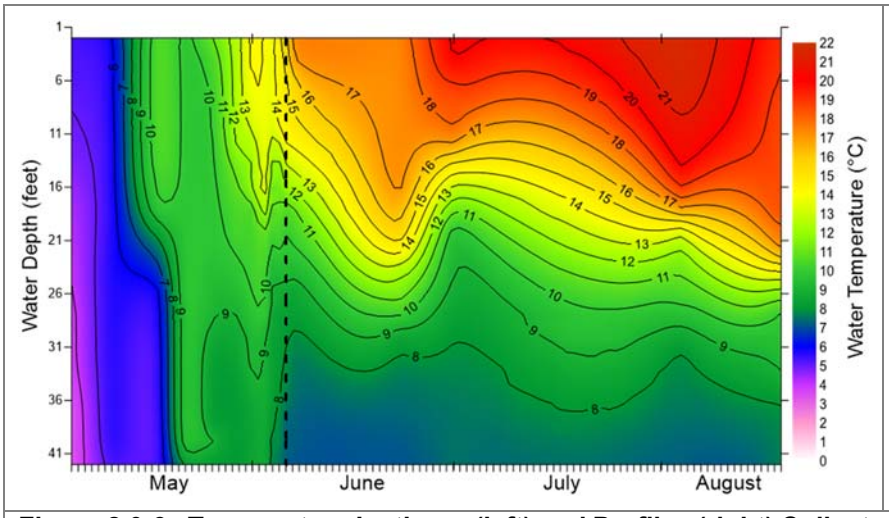


Figure 2.0-3. Temperature Isotherm (left) and Profiles (right) Collected from South Twin Lake Following the 2019 Herbicide Treatment. Dashed line on isotherm represents initial treatment date.

Based upon reviewing the measured herbicide concentration during the summer as well as technical advice from SePRO, a 2.25 ppb bump treatment of pelletized fluridone (Sonar One®) was conducted on July 22 and a 3.0 ppb bump treatment occurred on September 8 by Schmidt's Aquatic. The final dosing of the treatment was based on a mixing zone down to 18 feet at the time of the first bump treatment and 22 feet for the second bump treatment and each includes application of pelletized fluridone over the same 178.8 acres where the initial application occurred. The NSTLPRD raised concerns over the drop in fluridone concentrations prior to the first bump treatment and apparent lack of visible impacts to some EWM colonies in the lake as the summer progressed during continual communications with SePRO. In an effort to achieve slightly elevated concentrations in three specific sites where a large amount of EWM biomass were observed during the summer, the second bump treatment was modified to include higher application rates compared to the rest of the application areas as indicated on the table embedded on Map 2.

Figure 2.0-4 shows the results of the fluridone monitoring that occurred in association with the 2019 large-scale treatment on South Twin Lake. The fluridone concentrations were approximately maintained between 1.5-2.5 ppb as intended. The average concentrations for all sites were 1.6 ppb at 14 Days After Treatment (DAT), and 1.8 ppb at 28 DAT. Average fluridone concentrations were lower at 42 DAT at 1.2 ppb which prompted the implementation of the first bump treatment. Average concentrations were between 1.9-2.0 ppb from 56 DAT to 80 DAT before decreasing to 1.4 ppb at 91 DAT. Following the second bump treatment, average concentrations were measured at 2.0 ppb at 111 DAT and 1.7 ppb at the last sampling event conducted on 144 DAT.

It is anticipated that herbicide degradation would be minimal over the winter as fluridone is primarily broken down by sunlight, specifically UV-B (300-320 nm), but also by UV-A (320-380) spectrums. These wavelengths are absorbed by ice and snow, not allowing much penetration to fluridone in the lake during the winter. Although herbicide degradation is not likely to occur over winter, water exchange out of South Twin over the winter will result in a lowered fluridone concentration. Samples are to be collected in spring 2020 from South Twin Lake to measure the fluridone concentrations shortly after ice-off. Additional samples will be collected in 2020 until the herbicide reaches non-detectable levels.

The herbicide concentration monitoring plan included the collection of limited samples from Pioneer Lake which is approximately two miles downstream of South Twin Lake via the Twin River. All

samples collected from Pioneer Lake were below the detection limit for fluridone. Limited sampling also took place in North Twin Lake to measure if fluridone dissipation occurred to the upstream lake. These samples also were found to be below the detection limit.

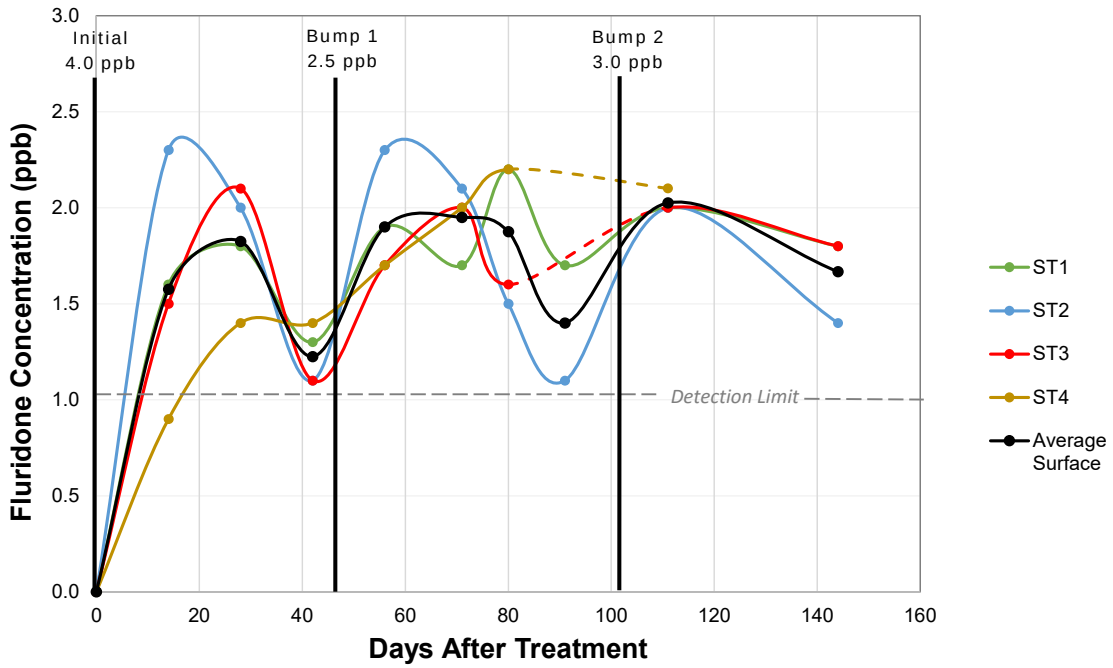


Figure 2.0-4. South Twin Lake 2019 Herbicide Concentration Monitoring Results from four monitoring locations.

Figure 2.0-5 displays the average fluridone concentrations associated with other recent low dose fluridone treatments in Wisconsin Lakes that Onterra has monitored. The measured concentrations achieved in South Twin Lake in 2019 are included for comparison.

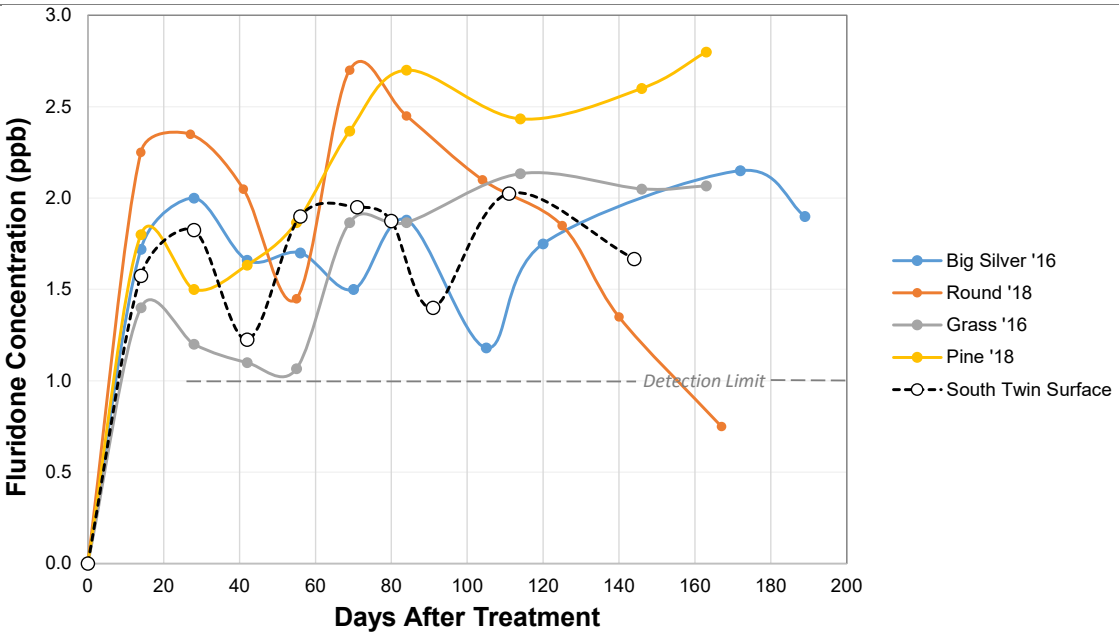


Figure 2.0-5. Herbicide Concentration Monitoring Results from four recent low dose whole-lake fluridone treatments in Wisconsin Lakes.

3.0 NORTH TWIN LAKE

North Twin Lake 2019 EWM Control Strategy

As outlined in the *North and South Twin Lakes Comprehensive Lake Management Plan* (June 2018), the NSTRLPRD created a strategy where the entirety of the EWM population on North Twin is being considered for active management. The goal of the Lake District is to use hand-harvesting as a preferred control mechanism, but has established a management trigger when herbicide spot treatment would be considered. If the following trigger is met, the Lake District would consider conducting herbicide spot treatments: "colonized areas where a sufficiently large treatment area can be constructed to hold concentration and exposure times (preference to *dominan*t or greater density AIS populations)." The management action also indicates that spot treatments would likely need to be conducted with herbicides that are effective with anticipated short exposure times.

The area extending north from the entrance to South Twin Lake towards the Lakota Street boat landing experienced large increases in EWM density during the past few years and this site surpassed the Lake District's threshold for consideration for herbicide spot treatment. This prompted the collection of pretreatment data during the late-season of 2018. Using a 23-meter spacing, 105 point-intercept sub-sample locations were placed over this site and data was collected in mid-October, with EWM being located at approximately 57% of sampling locations. The Lake District determined this site was a priority for active management during spring of 2019 and investigated potential treatment options.

Based on the results of the 2016 large-scale spot treatment, the Lake District did not believe that the combination 2,4-D and endothall use-pattern would meet expectations. The Lake District investigated Aquastrike ™ (UPI), which is a commercially available combination of diquat and endothall. Ultimately, the Lake District chose florpyrauxifen-benzyl, commercially available as ProcellaCOR™ (SePRO). This herbicide is specifically designed to control invasive milfoil in short exposure time scenarios. ProcellaCOR™ is in a new class of synthetic auxin mimic herbicides (arylpicolinates) with short concentration and exposure time (CET) requirements compared to other systemic herbicides. Because this is a new herbicide, data available from field trials is relatively limited.

During the winter of 2018-2019, the Lake District worked closely with Onterra, WDNR, SePRO and other project partners in developing the specific components of the herbicide treatment strategy.

As follow-up measures from the 2016 large-scale spot treatment in the southern end of the lake near the island, the District implemented professional hand-harvesting with DASH in 2019. In addition to a greater amount of effort in 2019, the Lake District believed that greater strides in EWM population management can be achieved by implementing the strategy earlier in the growing season when EWM and native plants are at an earlier growth stage.

2019 North Twin Lake Monitoring Results – Herbicide Spot Treatment

Onterra staff completed a Pre-Treatment Confirmation and Refinement Survey on North Twin Lake on May 22, 2019. The purpose of the survey was to refine the proposed treatment area extents and average depths as well as to gauge the condition and growth stage of the EWM population in the site. Onterra also provided volunteers from the District with the training and supplies necessary to carry out the post-treatment herbicide concentration monitoring.

During the survey, the crew observed the condition of the EWM plants in the treatment area characterized by mostly brownish colored plants that were likely from biomass that persisted since the previous year.

Some new growth in the form of greenish colored meristems was observed on many plants. The crew confirmed the extent of the proposed application area and completed a sub point-intercept survey in the proposed site to determine the frequency of occurrence of EWM. The sub point-intercept survey showed EWM was present at 44 of the 105 sampling locations representing a 41.9% frequency of occurrence. The average depth of the application area was modified from 7.0 to 8.0 feet as a result of the survey. Based on the growth condition of the EWM observed during the pretreatment survey, and following consultation with SePRO, it was believed that the herbicide spot treatment would be more effective if the plants were allowed to gain more active growth to allow for greater herbicide uptake. Volunteers from the District monitored the progression of the growth stage of the EWM and other aquatic plants in the following weeks and relayed those observations to the project partners to aid in determining the appropriate timing of the herbicide treatment. The final treatment strategy and herbicide concentration monitoring sites are displayed on Map 3. The herbicide treatment was completed on the morning of June 17, 2019 by Clean Lakes, Inc.

The efficacy of the 2019 ProcellaCOR treatment site was evaluated through qualitative and quantitative methods following treatment. Additionally, herbicide concentration monitoring was conducted in the hours and days following the herbicide treatment during which trained volunteers from the NSTLPRD collected and shipped samples to SePRO's laboratory for analysis. The herbicide concentration monitoring plan associated with the treatment was developed by Onterra, WDNR, and SePRO with the intent of gaining sufficient data to aid in understanding the concentrations of florpyrauxifen-benzyl that were achieved in the treatment area in the hours and days after treatment. Samples were collected from four sites within the herbicide application area at six time intervals after treatment. A copy of the herbicide concentration monitoring plan as well as the results are included as Appendix A.

Only a few of the herbicide concentration monitoring samples collected in hours after treatment had concentrations of florpyrauxifen-benzyl above the detection limit (1 ppb). SePRO, the manufacturer of ProcellaCOR, has stated that the herbicide rapidly binds with the organic material which may have been the case in association with this treatment. With the large scale fluridone treatment taking place in South Twin Lake during 2019, samples were collected from within the North Twin treatment area to test for the presence of fluridone. None of these samples showed detectable levels of fluridone.

Figure 3.0-1 displays the qualitative (EWM mapping surveys) and quantitative (point-intercept sub-sampling) monitoring survey results from before and after the ProcellaCOR treatment. Prior to treatment, the site harbored a robust EWM population of varying densities including several areas of *highly dominant* or *surface matting* plants (Figure 3.0-1, left frame). The post-treatment mapping surveys showed a reduction in EWM in the site such that no colonized EWM was present and the remaining plants were described as *single or few plant* occurrences (Figure 3.0-1, center-right frame). Divers from Aquatic Plant Management, LLC took underwater pictures of the ProcellaCOR treatment area and are included at the end of Appendix C.

Due to logistical constraints, the pretreatment quantitative sampling was not collected until October 16, 2018. It is possible that this late survey timing could potentially under-represent the occurrence of certain native species that may have senesced by the time of the survey. Following the treatment, the sub-sampling survey was completed both at a comparable mid-October (October 17, 2019) timeframe as well as at a more appropriate early-September timeframe (September 11, 2019) for understanding native plant frequencies. These data are displayed on Figures 3.0-1 and 3.0-4. Only species that exhibited greater than 1% occurrence in at least one of the surveys are included in the analysis with a full matrix of species frequencies included as Appendix B. Aquatic plants are subjected to environmental conditions that lead to naturally variable populations in any given year. Thus, changes in aquatic plant

populations cannot be definitively distinguished between natural variability, active management that may be occurring, or some combination of both factors.

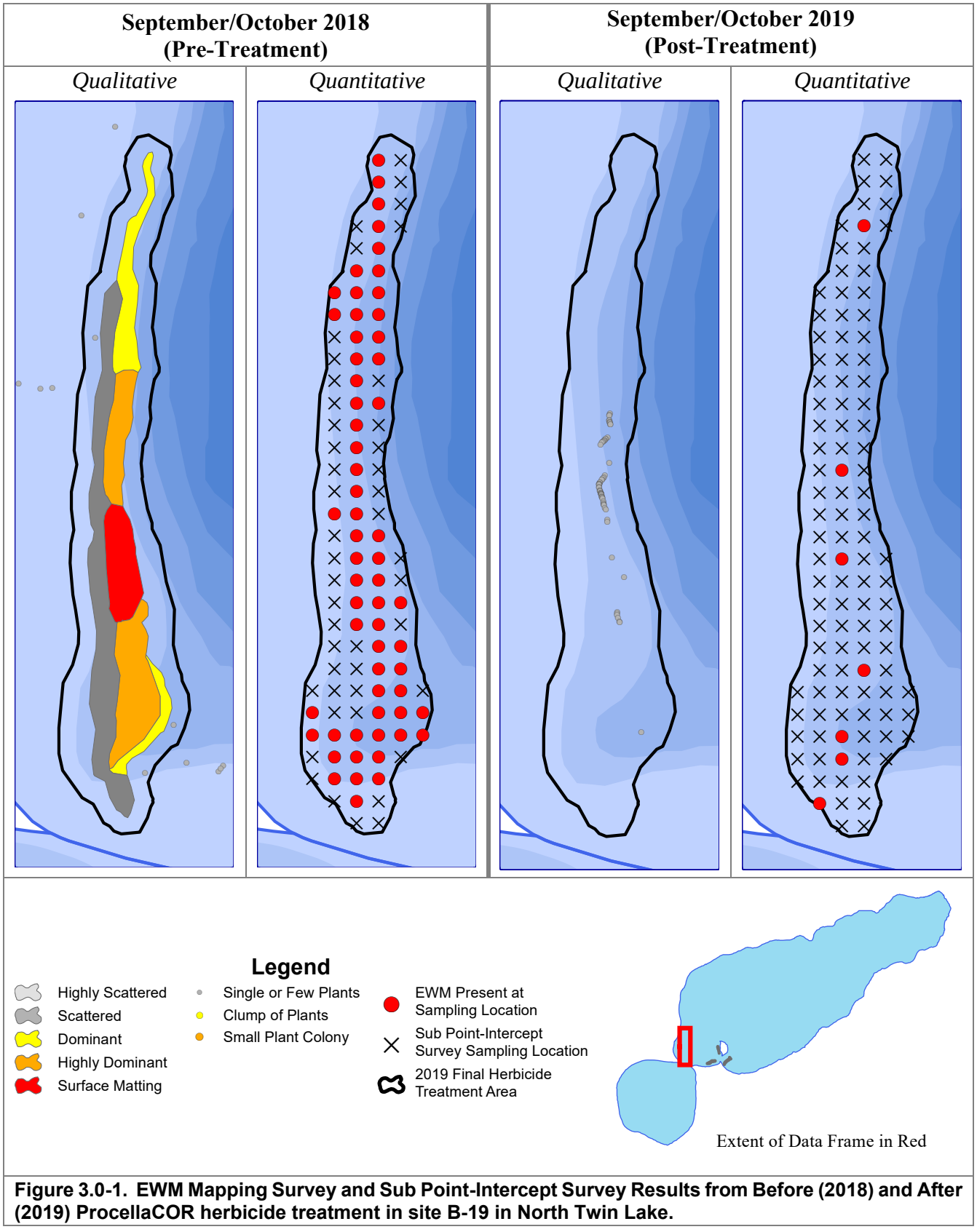


Figure 3.0-1. EWM Mapping Survey and Sub Point-Intercept Survey Results from Before (2018) and After (2019) ProcellaCOR herbicide treatment in site B-19 in North Twin Lake.

A pre-treatment sub point-intercept survey completed in October 2018 found EWM present at 60 of 105 sampling locations (57.1% FOO). The post-treatment point-intercept surveys indicated EWM to be present at 11 of 105 sampling locations during the September 2019 survey (10.5% FOO, -81.7%) and 7 of 105 sampling locations (6.7% FOO, -88.3%) in a replication of the survey completed in October 2019 (Figure 3.0-2). Both post-treatment EWM occurrences represent a statistically valid decrease compared to the pre-treatment frequency of occurrence.

Figure 3.0-2. Frequency of occurrence of Eurasian watermilfoil Before (2018) and After (2019) a spring 2019 ProcellaCOR herbicide spot treatment in North Twin Lake. Data from October 2018, September 2019, and October 2019 sub Point-Intercept Surveys (n=105). Dashed line represents spring 2019 herbicide treatment.

Four native species, coontail (*Elodea canadensis*), northern watermilfoil (*Myriophyllum sibiricum*), alternate-flowered watermilfoil (*Myriophyllum alterniflorum*), and Fries' pondweed (*Potamogeton friesii*) exhibited statistically valid decreases in occurrence when comparing the results of the October to October surveys. However, when considering the results of the September post-treatment survey, only northern watermilfoil and alternate-flowered watermilfoil showed statistically valid declines in occurrence compared to the pre-treatment survey (Figure 3.0-3). These species are closely related to EWM and known to be susceptible to herbicides that impact EWM.

The change in occurrence of common waterweed is not statistically valid when comparing the 2018 pre-treatment survey to the September 2019 post-treatment survey, however the data shows a statistically valid decline when compared to the October post-treatment survey. The 20.0% occurrence documented in the September post-treatment survey indicates that the population of common waterweed likely was not particularly impacted by the treatment. Likewise, the change in occurrence of Fries' pondweed is statistically valid if comparing October 2018 to October 2019, however, a substantial population of Fries' pondweed (14.3% FOO) was documented in the September 2019 survey (Figure 3.0-4).

Water marigold (*Biden's beckii*) and small pondweed (*Potamogeton pusillus*) exhibited a statistically valid increase in occurrence following treatment (Figures 3.0-3 and 3.0-4). The occurrence of white water-crowfoot, wild celery, clasping-leaf pondweed, water stargrass, white-stem pondweed, flat-stem pondweed, muskgrasses, and variable leaf pondweed were not statistically different between the surveys.

The point-intercept survey data appear to capture the senescence of slender and southern naiad in the post-treatment surveys where slender naiad went from 16.2% in September 2019 to 1.0% in October and where southern naiad decreased from 12.4% to 0% in the same time period (Figure 3.0-4). It appears likely that the October 2018 pre-treatment survey occurred after much of the populations of these species had already senesced for the growing season.

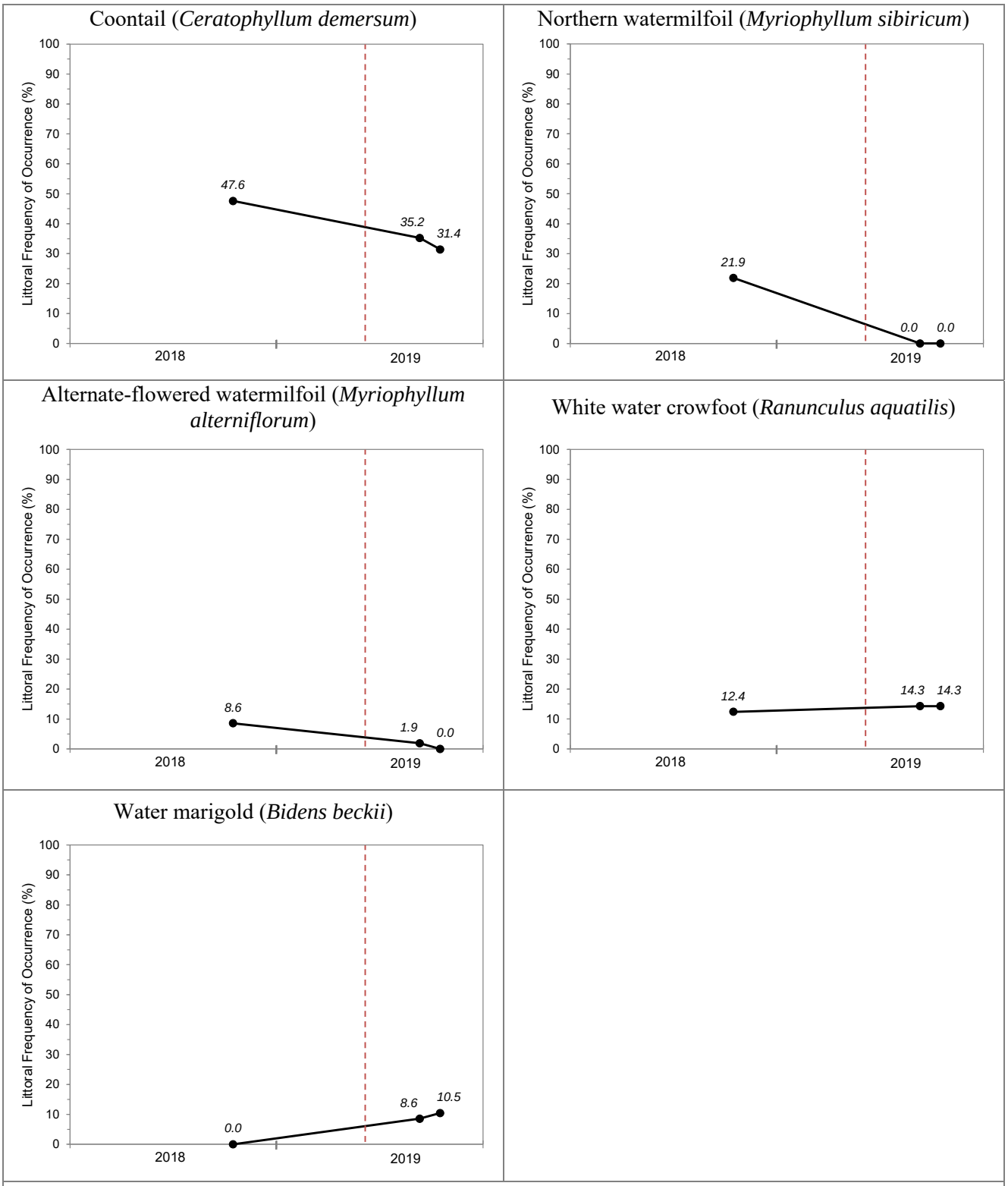


Figure 3.0-3. Frequency of occurrence of native dicot species in North Twin Lake. Data from October 2018, September 2019, and October 2019 sub Point-Intercept Surveys (n=105). Dashed line represents spring 2019 herbicide treatment.

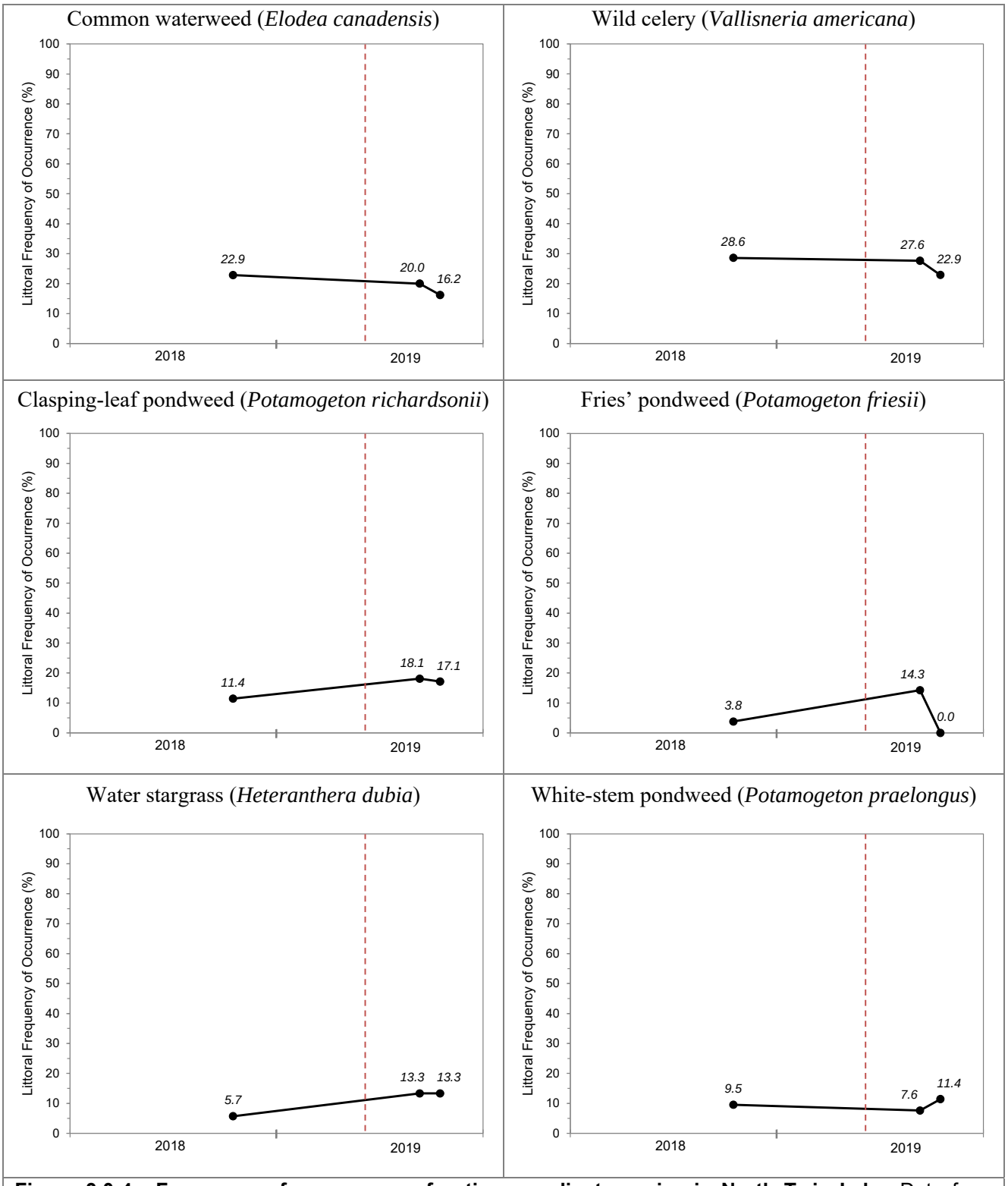


Figure 3.0-4. Frequency of occurrence of native non-dicot species in North Twin Lake. Data from October 2018, September 2019, and October 2019 sub Point-Intercept Surveys (n=105). Dashed line represents spring 2019 herbicide treatment.

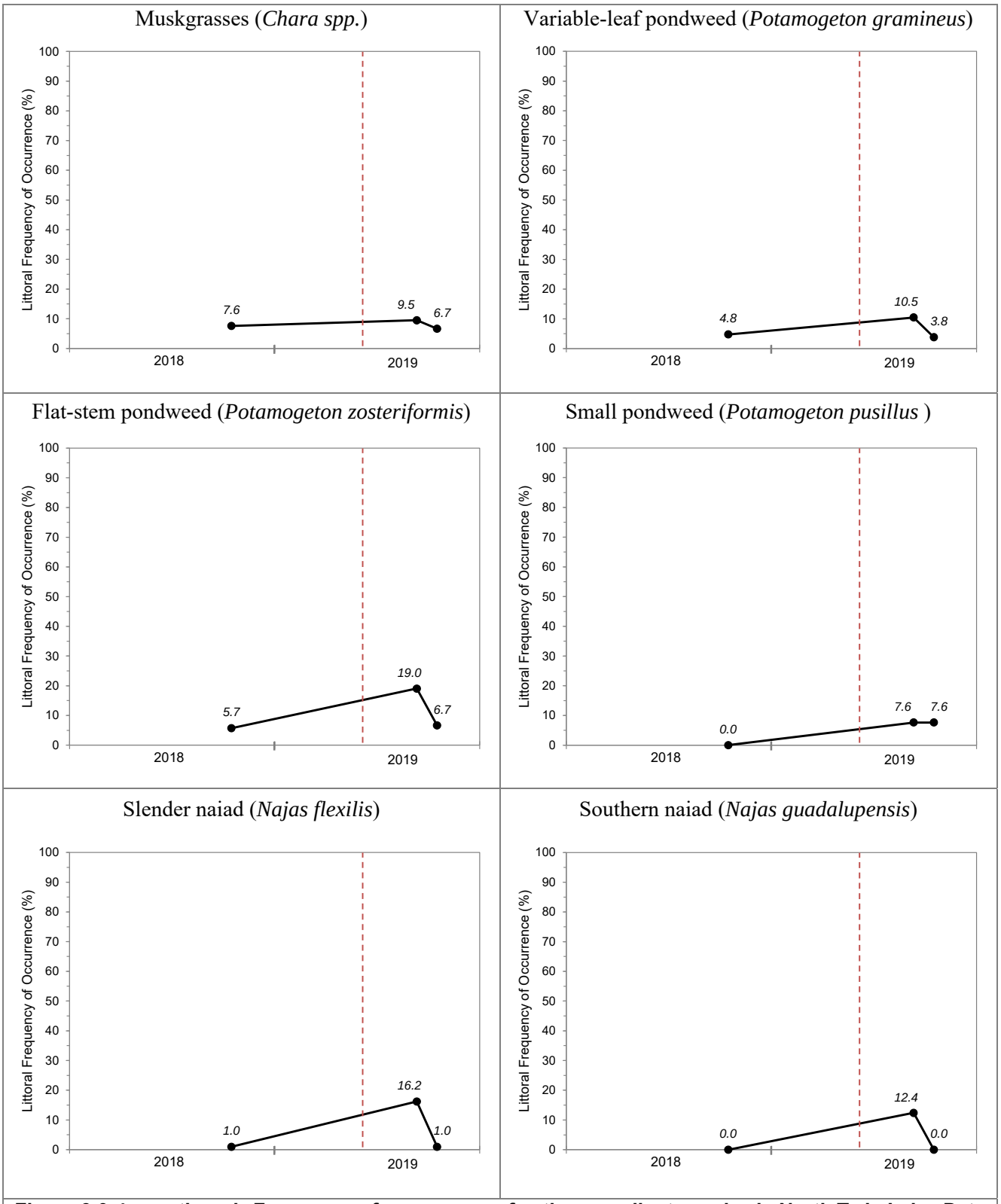


Figure 3.0-4 - continued. Frequency of occurrence of native non-dicot species in North Twin Lake. Data from October 2018, September 2019, and October 2019 sub Point-Intercept Surveys (n=105). Dashed line represents spring 2019 herbicide treatment.

2019 North Twin Lake Monitoring Results – Professional Hand Harvesting

Onterra staff completed a focuses Early Season AIS Survey on June 20, 2019. During the survey, only select areas of North Twin Lake were mapped where EWM has historically found and where preliminary hand-harvesting activities were being considered. The results of the survey are displayed on Map 4, where a total of four sites were included in the final DASH strategy for 2019. Site A-19 was given first priority for removal efforts, and if sufficient resources were available, then efforts would take place in the other permitted sites.

The District contracted with Aquatic Plant Management, LLC to provide nine days of professional DASH services in 2019. AIS removal specialists from APM conducted harvesting activities on June 26-28, July 8-12 and July 15, 2019. During the course of the removal efforts, a total of 853.5 cubic feet of EWM was harvested from site A-19. No removal efforts took place in three additional sites that were included in the permitted areas. Additional details of the professional harvesting actions are included in a summary dive report created by APM, LLC as Appendix C.

Onterra staff completed the 2019 Late-Season EWM Mapping Survey on North Twin Lake on September 10-11 & 17. The entire littoral area of the lake was included in the scope of the survey. The survey crews experienced variable weather conditions during the survey with a mix of sun and clouds, rain, and wind. Crews noted that the water appeared turbid at the time of the survey with lower water clarity than accustomed to. To supplement the visual survey, a submersible camera was deployed in select locations where active management occurred during 2019.

The results of the mapping survey are displayed on Map 5. The survey results show colonized EWM present in approximately the same locations as has been documented in previous surveys (Map 5). Colonized areas of EWM that consisted of *highly scattered*, *scattered*, or *dominant* densities were mapped in the vicinity of the island on the south end of North Twin Lake. The EWM population in the remaining areas of the lake was relatively sparse with a few congregations of *single or few plant* occurrences (Map 5).

The site that was targeted for professional harvesting is highlighted in Figure 3.0-5 where the top frames show the pre-harvesting EWM population mapped in September 2018, and June 2019 and the bottom frame show the post-harvesting EWM population mapped in September 2019. It should be noted that the late-summer survey occurred approximately eight weeks after the completion of the professional DASH efforts. This allows for sufficient time for EWM rebound in these areas from root crowns that were not completely removed. The field crew visually meandered the site and then completed a transect of the site with a submersible camera. Crews observed the site to be dominated by native vegetation at the time of the survey with substantial populations of native milfoils, coontail, and water marigold. The survey results showed that the EWM population was reduced in density throughout the entire site, where the colony that remained was described as *highly scattered*, the lowest density rating that is used within Onterra's five-tiered density scale. The reduction in the EWM population in the site met or exceeded lake managers' expectations for the control strategy.

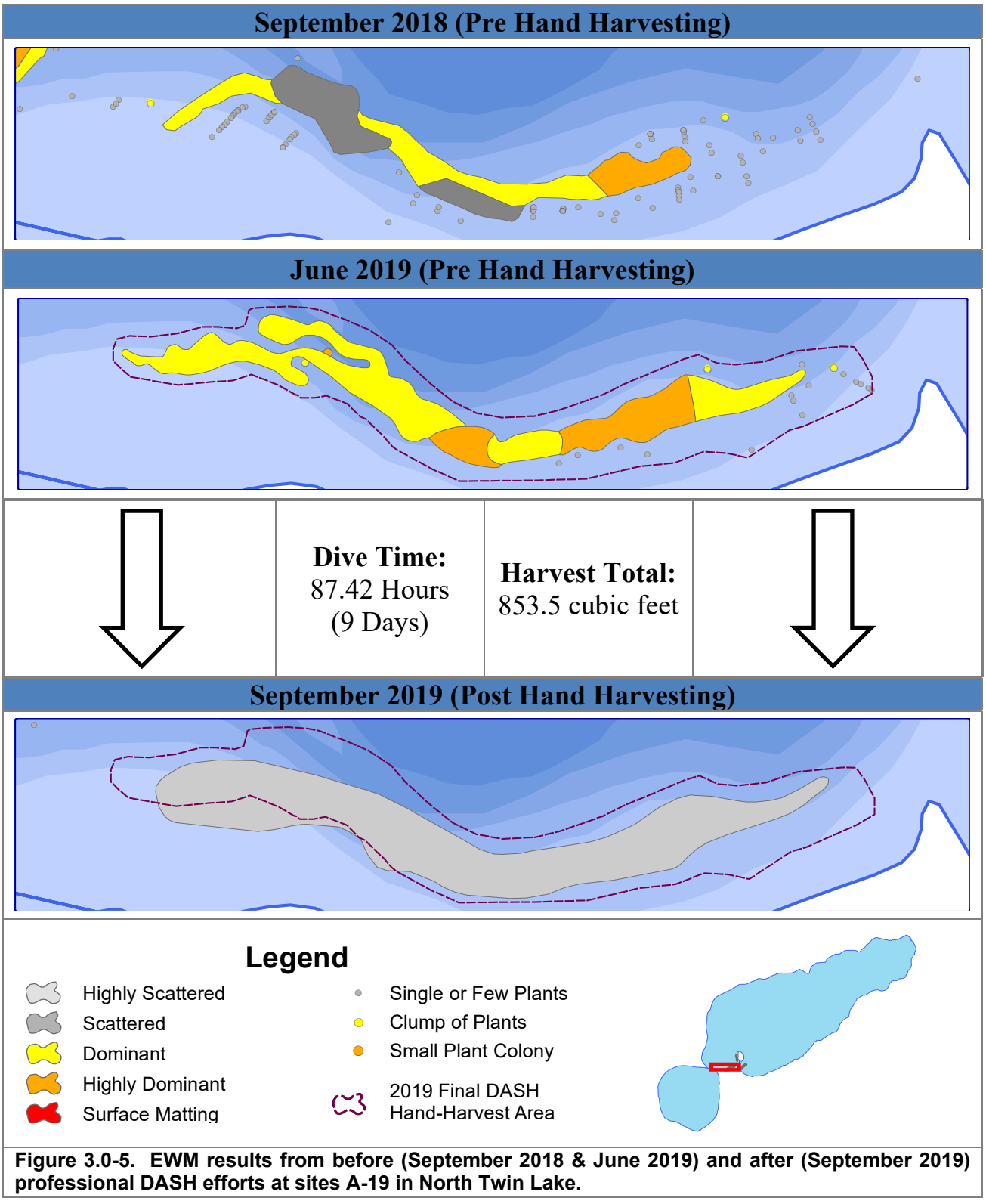


Figure 3.0-5. EWM results from before (September 2018 & June 2019) and after (September 2019) professional DASH efforts at sites A-19 in North Twin Lake.

4.0 CONCLUSIONS & DISCUSSION

The coordination and implementation of the 2019 EWM management strategy was completed as planned for North and South Twin Lakes with collaboration from several project partners including the NSTLPRD, WDNR, SePRO, and Onterra. Volunteer efforts provided by the NSTLPRD were instrumental in the completion of the pre- and post-treatment planning and monitoring associated with the treatments. The efficacy of the South Twin fluridone treatment was not determined based on data collected during 2019 but rather, will be evaluated in 2020 through the replication of qualitative and quantitative monitoring surveys. Herbicide concentration monitoring data that was collected from South Twin Lake following the fluridone treatment showed that concentrations of fluridone were slightly below target levels and of a similar concentration to other low-dose whole-lake fluridone treatments completed in recent years in Wisconsin. SePRO has indicated preference for a low-concentration bump treatment soon after ice-off in 2020.

The site that was treated with ProcellaCOR in North Twin Lake in 2019 shows promising results during the *year of treatment* with reductions in EWM demonstrated through comparative mapping surveys and point-intercept sub-sampling surveys. Some native aquatic plant species exhibited statistically valid decreases in occurrence following the 2019 treatment; however, the overall impacts to the native plant populations were consistent with expectations and not of a scale that would lend to immediate concern. A replication of the mapping survey and sub-sample point-intercept survey is scheduled for 2020 and will allow for an understanding of the longer-term efficacy of the treatment as well as an assessment of the native plant communities population dynamics and recovery one year after treatment.

Professional hand harvesting efforts in 2019 led to effective EWM control in the targeted area in North Twin Lake as demonstrated by a reduction in EWM density observed through the comparative mapping surveys. Continued monitoring in 2020 will determine whether the reduction in EWM in the targeted site extends beyond one growing season. Hand harvesting as a technique for EWM management continues to be evaluated for its applicability in managing the EWM population in North and South Twin Lakes.

2020 Integrated Pest Management Strategy

Herbicide Spot Treatment

Consistent with the EWM management goals stated within the *Comprehensive Management Plan*, the NLTLPRD seeks to continue an integrated approach to EWM management in 2020 that utilizes herbicide spot treatments and hand harvesting techniques. One site in North Twin Lake meets the defined "trigger" for considering an herbicide spot-treatment control strategy. Map 6 displays the 10.0-acre site in North Twin Lake that is proposed for herbicide treatment in 2020. The application area for the site was created by applying an approximate 60-foot buffer around the known EWM colonies. Following the promising initial results from the 2019 ProcellaCOR treatment, a similar treatment design is planned in association with the proposed 2020 treatment. A dosing strategy of 7.0 PDU/ acre-foot was proposed by SePRO and is similar to, but slightly below, the 8 PDU rate used in association with the 2019 treatment.

Monitoring Plan

The 2020 herbicide treatment would be monitored through the quantitative and qualitative evaluations. The 30-meter sampling grid used for this analysis was originally created in association with a quantitative sampling plan related to the 2017 combination 2,4-D/endothall large-scale spot treatment

(Figure 4.0-1). As discussed above, only a 10-acre portion of this area is being proposed for herbicide management in 2020.

The quantitative assessment would be completed through the comparison of the sub point-intercept survey from 2019 (*year before treatment*), 2020 (*year of treatment*) and 2021 (*year after treatment*). The 2020 survey will allow for an understanding of which species were initially impacted by the treatment. Understanding the EWM population in the *year of treatment* (2020) is important, however the results of a replication of the survey in 2021 (*year after treatment*) will allow for a better understanding of the efficacy of the treatment and help to understand whether EWM mortality was achieved rather than the treatment simply injuring the plants and suppressing their growth during the year of treatment.

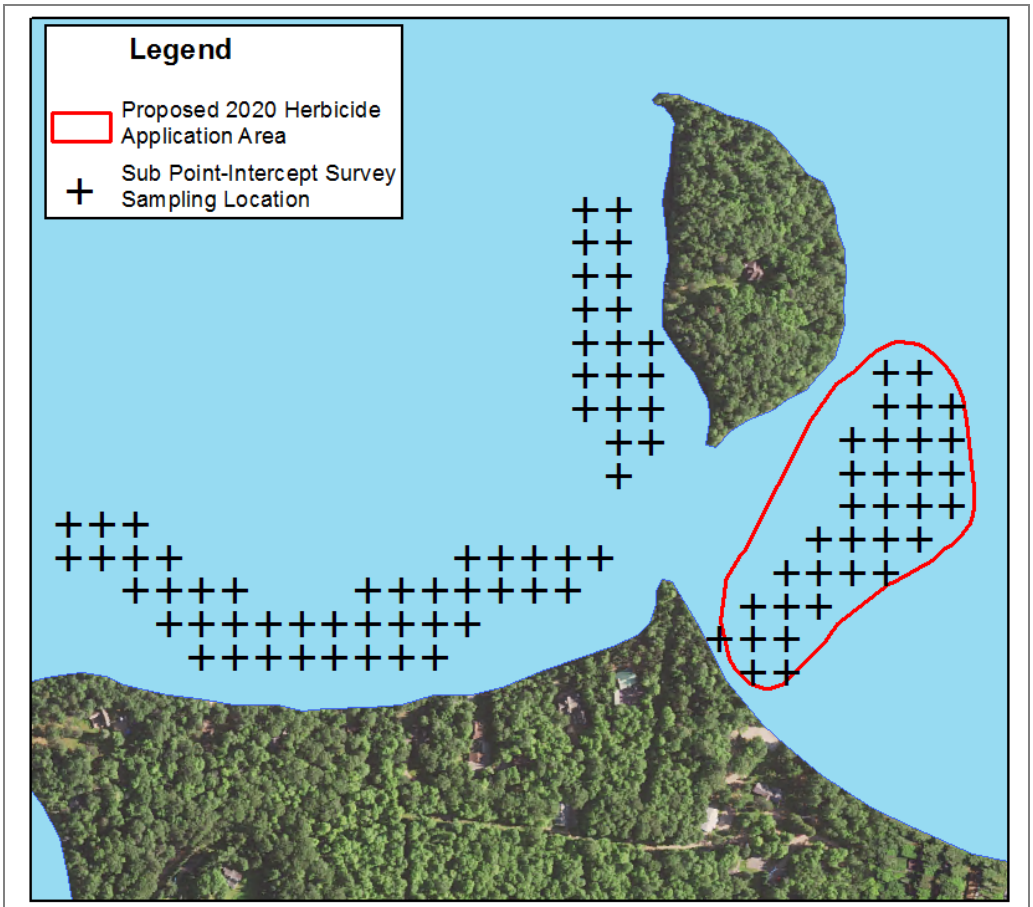


Figure 4.0-1. North Twin Lake Quantitative Monitoring Plan for Proposed 2020 Herbicide Treatment (n=33 within proposed 2020 herbicide treatment area).

A qualitative assessment of the 2020 herbicide treatment would include comparing the 2019 Late-Season EWM Mapping Survey (*year before treatment*)) to the 2020 Late-Season EWM Mapping Survey (*year of treatment*) mapping results. The treatment would be considered successful in meeting the EWM control goals if the *year of treatment* survey indicates little to no EWM present in the targeted areas during the year of treatment. Further, reductions in EWM in the targeted areas would be expected to last into 2021.

Herbicide concentration monitoring may occur following the herbicide treatment. The WDNR is evaluating the results of ProcellaCOR concentration monitoring from various similar projects around the state and will determine whether or not future treatments of this nature warrant this type of monitoring.

Professional Hand Harvesting

Map 7 offers a preliminary DASH strategy for 2020 that includes all other known occurrences of EWM in North Twin Lake that were identified during the 2019 Late-Season EWM Mapping Survey. Eight sites totaling 35.9 acres are included in the preliminary DASH strategy. Of the proposed hand harvesting sites, the 2019 ProcellaCOR treatment site is included for the purpose of implementing an integrated pest management strategy in the site where hand harvesting will serve to prolong the gains that were made in EWM control in 2019. Site A-20 is where all of the 2019 hand-harvesting efforts were focused and is included in the 2020 strategy in an effort to maintain the EWM in this site at a relatively low level. All additional proposed hand harvesting sites target the isolated known occurrences elsewhere in North Twin Lake. The modest EWM populations at these sites are believed to be appropriate for hand harvesting management in an effort to inhibit EWM from establishing in other locations around North Twin Lake. The amount of effort required to carry out the proposed hand harvesting strategy in 2020 is difficult to determine, however an effort similar to what was conducted in 2019 (nine days of DASH) may be an indication of what to expect. The District will work with their contracted harvesting firm to assess the progress of the harvesting efforts and determine the harvesting time and associated costs required to meet the District's goals for the strategy in 2020.

A focused 2020 ESAIS survey would serve to finalize the hand harvesting strategy for the year. Only the sites that are included in the preliminary hand harvesting strategy would be visited during the ESAIS survey, while the rest of North Twin Lake would not be surveyed until the Late-Season Survey. The survey results will be used to determine the prioritization of sites for the harvesting program and adjust the extents of the work areas as necessary in order to finalize the DASH permit.

Additionally, the NSTLPRD has contracted with Zero Gravity Aerial, LLC to conduct an aerial drone survey to identify high-density areas of vegetation for field inspection of EWM. In early-summer, Zero Gravity Aerial, LLC would fly a drone over the sections of North Twin Lake that are outside of the extent of the focused ESAIS visual survey, collecting digital imaging in a red/blue/green to better identify density of vegetation, specifically EWM. The spatial data would be incorporated into existing GIS with focus areas being visited during the subsequent Late-Season EWM Mapping Survey. This would assist in early detection of EWM in new areas of the lake, leading to a higher success of hand-harvesting efforts and therefor lessen the need for herbicide management techniques being employed.

The hand harvesting management strategy will be assessed by comparing the 2019 Late-Season EWM Mapping Survey results to the 2020 Late-Season EWM Mapping Survey results. The strategy would meet lake managers' expectations if the EWM population is found to be either maintained at approximately the same level or reduced in size and/or density between the two surveys.

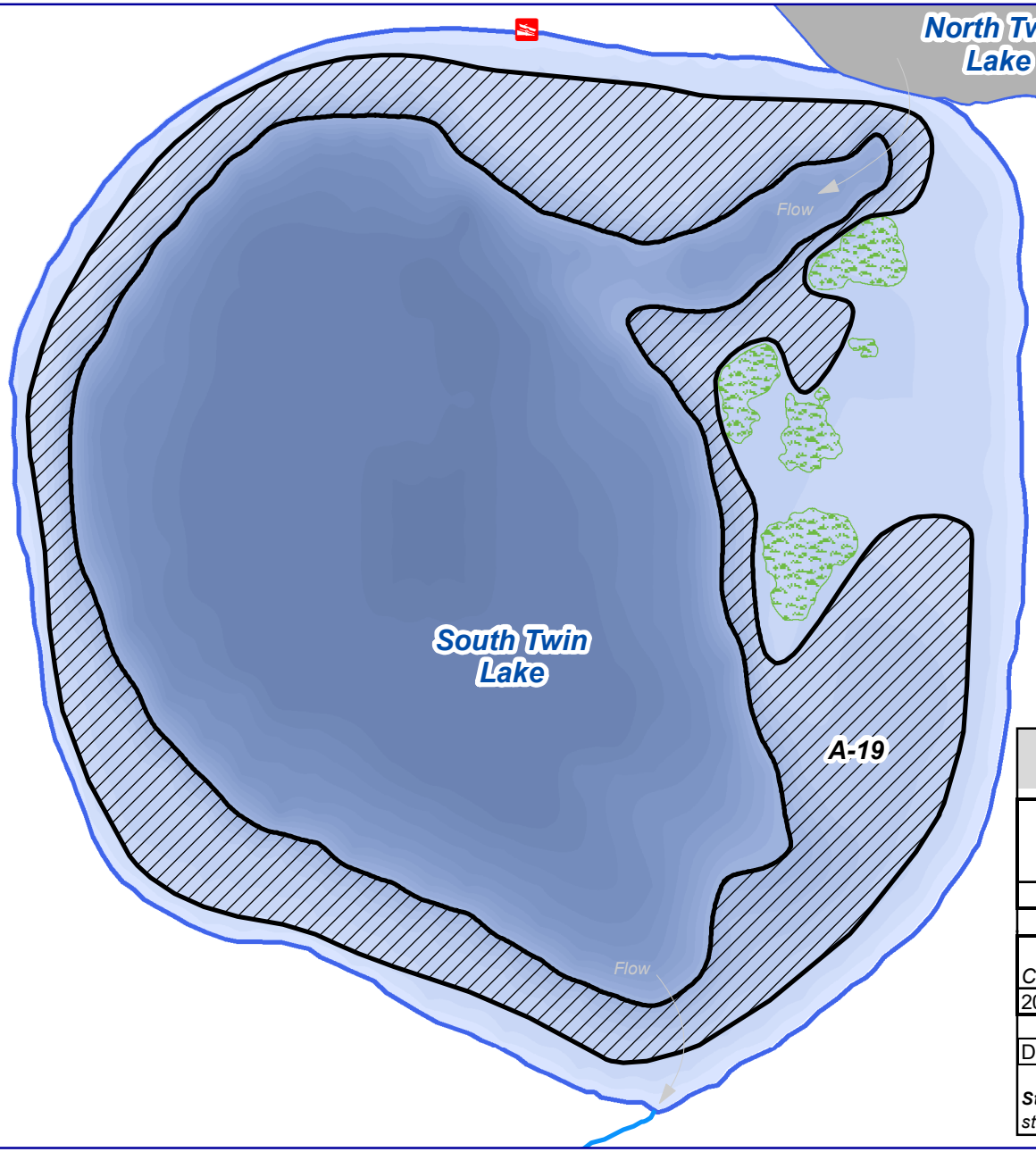
NSTLPRD Management Goals and Strategies

The WDNR-approved *North and South Twin Lakes Comprehensive Management Plan* (June 2018) is a living document that is under constant review and adjustment depending on the condition of the lake, the availability of funds, level of volunteer involvement, and the needs of the stakeholders. The NSTLPRD would like to be on the front edge of Best Management Practices for controlling EWM. What constitutes a Best Management Practice (BMP) changes in time as science and adaptive management progresses through science. Table 4.0-1 lists the Management Goals from the Implementation Plan of the *Comprehensive Management Plan*.

Table 4.0-1. Twin Lakes Comprehensive Lake Management Plan Implementation Plan: Management Goals.
Management Goal 1- *Control Existing and Prevent Further Aquatic Invasive Species Infestations within the Twin Lakes*
Management Goal 2 – *Maintain Current Water Quality Conditions*
Management Goal 3 *–Increase NSTLRA's Capacity to Communicate with Lake Stakeholders and Facilitate Partnerships with Other Management Entities*

Based on the experience and knowledge gained in managing EWM in North and South Twin Lake, the NSTLPRD has created updated objectives and strategies that relate to the management goals listed above. Appendix D includes materials authored by the NLSTLPRD that includes conclusions reached in relation to recent management actions and phased activities that work towards meeting future objectives, goals and strategies in managing the Twin Lakes.

The District seeks to develop an EWM management matrix to guide active control activities based on the results of the mapping surveys in order to meet specific goals of the District. The table included in Appendix D reflects the working matrix that has been developed by the District for EWM management in North Twin Lake. The table identifies what IPM strategies would be used specific to North Twin Lake based on the size and density of the EWM population. Some adaptation of this table may be integrated into future aquatic plant management strategies in North Twin Lake.



2019 EWM Management Strategy
Pelletized Fluridone

Site	Acres	Ave. Depth (feet)	Volume (ac-ft)	Applicaiton Area Dose ppb
A-19	178.8	8.1	1448.3	20.50

Calculation Method	*Area (acres)*	*Whole-Lake Volume*	*Dosing Volume*	*Epilimnetic Fluridone (ppb)*
2015 PI Bathy	633	12,271	7,176	4.08

Dosing Depth (ft):	16	*Target (ppb):*	4.00

***Strategy**: Achieve and maintain 1.75 - 3.5 ppb for 2019 open water season following spring stratification. 2 bumps of 2 ppb each are anticipated.*

N W E S

950
Feet

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

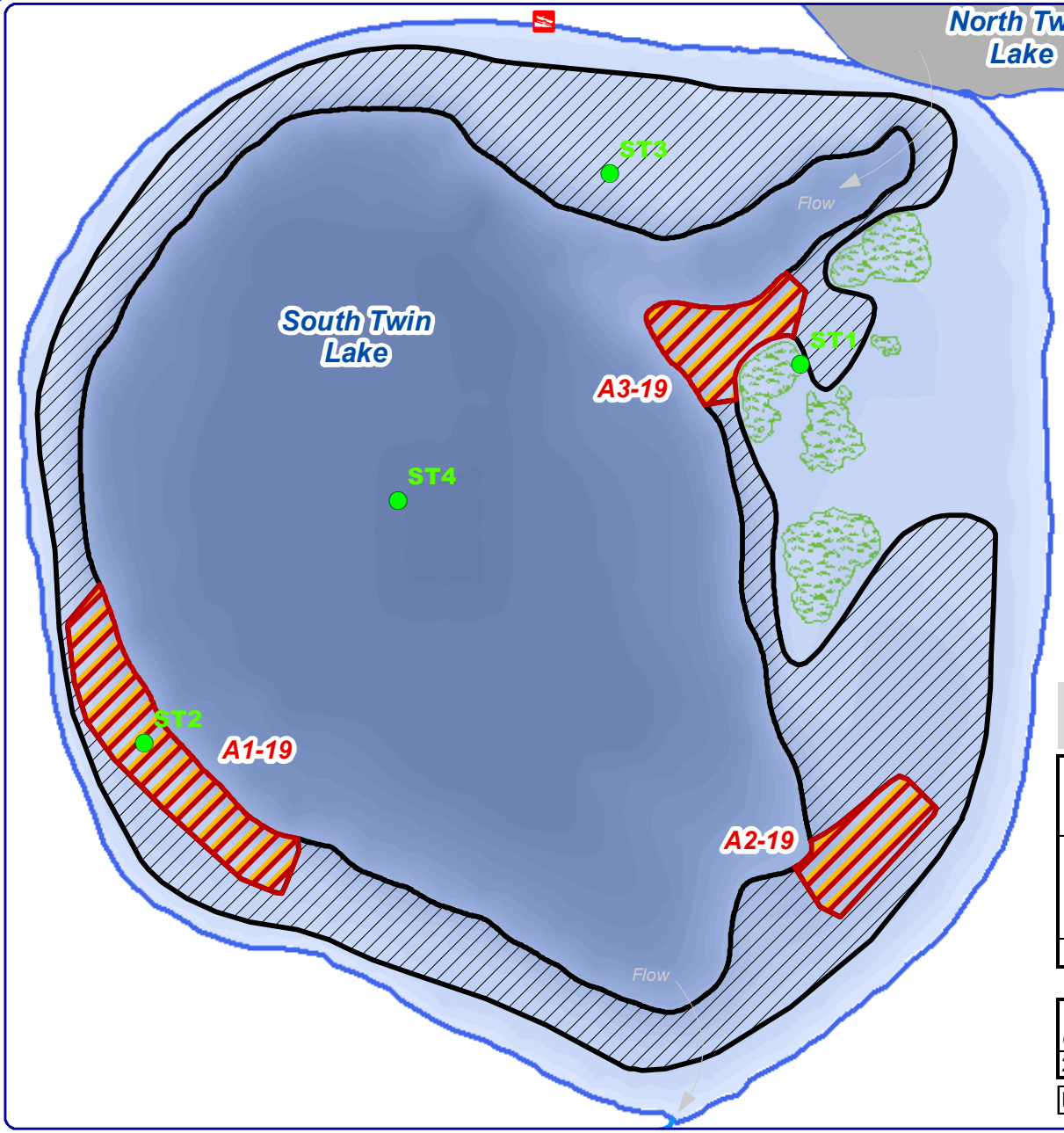
Sources:
Roads & Hydro: WDNR
Bathymetry: Onterra, 2015
EWM Survey: Onterra, 2018
Map date: June 7, 2019 - TWH

Project Location in Wisconsin

Legend

Herbicide Application Area

Map 1
South Twin Lake
Vilas County, Wisconsin
2019 Final EWM Management Strategy



2019 EWM Management Strategy
Pelletized Fluridone - Bump 2

Site	Acres	Ave. Depth (feet)	Volume (ac-ft)	Applicaiton Area Dose ppb	SonarOne lbs
A-19	151.8	8.1	1229.6	17	1129
A1-19	13.7	8.1	111.0	30	180
A2-19	6.4	8.1	51.8	30	84
A3-19	6.9	8.1	55.9	30	91
Total	**178.8**		**1448.3**		**1484**

Calculation Method	*Area (acres)*	*Whole-Lake Volume*	*Dosing Volume*	*Epilimnetic Fluridone*
2015 PI Bathy	633	12,271	9,107	3.02

Dosing Depth (ft):	22	*Target (ppb):*	3.00

N W E S

920
Feet

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

Sources:
Roads & Hydro: WDNR
Bathymetry: Onterra, 2015
EWM Survey: Onterra, 2018
Map date: September 3, 2019 - EJH

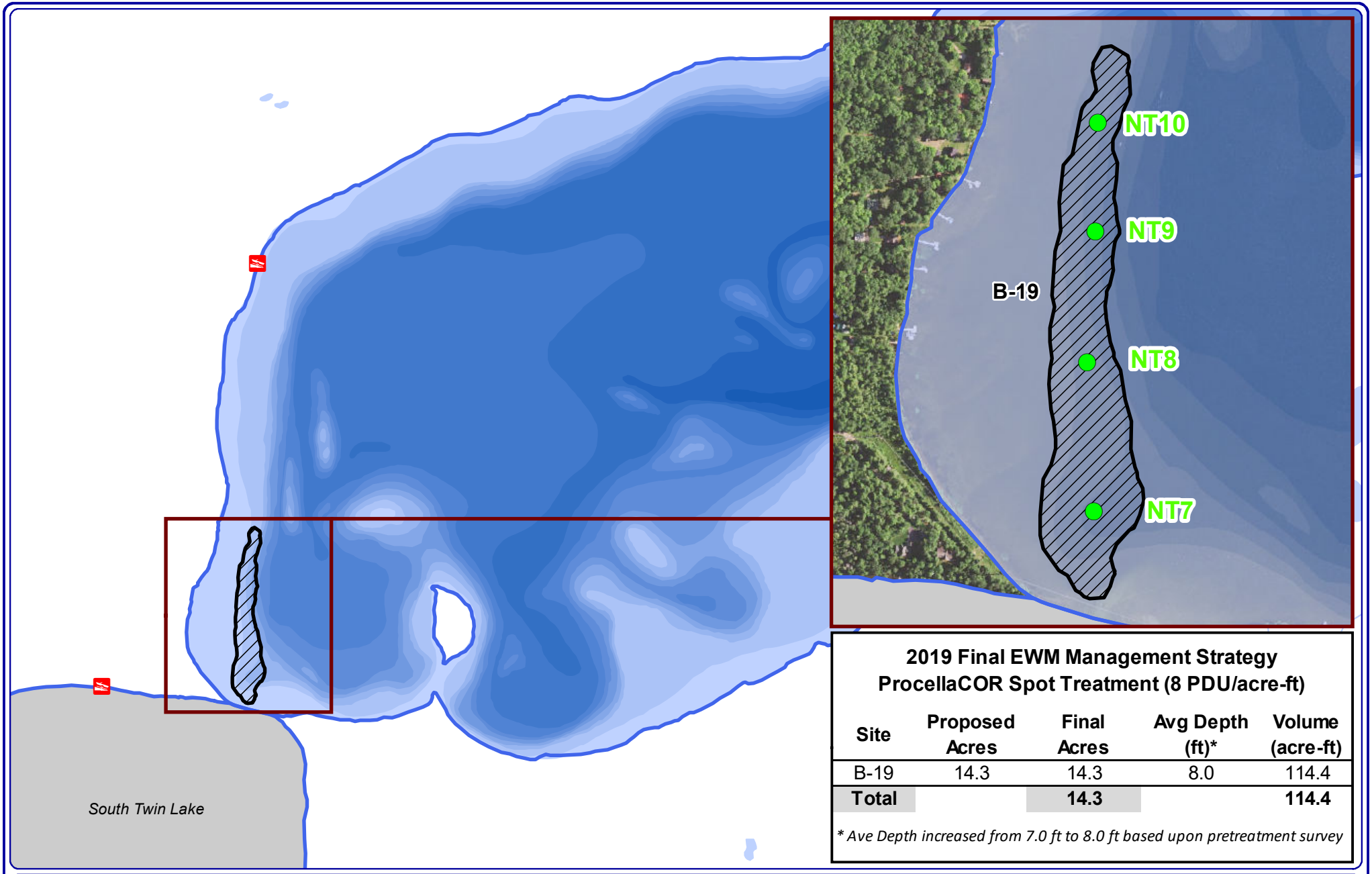
Project Location in Wisconsin

Legend

- Herbicide Application Area
- Increased Rate Herbicide Application Area
- 2019 Herbicide Monitoring Location

Map 2
South Twin Lake
Vilas County, Wisconsin

2019 Bump #2 Treatment Strategy



2019 Final EWM Management Strategy
ProcellaCOR Spot Treatment (8 PDU/acre-ft)

Site	Proposed Acres	Final Acres	Avg Depth (ft)*	Volume (acre-ft)
B-19	14.3	14.3	8.0	114.4
Total		**14.3**		**114.4**

** Ave Depth increased from 7.0 ft to 8.0 ft based upon pretreatment survey*

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2,000
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
Orthophotograph: NAIP, 2017
Aquatic Plants: Onterra, 2019
Map Date: May 24, 2019


Project Location in Wisconsin

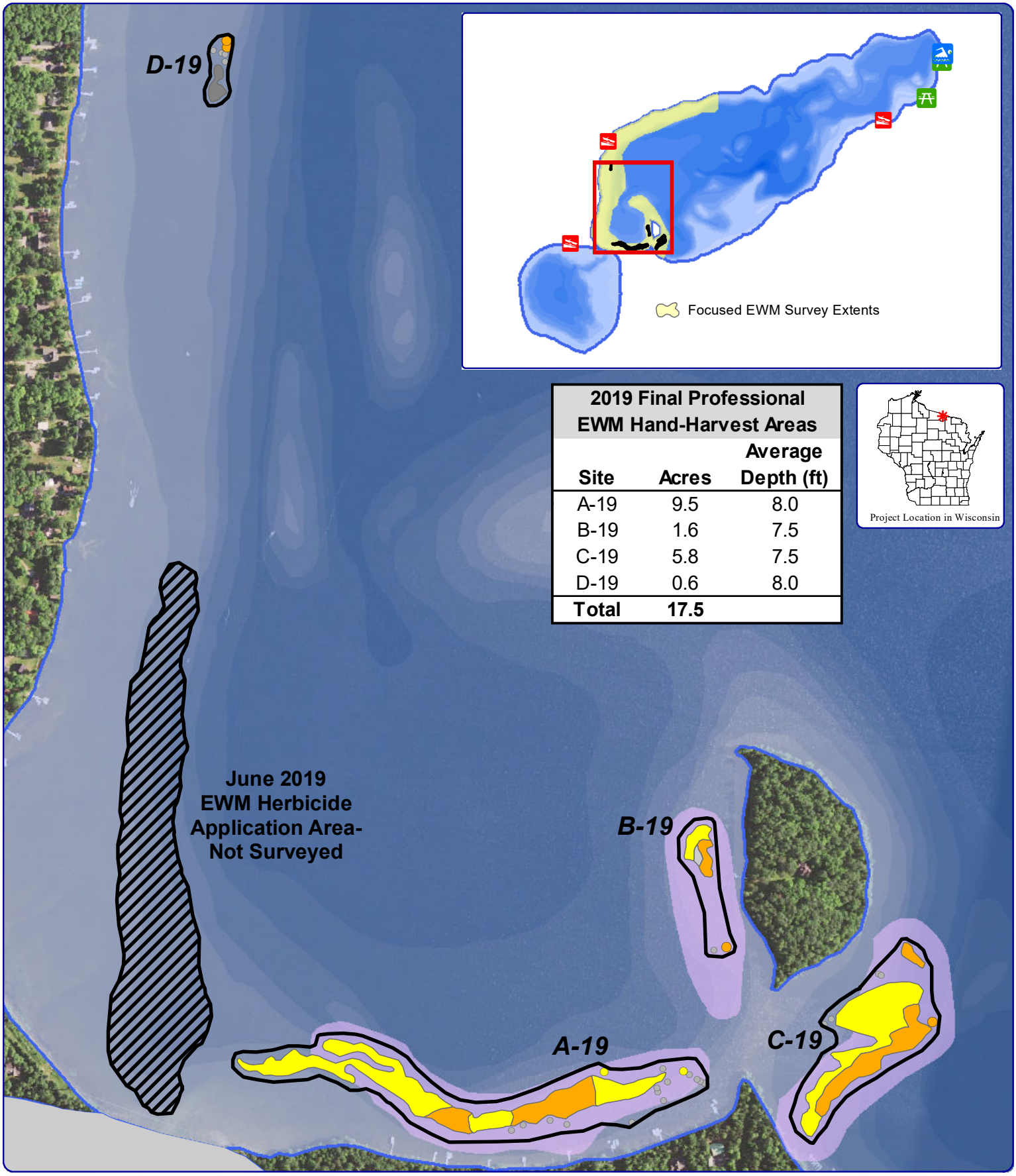
Legend

2019 Herbicide Monitoring Location

Final Herbicide Application Area

Map 3
North Twin Lake
Vilas County, Wisconsin

2019 Final EWM Treatment Strategy



2019 Final Professional EWM Hand-Harvest Areas		
Site	Acres	Average Depth (ft)
A-19	9.5	8.0
B-19	1.6	7.5
C-19	5.8	7.5
D-19	0.6	8.0
Total	**17.5**	

Project Location in Wisconsin

N
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540
Feet

Onterra LLC
Lake Management Planning
135 South Broadway Suite C
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Orthophotograph: NAIP, 2017
Aquatic Plants: Onterra, 2019
Map Date: June 21, 2019

Legend

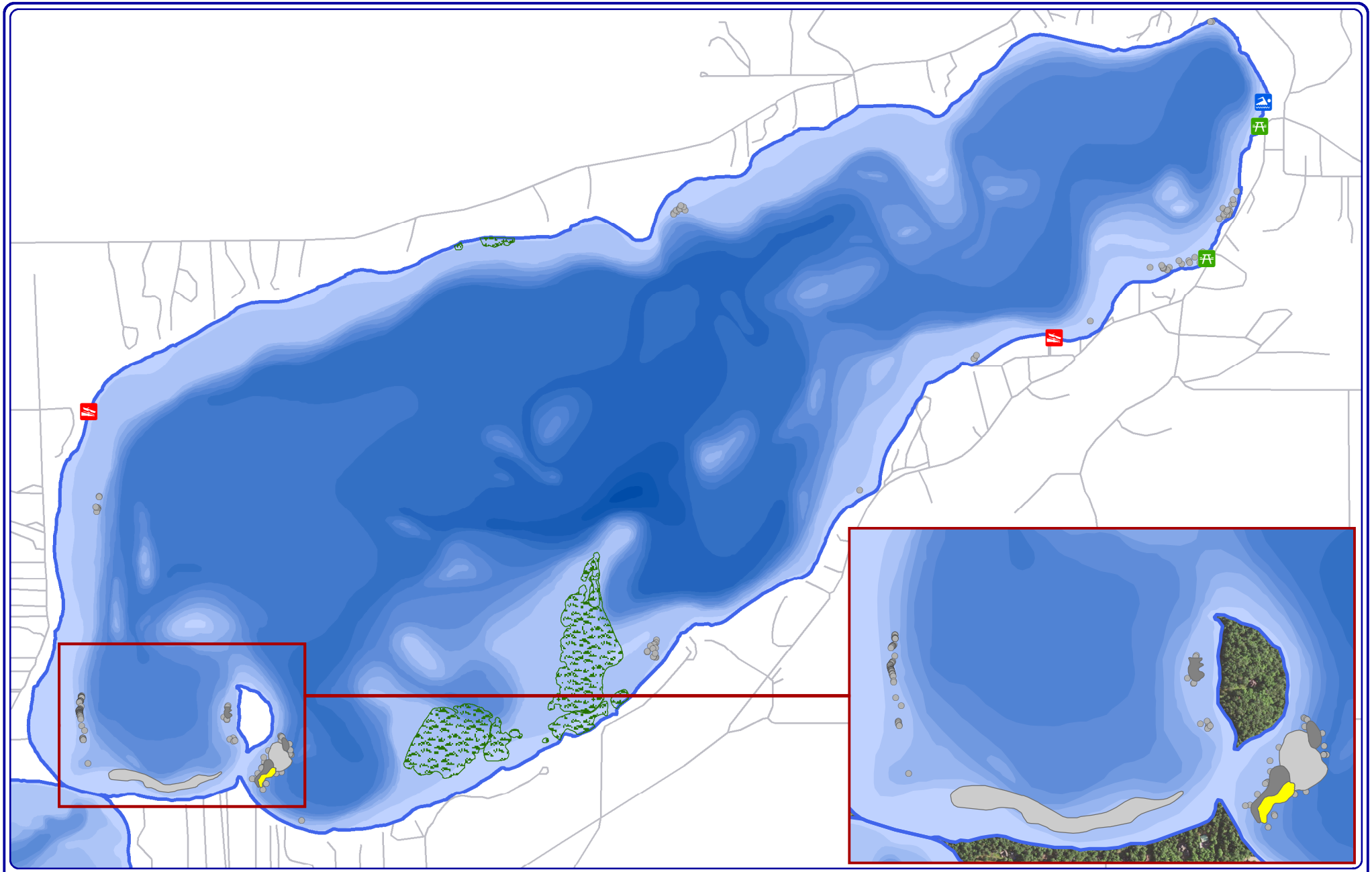
Eurasian Watermilfoil (June 20, 2019)
- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony

2019 Final DASH Hand-Harvest Area

2017 Herbicide Application Area

Map 4
North Twin Lake
Vilas County, Wisconsin

June 2019 EWM Locations



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2,000
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
Orthophotograph: NAIP, 2015
Aquatic Plants: Onterra, 2019
Map Date: September 23, 2019 JMB
Filename: NTwin_EWMPB_Sept19.mxd

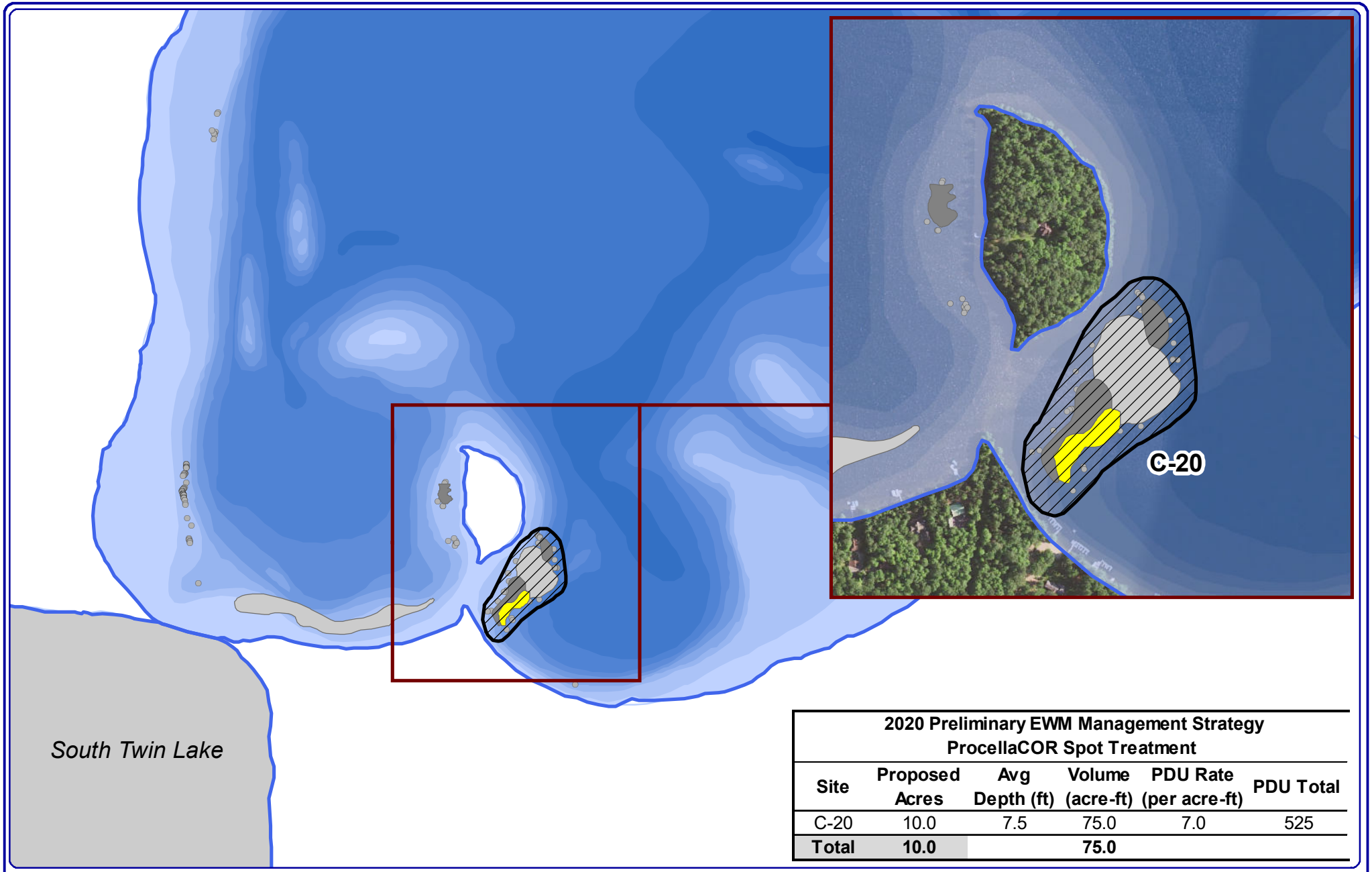
Project Location in Wisconsin

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant *(None)*
- Surface Matting *(None)*
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- Bullrush Community *(Summer 2016)*

Map 5
North Twin Lake
Vilas County, Wisconsin

September 2019 EWM Survey Results



2020 Preliminary EWM Management Strategy
ProcellaCOR Spot Treatment

Site	Proposed Acres	Avg Depth (ft)	Volume (acre-ft)	PDU Rate (per acre-ft)	PDU Total
C-20	10.0	7.5	75.0	7.0	525
Total	**10.0**		**75.0**		

N
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1,200
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
Orthophotograph: NAIP, 2017
Aquatic Plants: Onterra, 2019
Map Date: November 15, 2019 TWH

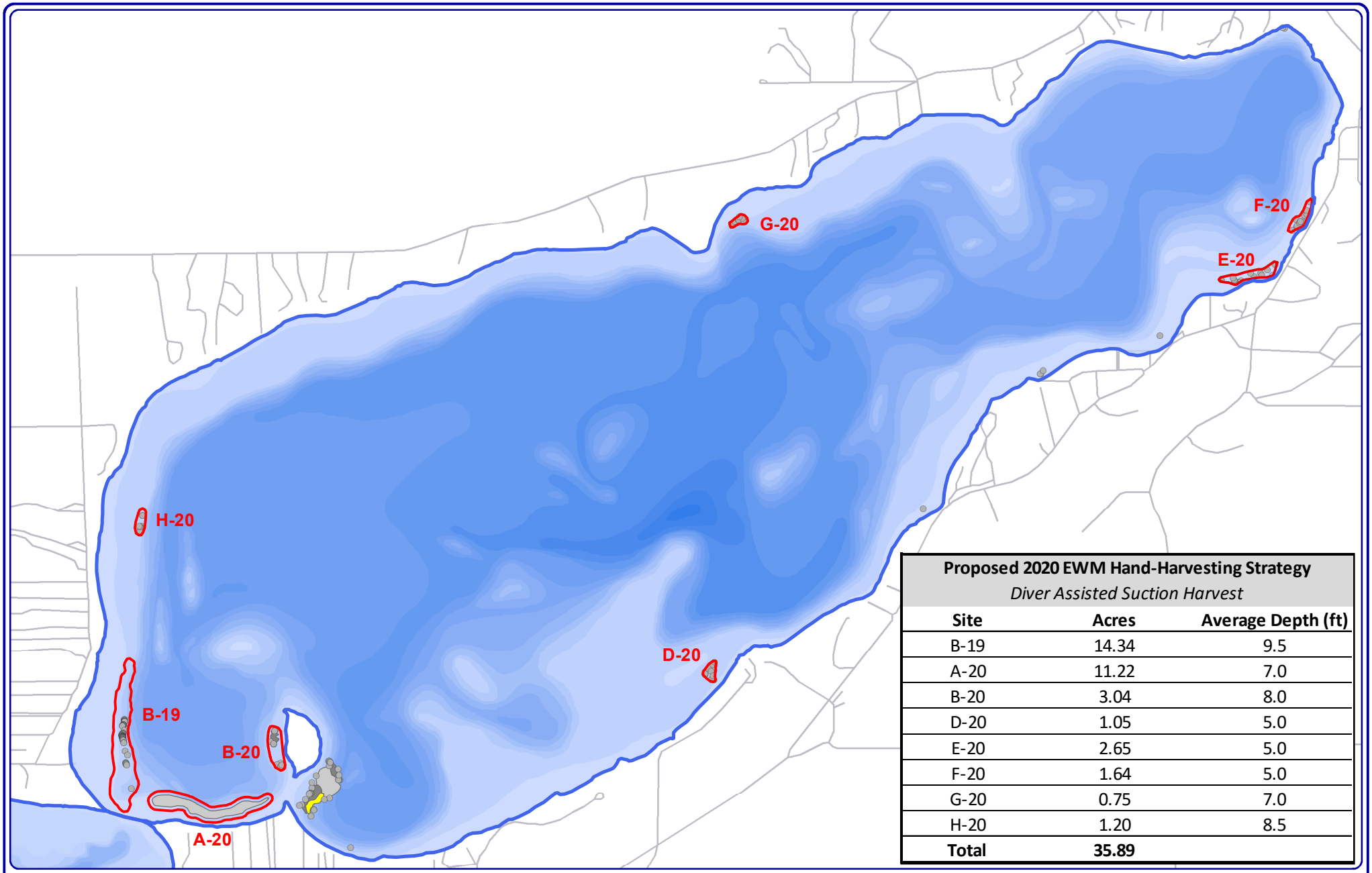

Project Location in Wisconsin

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant *(None)*
- Surface Matting *(None)*
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- Preliminary Herbicide Application Area

Map 6
North Twin Lake
Vilas County, Wisconsin

2020 Preliminary EWM Treatment Strategy



Proposed 2020 EWM Hand-Harvesting Strategy *Diver Assisted Suction Harvest*		
Site	**Acres**	**Average Depth (ft)**
B-19	14.34	9.5
A-20	11.22	7.0
B-20	3.04	8.0
D-20	1.05	5.0
E-20	2.65	5.0
F-20	1.64	5.0
G-20	0.75	7.0
H-20	1.20	8.5
Total	**35.89**	

N W E S

2,000 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: Onterra
Aquatic Plants: Onterra, 2019
Orthophtography: NAIP, 2017
Map Date: January 8, 2020 AMS
Filename:NTwin_2020_HH_Prelim.mxd


Project Location in Wisconsin

Legend
September 2019 EWM Survey Results

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- Proposed 2020 Hand-Harvest Work Area

Map 7
North Twin Lake
Vilas County, Wisconsin

Proposed 2020 Hand-Harvesting Strategy

A

APPENDIX A

North Twin Herbicide Concentration Monitoring

- **Sample Plan**
- **Results**

North Twin Lake, Vilas County (WBIC: 1623800)
Herbicide Sample Plan, 2019
Onterra, LLC

North Twin Lake, Vilas County is an approximately 2,871-acre drainage lake and has a mean depth of 28 feet and a maximum depth of 60 feet. Florpyrauxifen-benzyl (commercially as ProcellaCor) is proposed to be applied to 14.3 acres of the lake in spring 2019 to control Eurasian watermilfoil milfoil. Herbicide concentration sampling will be conducted in order to monitor the herbicide concentrations in the hours following the application.

Water samples will need to be collected at the sites and depths listed below. Data are in decimal degrees and the datum is WGS84. A map of the herbicide sample site locations is attached.

North Twin Lake Herbicide Sample Sites				
Site	**Station ID**	**Latitude**	**Longitude**	**Sample Depth**
NT7	10052463	46.039254	-89.163033	Integrated (0-6 feet)
NT8	10052464	46.041017	-89.163126	Integrated (0-6 feet)
NT9	10052465	46.042563	-89.162958	Integrated (0-6 feet)
NT10	10052466	46.043849	-89.162895	Integrated (0-6 feet)

Samples will need to be collected at different time intervals (Hours After Treatment – HAT throughout the project and are listed below. If a sample cannot be collected at the interval listed below, please collect the sample as soon as reasonably possible and record the change.

Interval (HAT)	NT7	NT8	NT9	NT10
1 HAT	X	X	X	X
3 HAT	X	X	X	X
6 HAT	X	X	X	X
12 HAT	X	X	X	X
24 HAT	X	X	X	X
48 HAT	X	X	X	X

X = sample to be collected (24 total samples)
HAT = Hours After Treatment

All water samples will be collected using an integrated sampler (Photo 1). A video tutorial demonstrating the proper use of an integrated sampler device is available on Onterra's YouTube web page.

It is important to rinse the integrated sampler 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). The clear glass bottle should be triple rinsed with the water from the custom mixing bottle. After the clear glass bottle is triple rinsed, it is to be carefully poured into the brown glass bottle which has a preservative solution already inside (Photo 3). The sticker on the brown glass bottle must be appropriately labeled with the site ID and time interval for which the sample was collected (Example: NT7, 1 HAT). The final sample (in the brown bottle) as well as the emptied clear glass bottle should be carefully placed within the provided 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. Samples should be kept refrigerated until shipping.

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 GPS units, temperature probes, 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 datasheets will be provided.

It is important to use a separate data sheet for each day that is monitored. Fill out one *Chain of Custody* data sheet for each sample interval and fill in the highlighted fields including the following:

Sampler: (Volunteer Name)
Number of samples to be analyzed: (number of samples being sent in with the form)
Client Sample ID: (example: NT7, NT8, etc)
Date sample collected
Shipped by: (name and date/time samples were shipped)

The North and South Twin Lakes P & R District will need to set-up a payment method with the SePro Accounting Department for billing purposes. The group can establish a secure card on file with SePro by contacting the SePro Accounting Department at (317)-580-8291. The samples should be shipped by overnight currier (FEDEX preferred) along with the *Chain of Custody* data sheets to the SePRO Research & Technology Campus. Samples should not be shipped on loose ice. Ice packs or frozen water bottles (contained in a zip bag) may be shipped with the samples to keep them cool. See the attached document *Sample Collection Procedures for FasTEST* for additional shipping considerations from SePro. Note that samples should not be shipped on a Friday, but rather refrigerated and shipped on the following Monday.

If you have any questions, please call or email one of the contacts listed below.

Project specifics, logistics and sampling methods	
Todd Hanke **Onterra, LLC** **thanke@onterra-eco.com** **Cell Phone (920) 360-7233** **Office Phone (920) 338-8860**	**Eddie Heath** **Onterra, LLC** **eheath@onterra-eco.com** **Cell Phone (920) 360-1851** **Office Phone (920) 338-8860**
WDNR Support	
Michelle Nault **WI DNR** **Michelle.Nault@wisconsin.gov** **Office (608) 513-4587**	
SePro	
Michael Hiatt **SePro Aquatic Specialist** **michaelh@sepro.com**	**SePro Research & Technology Campus** **srtclab@sepro.com** **(252) 437-3282**

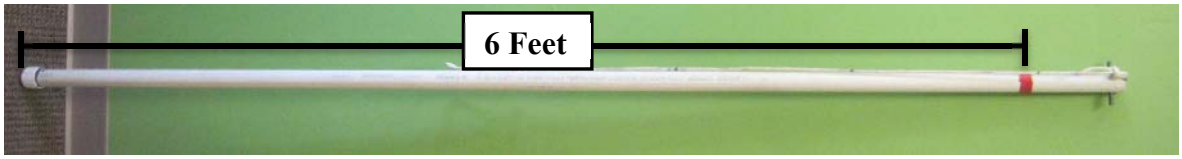
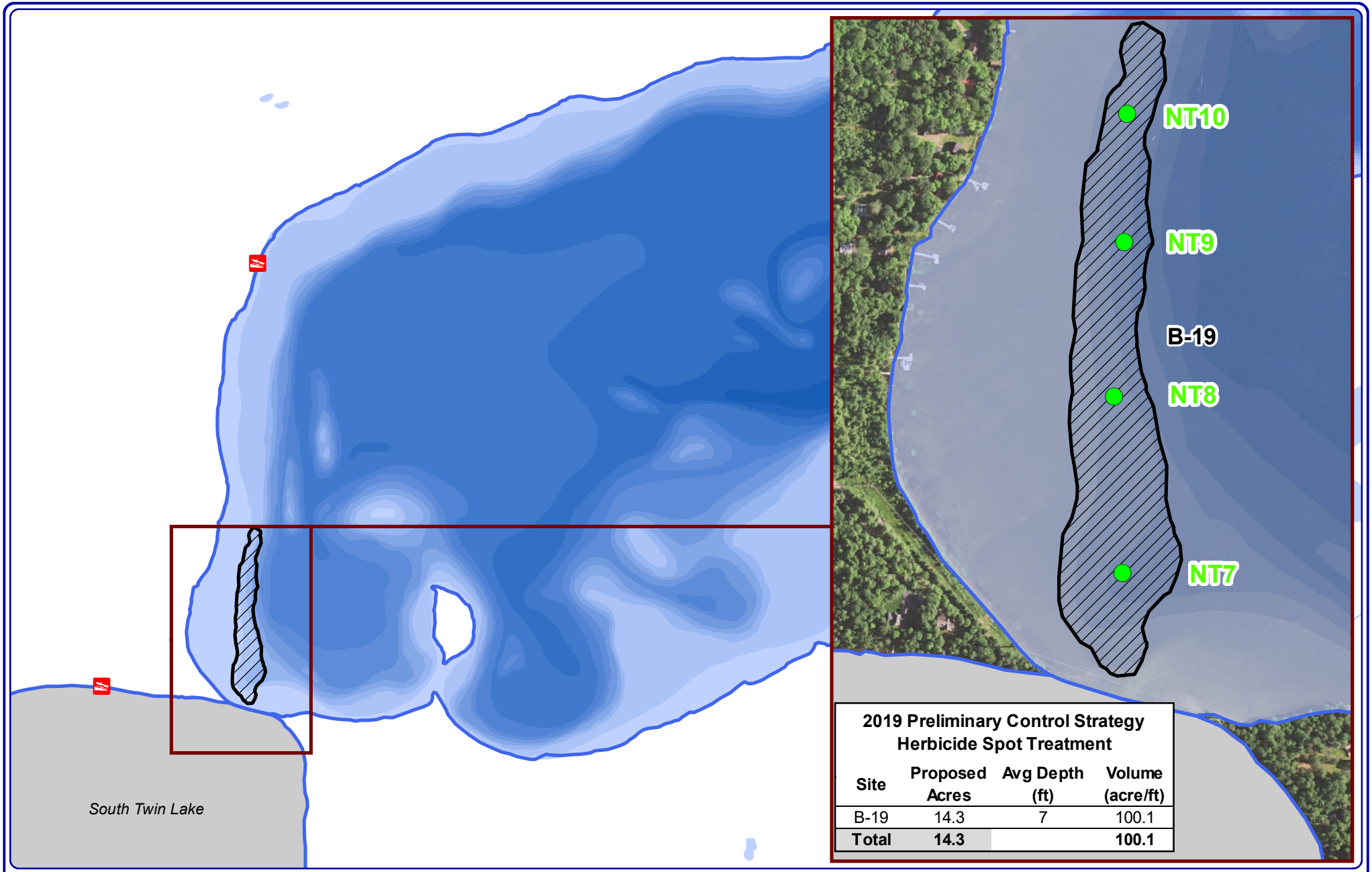


Photo 1. Integrated sampling device.

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.



2019 Preliminary Control Strategy
Herbicide Spot Treatment

Site	Proposed Acres	Avg Depth (ft)	Volume (acre/ft)
B-19	14.3	7	100.1
Total	**14.3**		**100.1**

N W E S

2,000
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
Orthophotograph: NAIP, 2017
Aquatic Plants: Onterra, 2018
Map Date: April 23, 2019

Project Location in Wisconsin

Legend

- 2019 Herbicide Monitoring Location
- Preliminary Herbicide Application Area

DRAFT MAP

North Twin Lake
Vilas County, Wisconsin

2019 Preliminary EWM Treatment Strategy

SRTC

SePRO Research & Technology Campus

SePRO

FasTEST® Monitoring

Chain of Custody

Company Name:* Onterra, LLC

Contact Person:* Eddie Heath

Billing Address:* 815 Prosper Road

Telephone:* 920-338-8860

E-mail Address:* eheath@onterra-eco.com

*Required fields

Project/Reference Name: North Twin Lake 2019 Herbicide Concentration Monitoring

SePRO Aquatic Specialist Name: Michael Hiatt

Sampler: _____

Number of samples to be analyzed: _____

Will water from treatment site be used for irrigation or potable purposes? If so, please describe: _____

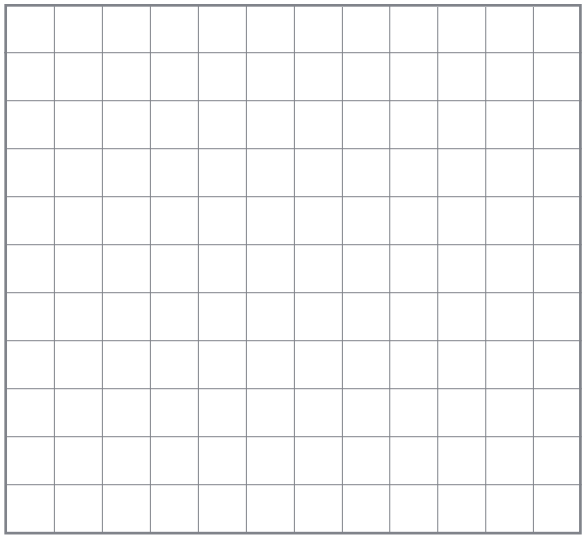
Check Payment Method: ☐ PO Number_____ ☐ VISA ☐ MasterCard Card No._____ CCV Code:_____ Expiration Date: _____

☐ **Check here if you would like us to keep this credit card information on file for future lab analysis orders.**

(To establish a secure credit card file for future billing, please contact the SePRO Accounting Department at 317-580-8291).

Draw a map of water body or enclose a copy of a prepared map identifying the following:

- **Sample locations by Sample Numbers as listed on the *other side of this form*.**
- **Treatment area, if not the whole lake.**
- **Irrigation or potable water intake locations**



Field Notes:

Direct all inquiries about your sampling and FasTEST results to your SePRO Technical Specialist.

Ship samples to:
SePRO SRTC
16013 Watson Seed Farm Road
Whitakers, NC 27891-9114
E-mail: srtclab@sepro.com
Tel: (252) 437-3282

 Revision Date: 03/11/2019 Effective Date: 03/11/2019 QAQC_F040_FasTEST COC_03112019

SRTC

SePRO Research & Technology Campus

SePRO

FasTEST® Monitoring

Chain of Custody

Water Body Name: North Twin Lake Water Body Size (acres): 2,871 State: Wisconsin

Depth Average and Depth Collected (feet): _____ Target Plant Species: Eurasian watermilfoil

Formulations Applied (Place an "X" in the boxes of analysis desired)

One form for each water body and formulation

Sonar® (fluridone) A.S. ☐ PR ☐ Q ☐ SRP ☐ One ☐ Genesis ☐	Renovate® (triclopyr) 3 ☐ OTF ☐	Renovate® MAX G (triclopyr & 2,4-d) ☐	Sculpin® G (2,4-d) ☐			
Galleon® (penoxsulam) ☐	Nautique® (copper) ☐	Komeen® (copper) ☐	SeClear (copper) ☐	K-Tea® (copper) ☐	Captain® (copper) ☐	Captain® XTR (copper) ☐
Habitat® (imazapyr) ☐	Clearcast® (imazamox) ☐	Oasis® (topramezone) ☐	Stingray® (carfentrazone-ethyl & chloropropionic acid†) ☐	ProcellaCOR® ■		

Client Sample Site I.D. (Required field)	Date(s) Treated	Date Sample Collected (Required field)	Application Rate(s)	Treated Area (In Acres)	Sample Location – Identify sites on map (GPS coordinates preferred)	Lab Use Only - Notes
1. NT 1						
2. NT2						
3. NT3						
4. NT4						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						

FasTEST results will be reported 48 hours from receipt of samples by laboratory. Inaccurate or incomplete information on this form may delay analysis and reporting. †This laboratory is not accredited for these tests: Stingray.

Shipped by: _____ Date/Time: _____

To be filled out by laboratory

Received by: _____ Date/Time: _____

 Revision Date: 03/11/2019 Effective Date: 03/11/2019 QAQC_F040_FasTEST COC_03112019

SePRO Research & Technology Campus

Sampling Collection Procedures for FasTEST®

FasTEST provides rapid and accurate analysis of aquatic herbicide concentrations in water. FasTEST assay services are available for monitoring the following SePRO aquatic products: Sonar®, Renovate® 3, Renovate® OTF, Renovate® MAX G, Galleon® SC, Sculpin® G, Captain®, K-Tea®, SeClear, Komeen®, Nautique*, Clearcast®, Habitat®, Oasis®, ProcellaCOR®, and Stingray®. It is extremely important to maintain a contamination free environment during water sample collection. **Do not** collect water samples from a boat that was used to apply the SePRO aquatic product you are monitoring. All equipment and clothes used during sampling should be completely free of the aquatic herbicide.

Follow these collection steps in sequence:

1. **Complete FasTEST Chain of Custody (COC) and enclose with sample(s). This is included with sampling bottles, or may be downloaded from the SePRO web site. Appropriate billing information MUST be completed before analysis.**
2. Draw a map, or attach a map, of the water body and location of each water collection on accompanying Chain of Custody. Number each sample location and transfer to page one of the Chain of Custody.
3. Complete accompanying sample water bottle labels and affix labels to sample bottles. Number each sample water bottle with corresponding sample location number from COC form. Include date and name of water body on label.
4. At the collection site, remove the bottle cap from the designated bottle, triple rinse the bottle with water from this site and submerge the bottle upside down until elbow deep. Should your program require sampling at depth, utilize the proper device to collect water from the target depth or depths.
5. Turn the bottle upright and allow filling as you slowly bring the bottle toward the surface.
6. When the bottle is full, yet still underwater at the targeted collection depth; screw the cap back on the bottle. It is recommended to secure cap with tape to prevent the cap loosening during shipment.
7. Place the sample bottle(s) in a cooler and close the lid to prevent exposure to sunlight.
8. Refrigerate samples if they will not be shipped within 24-hours of collection to keep samples cool until shipment. **Do not ship samples collected on a Friday**, refrigerate and ship Monday.
9. **Do not** ship samples in loose ice.
10. We request that samples are overnighted and ice packs are used when outdoor temperatures reach 90 plus degrees. **Shipping via FedEx is recommended.** Note: shipments by U.S. mail typically require additional time in transit to the SRTC.
11. Ship samples to: **SePRO Research & Technology Campus**
    16013 Watson Seed Farm Road
    Whitakers, NC 27891-9114
    E-mail: srtclab@sepro.com
    Tel: (252) 437-3282
12. If you have questions pertaining to sample collection, please contact your SePRO Aquatic Specialist. If you need to order FasTEST sample bottles, please contact the SRTC at **(252) 437-3282** or by e-mail, **srtclab@sepro.com**. COC forms are available on our web site **www.sepro.com/lab**.

FAQs

Q. Why ship Chain of Custody (COC) in a plastic bag?

A. When the Chain of Custody is not protected from moisture, it may become wet and thus very difficult to read…if we can't read or salvage the COC, the sample cannot be analysed until we establish where the sample originated. This may result in later turnaround than our 48-hour policy for water analysis.

Q. Why ship overnight?

A. Shipping overnight ensures that your water sample is not left in an environment (such as the back of a delivery truck or warehouse) in which external factors may affect sample integrity.

Q. Why ship samples on ice?

A. We know that water samples maintain their integrity if kept on ice or in a cold environment; we do not know the same about samples that arrive warm or hot, this leaves the potential for skewed results.

Q. Why send water samples in an opaque Nalgene® bottle?

A. Many of the herbicides we test for are broken down by photolysis (absorption of light), so translucent bottles may promote additional breakdown before analysis is complete.

Q. Why send ProcellaCOR water samples in glass amber vial with PTFE lid?

A. ProcellaCOR has tendency to adhere to plastic, interfering with the analysis.

SePRO Research & Technology Campus

FasTEST*

16013 Watson Seed Farm Road, Whitakers, NC 27891

Chain of Custody: COC5323 **LABORATORY REPORT**

Customer Company **Customer Contact**

Company Name Onterra LLC	Contact Person: Eddie Heath
Address: 815 Prosper Rd, De Pere, Wi 54115	E-mail Address: eheath@onterra-eco.com
	Phone: 920.338.8860

Waterbody Information

Waterbody:	North Twin - WI
Waterbody size:	2788
Depth Average:	3

Sample ID	Sample Location	Test	Method	Results	Sampling Date / Time
CTM16215-1	NT7 1HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16216-1	NT8 1HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	1.4	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16217-1	NT9 1HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	4.1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16218-1	NT10 1HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	13.7	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16219-1	NT7 3HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16220-1	NT8 3HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16221-1	NT9 3HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16222-1	NT10 3HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	1.2	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16223-1	NT7 6HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	

CTM16224-1	NT8 6HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16225-1	NT9 6HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16226-1	NT10 6HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16227-1	NT7 12HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16228-1	NT8 12HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16229-1	NT9 12HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16230-1	NT10 12HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/17/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16231-1	NT7 24HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/18/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16232-1	NT8 24HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/18/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16233-1	NT9 24HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/18/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16234-1	NT10 24HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/18/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16235-1	NT7 48HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/19/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16236-1	NT8 48HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/19/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16237-1	NT9 48HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/19/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM16238-1	NT10 48HR	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	06/19/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	

ANALYSIS STATEMENTS:
SAMPLE RECEIPT /HOLDING TIMES: All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.
PRESERVATION: Samples requiring preservation were verified prior to sample analysis and any qualifiers will be noted
in the report.
QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.
COMMENTS: No significant observations were made unless noted in the report.
MEASUREMENT UNCERTAINTY: Uncertainty of measurement has been determined and is available upon request.

Laboratory Information
Date / Time Received: 06/21/19 11:00 AM
Date Results Sent: Wednesday, June 26, 2019

Disclaimer: The results listed within this Laboratory Report relate only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a dry weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the exclusive use of SRTC Laboratory and its client. This report shall not be reproduced, except in full, without written permission from SRTC Laboratory. The Chain of Custody is included and is an essential component of this report.

This entire report was reviewed and approved for release.

Reviewed By: Laboratory Supervisor

B

APPENDIX B

Sub-Sample Point-Intercept Survey Results & Chi-Square Analysis in Association with the 2019 florpyrauxifen-benzyl (ProcellaCOR) Treatment in North Twin Lake.

	Scientific Name	Common Name	LFOO (%)			Oct_2018-Sept_2019		Oct_2018-Oct_2019	
			Oct_2018	Sept_2019	Oct_2019	% Change	Direction	% Change	Direction
Dicots	*Myriophyllum spicatum*	Eurasian watermilfoil	57.1	10.5	6.7	-81.7	▼	-88.3	▼
	Ceratophyllum demersum	Coontail	47.6	35.2	31.4	-26.0	▽	-34.0	▼
	Ranunculus aquatilis	White water crowfoot	12.4	14.3	14.3	15.4	△	15.4	△
	Bidens beckii	Water marigold	0.0	8.6	10.5		▲		▲
	Myriophyllum sibiricum	Northern watermilfoil	21.9	0.0	0.0	-100.0	▼	-100.0	▼
	Myriophyllum alterniflorum	Alternate-flowered watermilfoil	8.6	1.9	0.0	-77.8	▼	-100.0	▼
	Ceratophyllum echinatum	Spiny hornwort	0.0	1.0	0.0		△		-
Non-dicots	*Vallisneria americana*	Wild celery	28.6	27.6	22.9	-3.3	▽	-20.0	▽
	Elodea canadensis	Common waterweed	22.9	20.0	16.2	-12.5	▽	-29.2	▽
	Potamogeton richardsonii	Clasping-leaf pondweed	11.4	18.1	17.1	58.3	△	50.0	△
	Heteranthera dubia	Water stargrass	5.7	13.3	13.3	133.3	△	133.3	△
	Potamogeton praelongus	White-stem pondweed	9.5	7.6	11.4	-20.0	▽	20.0	△
	Potamogeton zosteriformis	Flat-stem pondweed	5.7	19.0	6.7	233.3	▲	16.7	△
	Chara spp.	Muskgrasses	7.6	9.5	6.7	25.0	△	-12.5	▽
	Potamogeton berchtoldii	Slender pondweed	0.0	28.6	0.0		▲		-
	Potamogeton pusillus	Small pondweed	0.0	7.6	7.6		▲		▲
	Potamogeton gramineus	Variable-leaf pondweed	4.8	10.5	3.8	120.0	△	-20.0	▽
	Najas flexilis	Slender naiad	1.0	16.2	1.0	1600.0	▲	0.0	-
	Potamogeton friesii	Fries' pondweed	3.8	14.3	0.0	275.0	▲	-100.0	▼
	Najas guadalupensis	Southern naiad	0.0	12.4	0.0		▲		-
	Nitella spp.	Stoneworts	3.8	0.0	1.0	-100.0	▼	-75.0	▽
	Potamogeton amplifolius	Large-leaf pondweed	0.0	1.0	1.0		△		△
	Potamogeton robbinsii	Fern-leaf pondweed	0.0	0.0	1.0		-		△
	Potamogeton Richardsonii x P. praelongus	Clasping-leaf x White-stem pondweed hybrid	0.0	0.0	1.0		-		△
	Potamogeton strictifolius	Stiff pondweed	1.0	0.0	0.0	-100.0	▽	-100.0	▽
	Potamogeton illinoensis	Illinois pondweed	1.0	0.0	0.0	-100.0	▽	-100.0	▽
	Filamentous algae	Filamentous algae	1.0	0.0	0.0	-100.0	▽	-100.0	▽

▲ or ▼ = Change Statistically Valid (Chi-square; α = 0.05)
△ or ▽ = Change Not Statistically Valid (Chi-square; α = 0.05)

C

APPENDIX C

2019 EWM Hand-Harvesting Report – Aquatic Plant Management, LLC

North Twin Lake EWM Treatment Report 2019

PO Box 1134 Minocqua, WI 54548

North Twin Lake EWM Treatment Summary 2019

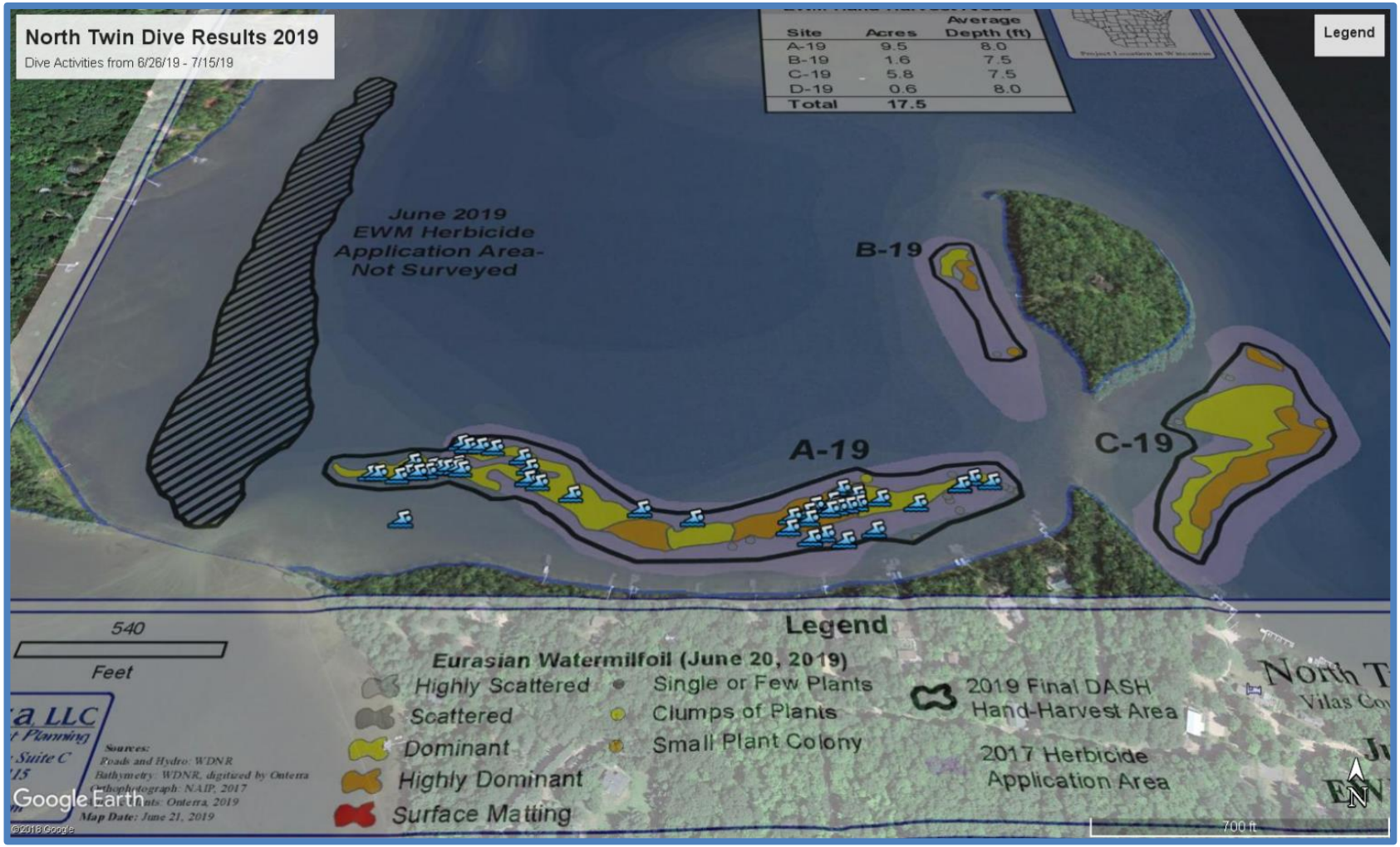
Summary: Over the course of three separate weeks from June 26th through July 15th, Aquatic Plant Management LLC (APM) conducted Diver Assisted Suction Harvesting (DASH) of Eurasian Watermilfoil (EWM) on North Twin Lake in Vilas County, WI. Utilizing GPS coordinates provided by Onterra LLC, the dive team initially focused their efforts on the dominant colony on the east end of site A-19. Starting on July 8th, the dive team also started diving on the west end of A-19 using a "pinch" approach. The EWM growth within the dominant area (yellow) on the east end of A-19 is characterized by somewhat scattered stands of multi-stemmed plants laying flat against the lakebed. The plants within this area were found to be in poor condition, with fragile stems, but exhibiting no signs of auto fragmentation or new growth. As the teams reached the highly dominant (orange) area within A-19, it was noted that the plants were in much better condition, growing vertically in the water column with a much higher tensile strength. The EWM in this location was also showing signs of new growth at the base of the plants. On the west side of A-19, the EWM growth was somewhat similar to the eastern terminus, but at a higher density, and with a higher frequency of single or few stemmed plants. The western terminus also comparatively contained a significantly higher amount of native plant growth. In total, the dive team was able to remove **853.5 cubic feet** of EWM from the lake.

Conditions:

- 6/26/19: Weather was partly cloudy with an air temperature of 75 degrees; water temperature was 71 degrees with an 12.0 foot clarity reading from the Secchi disk
- 6/27/19: Weather was cloudy with thunderstorms in the afternoon with an air temperature of 75 degrees; water temperature was 71 degrees with an 12.5 foot clarity reading from the Secchi disk
- 6/28/19: Weather was sunny with an air temperature of 81 degrees; water temperature was 71 degrees with an 12.0 foot clarity reading from the Secchi disk
- 7/8/19: Weather was sunny with an air temperature of 83 degrees; water temperature was 73 degrees with an 12.5 foot clarity reading from the Secchi disk
- 7/9/19: Weather was sunny with an air temperature of 81 degrees; water temperature was 73 degrees with an 12.0 foot clarity reading from the Secchi disk
- 7/10/19: Weather was partly cloudy with an air temperature of 81 degrees; water temperature was 73 degrees with an 12.5 foot clarity reading from the Secchi disk
- 7/11/19: Weather was sunny with an air temperature of 82 degrees; water temperature was 78 degrees with an 12.0 foot clarity reading from the Secchi disk
- 7/12/19: Weather was cloudy with thunderstorms in the afternoon with an air temperature of 77 degrees; water temperature was 71 degrees with an 13.5 foot clarity reading from the Secchi disk
- 7/15/19: Weather was partly cloudy with thunderstorms in the afternoon an air temperature of 75 degrees; water temperature was 78 degrees with an 10.0 foot clarity reading from the Secchi disk

Recommendations: Due to the condition of the EWM population intermixed native plants, particularly on the western end of A-19, DASH was challenging, but still an effective approach to reduce the overall EWM population. The North and South Twin Lake Protection and Rehabilitation Lake District should continue to closely monitor the EWM growth over the course of the summer in evaluate the effectiveness of the DASH activities.

Map of North Twin Lake Dive Sites



Detailed Diving Activities (1/3)

Date	Dive Location	Latitude	Longitude	Time Under-water	AIS CF Removed	AIS Density	Avg Water Depth	Native By-Catch (CF)	Native Species	Native Density	Substrate Type
6/26/19	A-19	46.03866	-89.15416	3.33	12.0	Medium	7	0.00	None	Low	Organic/Sand
6/26/19	A-19	46.03844	-89.15504	1.67	13.0	High	9	0.00	None	Medium	Organic/Sand
6/26/19	A-19	46.03849	-89.15545	1.83	20.5	High	9	1.00	Elodea	Medium	Sand
6/27/19	A-19	46.0387	-89.15437	1.75	15.0	Medium	10	1.00	Pondweeds	High	Sand
6/27/19	A 19	46.03863	-89.15451	1.17	8.0	Medium	8	<0.5	Pondweeds	Low	Sand
6/27/19	A-19	46.03863	-89.15451	1.33	10.5	Medium	8	<0.5	Pondweeds	Medium	Sand
6/27/19	A 19	46.03855	-89.15572	2.17	18.0	High	10	0.50	Pondweeds	Low	Sand
6/27/19	A-19	46.03853	-89.15572	3	46.0	High	10	0.00	None	Low	Sand
6/28/19	A-19	46.038078	-89.15589	2.67	23.5	High	9	1.00	Pondweeds	Medium	Sand
6/28/19	A-19	46.038139	-89.15611	2.75	15.0	High	8	0.50	Pondweeds	Medium	Sand
6/28/19	A-19	46.03818	-89.15555	3.17	29.0	High	8.5	0.00	None	Low	Sand
6/28/19	A-19	46.0381	-89.15626	2.75	21.0	High	9	<0.5	Elodea	Low	Sand
6/28/19	A-19	46.0382	-89.15649	1.42	22.0	High	9	0.00	None	Low	Sand
7/8/19	A-19	46.03875	-89.16126	3.58	40.5	High	11	6.50	Pondweeds	Medium	Organic/Sand
7/8/19	A-19	46.03876	-89.16084	1.75	31.0	High	12	1.00	Pondweeds	Medium	Sand
7/8/19	A-19	46.03902	-89.15989	1.25	20.0	High	11	0.00	None	Medium	Sand
7/8/19	A-19	46.03859	-89.15588	2.08	12.0	Medium	8.5	1.00	Chara	Medium	Organic/Sand
7/8/19	A-19	46.03844	-89.15571	1.42	33.0	High	8.5	<0.5	Pondweeds	Low	Organic/Sand
7/8/19	A-19	46.03842	-89.15582	0.92	12.0	High	8.5	<0.5	Pondweeds	Low	Organic/Sand
7/8/19	A-19	46.03847	-89.15600	0.92	12.0	High	8.5	<0.5	Pondweeds	Low	Organic/Sand
7/8/19	A-19	46.03842	-89.15596	1.5	24.0	High	8.5	<0.5	Pondweeds	Low	Organic/Sand
Total					**438.0**						

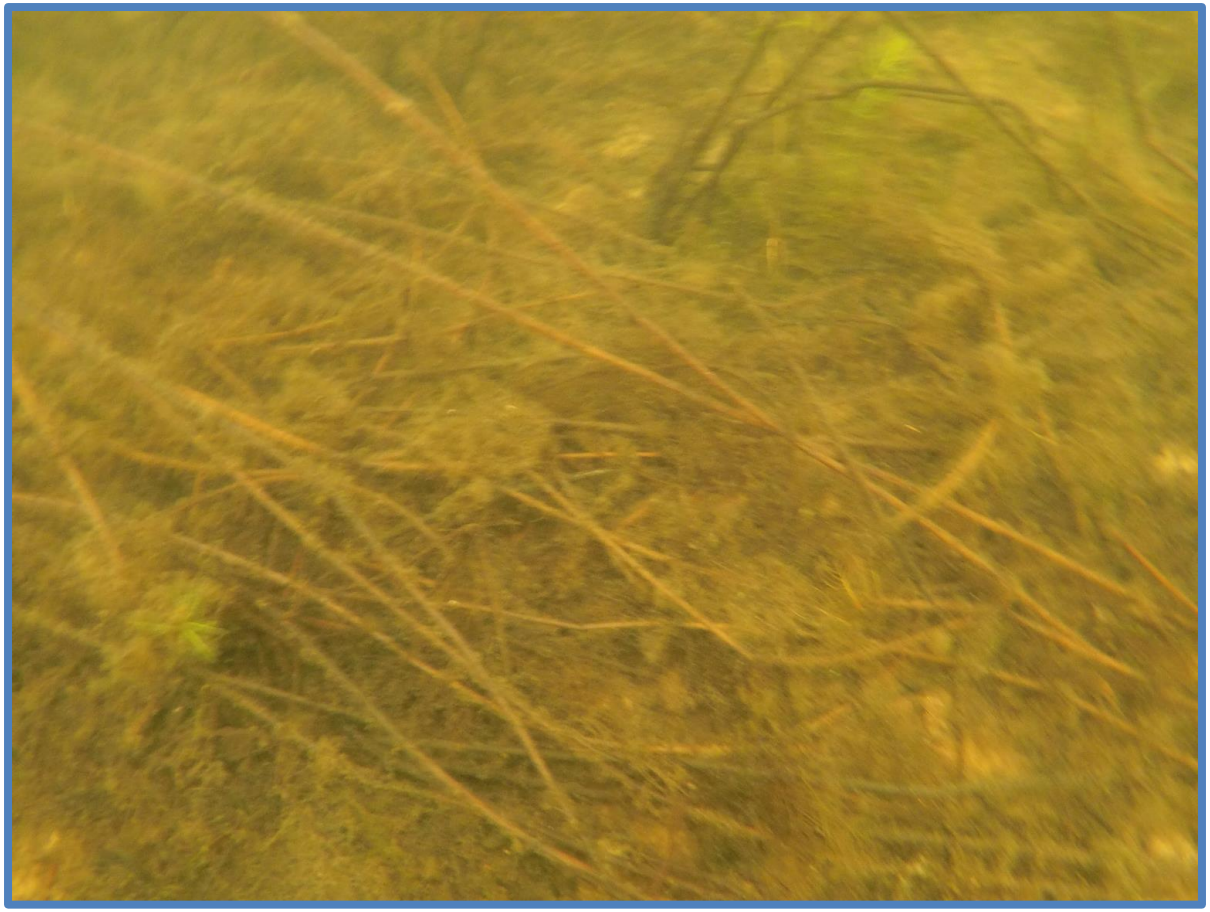
Detailed Diving Activities (2/3)

Date	Dive Location	Latitude	Longitude	Time Under-water	AIS CF Removed	AIS Density	Avg Water Depth	Native By-Catch (CF)	Native Species	Native Density	Substrate Type
7/9/19	A-19	46.03904	-89.16021	1.5	23.5	High	12	1.50	Pondweeds	Low	Organic/Sand
7/9/19	A-19	46.03904	-89.16021	2.08	16.0	High	13	1.50	Pondweeds	Medium	Sand
7/9/19	A-19	46.03904	-89.16006	1	20.0	High	10	<0.5	Elodea	Low	Sand
7/9/19	A-19	46.03907	-89.16029	1.75	10.0	Medium	9	0.00	None	Low	Sand
7/9/19	A-19	46.03875	-89.16118	0.83	13.5	Medium	7.5	1.00	Northern Milfoil	High	Sand
7/9/19	A-19	46.03872	-89.16094	0.5	10.0	Medium	7.5	1.50	Northern Milfoil	High	Sand
7/9/19	A-19	46.03887	-89.16081	1.58	15.0	Medium	7.5	1.00	Northern Milfoil	High	Sand
7/9/19	A-19	46.03887	-89.16081	0.75	15.5	Medium	7.5	1.00	Northern Milfoil	High	Sand
7/9/19	A-19	46.03877	-89.16062	1.33	10.0	Medium	7.5	0.50	Northern Milfoil	High	Sand
7/10/19	A-19	46.03842	-89.15620	2	25.0	High	11	0.50	Elodea	Low	Sand
7/10/19	A-19	46.03842	-89.15588	1	9.0	High	11.5	0.00	None	Low	Sand
7/10/19	A-19	46.03836	-89.15628	1.33	14.0	Medium	13.5	0.00	None	Low	Sand
7/10/19	A-19	46.03831	-89.15646	0.5	1.5	Medium	11	0.00	None	Low	Sand
7/10/19	A-19	46.03881	-89.16047	0.92	6.0	Low	8	<0.5	Pondweeds	High	Organic/Sand
7/10/19	A-19	46.0384	-89.15594	0.75	14.5	High	8	<0.5	Pondweeds	Low	Organic/Sand
7/10/19	A-19	46.03838	-89.15603	1.58	12.5	High	8	<0.5	Pondweeds	Low	Organic/Sand
7/10/19	A-19	46.03829	-89.15627	1.58	16.5	High	8	<0.5	Pondweeds	Low	Organic/Sand
Total					**232.5**						

Detailed Diving Activities (3/3)

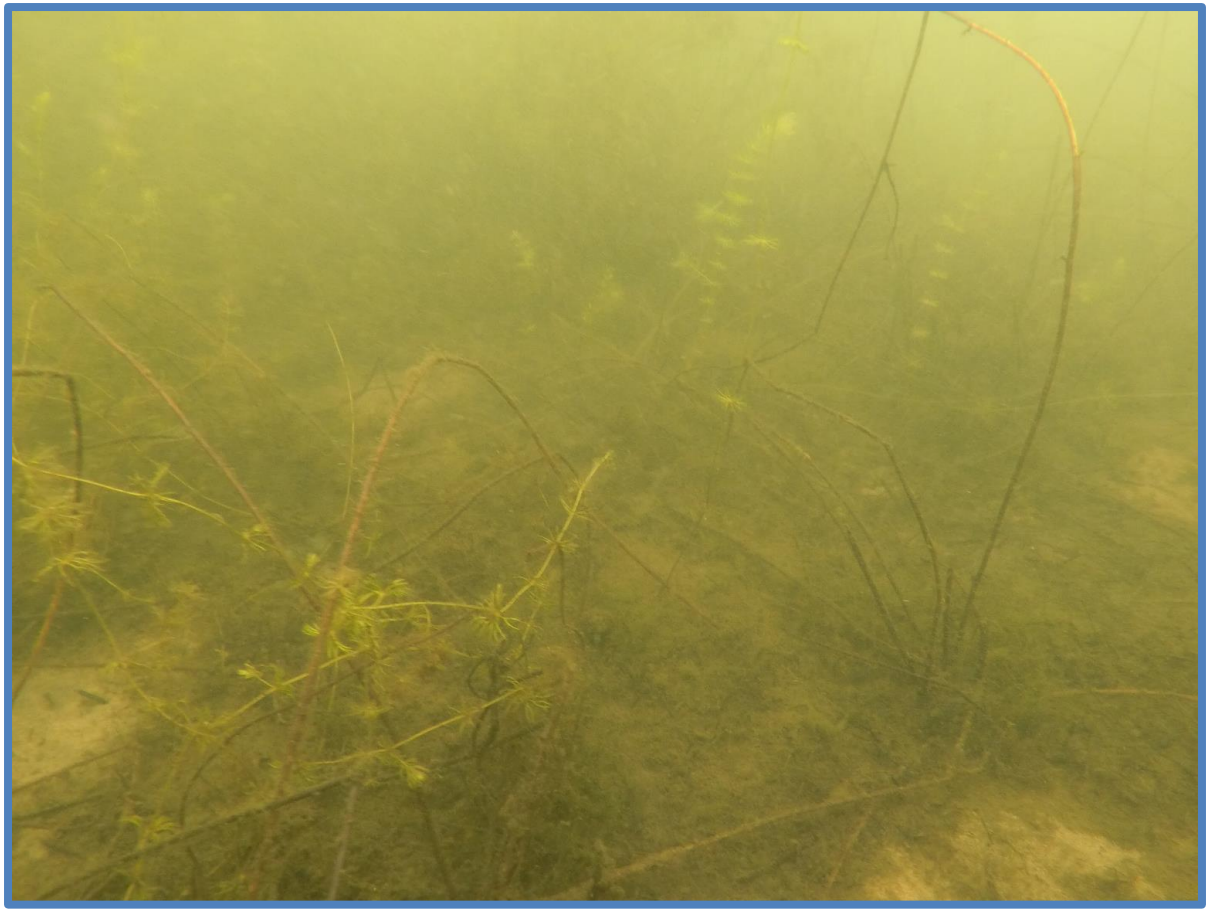
Date	Dive Location	Latitude	Longitude	Time Under-water	AIS CF Removed	AIS Density	Avg Water Depth	Native By-Catch (CF)	Native Species	Native Density	Substrate Type
7/11/19	A 19	46.03828	-89.16079	1.42	5.0	Low	5	<0.5	Pondweeds	Medium	Organic/Sand
7/11/19	A 19	46.03881	-89.15945	1.33	15.0	High	9.5	1.00	Pondweeds	Medium	Organic/Sand
7/11/19	A 19	46.03892	-89.15955	1.67	29.0	High	10	0.50	Pondweeds	Medium	Organic/Sand
7/11/19	A 19	46.03865	-89.15932	1.33	21.0	High	7	0.50	Pondweeds	Medium	Organic/Sand
7/11/19	A-19	46.03881	-89.16040	2.17	7.5	Low	6	<0.5	Pondweeds	Low	Sand
7/11/19	A-19	46.03876	-89.16073	1.75	3.0	Low	5	<0.5	Pondweeds	Medium	Sand
7/11/19	A-19	46.03882	-89.16058	1.75	28.0	High	8	0.00	None	Low	Sand
7/11/19	A-19	46.03876	-89.16073	1	4.0	Medium	9	0.00	None	Low	Sand
7/12/19	A-19	46.0387	-89.15944	1.67	9.0	Medium	7	0.00	None	Low	Sand
7/12/19	A-19	46.03869	-89.15945	1.33	5.0	Medium	12	<0.5	Elodea	Medium	Sand
7/12/19	A-19	46.03885	-89.16029	2.08	9.0	Medium	8.5	0.50	Pondweeds	High	Organic/Sand
7/12/19	A-19	46.03881	-89.16029	1	10.0	Medium	8.5	0.50	Pondweeds	High	Organic/Sand
7/12/19	A-19	46.03879	-89.16023	1.25	10.5	Medium	8.5	0.50	Pondweeds	High	Organic/Sand
7/15/19	A-19	46.03853	-89.15893	2.42	15.0	High	8	1.00	Elodea	Low	Sand
7/15/19	A-19	46.03838	-89.15814	1.17	5.5	Medium	8	0.00	None	Low	Sand
7/15/19	A-19	46.03829	-89.15755	0.67	6.5	Low	6.5	0.00	Elodea	Low	Sand
Total					**183.0**						

ProcellaCOR Treatment Area Photos (1/5)



Note: Picture taken on 7/28/19

ProcellaCOR Treatment Area Photos (2/5)

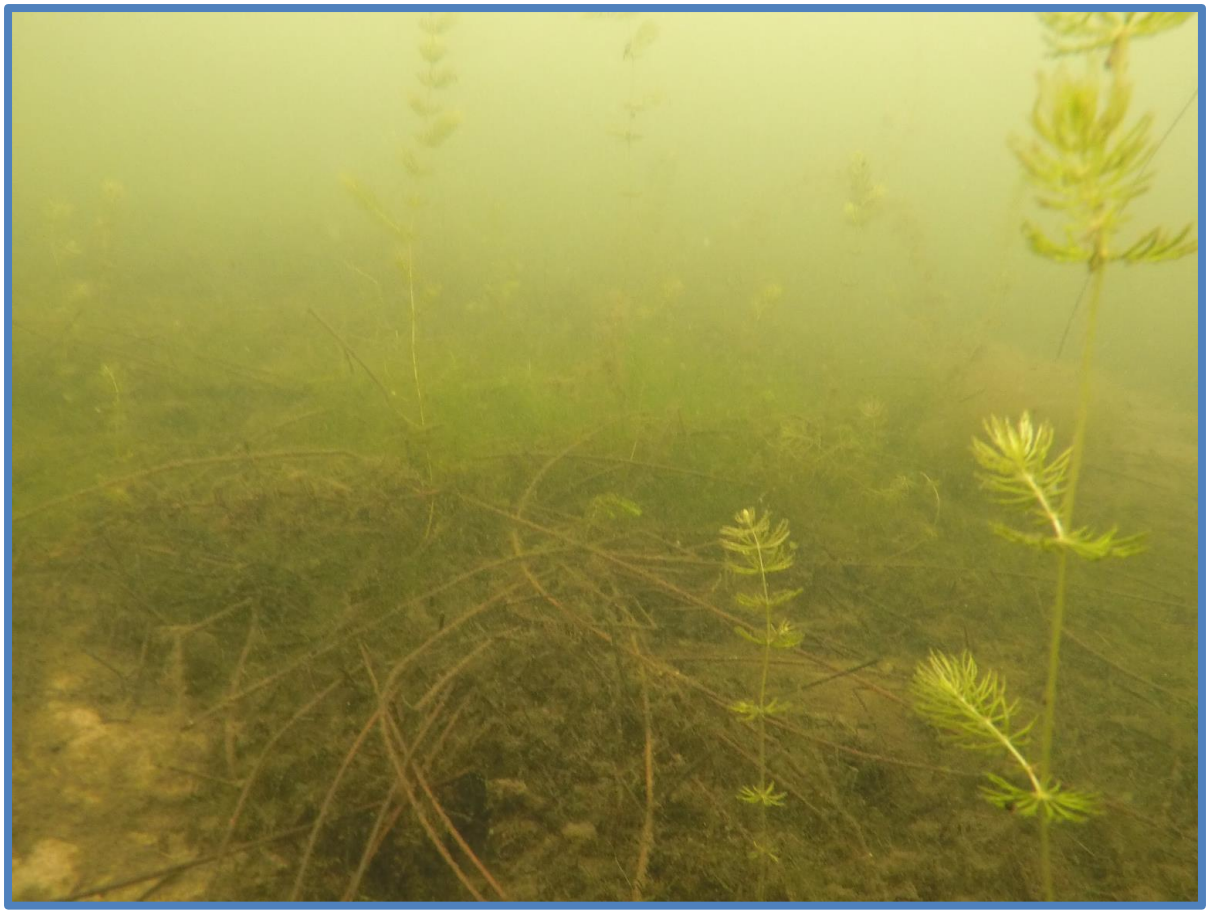


Note: Picture taken on 7/28/19

ProcellaCOR Treatment Area Photos (3/5)

Note: Picture taken on 7/28/19

ProcellaCOR Treatment Area Photos (4/5)



Note: Picture taken on 7/28/19

ProcellaCOR Treatment Area Photos (5/5)

Note: Picture taken on 7/28/19

D

APPENDIX D

North and South Twin Lake Protection and Rehabilitation District
Annual Report Supplemental Materials

P.O. Box 152
Conover, WI 54519

TO: WDNR
FROM: NSTLPRD
RE: Supplemental thoughts to 2019 Annual Report

Over the past few years, the NSTLPRD and NSTLRA have worked diligently to combat invasive species in North and South Twin Lakes. We have developed, what we believe to be very good relationships with personnel at the WDNR, our Consultant Onterra, a variety of Applicators, professionals at SePro and other professionals who have helped educate us regarding invasive species, native plants as well as management alternatives for our lakes. It is that collaborative effort that we believe has allowed us to develop a phased management plan to gain control and then maintain control over invasive species(primarily EWM) in the Twins.

Phase I - This has been an integrated activity to aggressively gain control over the extremely adverse condition of S Twin (40%+ of littoral with significant dense surface matting) and identify and control emerging colonies on N Twin. Our three-year grant for years 2019 – 2021 included whole lake treatment of S Twin, consistent DASH activities on emerging colonies of N Twin as well as control over a large dense 14+ acre colony via a ProcellaCOR treatment. These actions in concert with active water temperature, water quality and herbicide concentration level monitoring, and combined with up-to-date information on the native plant community presents critical data to evaluate results and identify best IPM strategies for the future.

The results of the Fluridone whole lake treatment are encouraging but real results will not be known until 2020 and beyond. We have a warranty with SePro which also provides financial comfort should results not meet expectations. This treatment did require each bump to exceed our budgeted product volumes planned in our grant. The initial results of the ProcellaCOR treatment on 14+ acres is very encouraging with EWM showing very sparsely in fall PI and underwater pictures and survey identifying strong native plant population which is detailed in the annual report. This treatment did require an increased product use because of water volume increased from a depth of 7’ to 8’. The combination of the product increases in these two activities exceeded our grant budget in the aggregate by approximately $28,000. Lastly, we again targeted an 11-acre dense colony of EWM using DASH. The DASH, while being effective, when using it on a large/dense colony is quite costly.

In the past 2 years, we have employed approximately 20 days of DASH which have managed less than 10 acres at a cost of over $60,000. Based on these activities, we believe that DASH in a dense area requires a minimum of 2 days/acre or a cost/acre of approximately $6000 - $7000. In contrast, the ProcellaCOR treatment on 14+ acres of N Twin was completed at a cost of $39,000 or $2800/acre.

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Phase I Conclusion – While we believe both DASH and the ProcellaCOR treatment appear to be successful, the immediacy of the ProcellaCOR results, combined with a cost of 40% of what DASH is per acre, makes ProcellaCOR the more logical future strategy for 5+ acre colonies which exhibit moderate, dense or dominant EWM. The S Twin conclusion is to be determined but will be discussed further in Phase II below.

Phase II – This phase has as key objectives as follows;

- Actively monitor the results of the S Twin whole lake treatment. Develop and implement follow up IPM strategies which may include DASH or herbicide spot treatments to maintain control over EWM on S Twin. We wish to define "Control" as a littoral concentration consistently maintained at < 10% with no dominant or surface colonies of EWM.
- Use expanded surveys of N Twin, which began in fall 2019, to identify trending existing colonies or new emerging colonies. Use an aerial drone survey to provide a detailed analysis of the northern 75% of N Twin to efficiently identify existing/emerging colonies to supplement fall PI surveys.
- Treat the area identified as C-19 (10 acres) with ProcellaCOR in 2020 in order to gain control over the remaining area on the Twins which exceeds 5 acres and has moderate concentration of EWM.
- Utilize 15 days of DASH to complete colony A-19 and then move to other small colonies in N Twin based on risk of size, location in area of high recreation or other factors considered important to prevent colony expansion on N Twin.

Phase II Conclusion – When the 2019 grant budget was created, we did not expect that the DASH activities in A-19 would essentially require approximately 35-40 days of management to gain control. Additionally, we did not expect to spend over $28,000 over our grant budget for the S Twin/N Twin herbicide treatments. While we have made excellent progress in approaching control, it will be critical to obtain additional grant funding and permit approval as outlined in Phase III in order to secure control.

Phase III – Continue Phase II activities in years 2020 and 2021 as previously outlined in our AIS grant approved in 2019 but we must incorporate the following if we are to complete the active management phases for the Twins in order to secure control over EWM. Thus, we believe the below are imperative;

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- Request a new grant in 2020 to allow financial support for the ProcellaCOR proposed treatment of the colony on N Twin noted as C-19.
- Allocate the $28,000 of over budget in 2019 herbicide treatments as an offset against the $36,000 of DASH planned in 2019 leaving only $8000 for DASH.
- New grant for $28,000 of DASH in 2020 due to use of funds in 2019. DASH is critical to complete N Twin control which has been implemented the past 2 years in order to achieve desired colony control.
- New grant funding for 2021 herbicide treatment of area(s) which we identify in aerial survey or fall PI on N Twin or possibly a critical high traffic colony on S Twin dependent on survey results.
- New grant for 2022 DASH activities for either Twins as needed to manage emerging colonies or maintain control over colonies previously treated with herbicides.

Phase III Conclusion – Obtaining a 2020 grant to extend IPM and monitoring strategies through 2022 is critical to complete the control phase, maintain future control as well as monitoring and gathering data to best develop future IPM strategies. The NSTLPRD is requesting only a 50% matching grant as it projects it can levy the cash flow required from Riparians and yet maintain an annual levy which is financially and fiscally representative of what we projected when the District was formed. Our partnership is a function of both strategical and financial alliance in order to preserve and protect the Twin Lakes resource.

Future Goals and Strategies – Lastly, attached is an executive summary of future goals, strategies as well as a management matrix in draft form which will allow us to manage the lakes using a less aggressive approach once we have achieved “Control”. We believe we have developed great partnerships with key stakeholders, including transparency of communication which are critical to our future collaborative efforts in protecting The Twins.

NSTLPRD Draft Management Goals and Strategies

Goal 1 S Twin goal is to keep EWM < 10% in the littoral zone

Goal 2 N Twin goal is to not allow any expansion in the lake using 2019 fall survey as a baseline.

Strategy 1 S Twin EWM monitoring shall be conducted each fall to trend EWM concentration in the littoral zone. If the littoral % from such monitoring in any year is between 10%-15% the LD board shall consult with the WDNR, it's consultant, lake riparians, and other experts such as SePro to evaluate what management activities should be employed in the subsequent year to get control consistent with Goal 1. Treatment options to include, hand pulling, DASH, large or small scale spot treatments, mechanical harvesting and whole lake herbicide treatments. Consideration should look at historical activities, consider density and dominant nature of EWM, native plant trends and other factors considered relevant.

Strategy 2 N Twin monitoring each fall to identify change in EWM concentration, breadth, native plant population and other factors. Treatment strategy of each identified colony should be categorized in accordance with thye below table of potential IPM Strategies to consider respectively for each colony.

Strategy 3 Continue to maintain CBCW grant and consider expansion of service as well as education of riparians regarding Invasive species on the Twins

Strategy 4 Conduct an aerial survey in 2020 of N Twin to assist in the identification of emerging colonies in N Twin which are often difficult to identify. Fall surveys then can more closely evaluate each identified colony and subsequent management activities can be considered per the below table.

Strategy 5 Continue to monitor native plant population in both South and N Twin to gather data regarding natural trends and potential impact of management activities on native plants over time.

Strategy 6 Obtain relevant data from WDNR and other sources regarding current and emerging management activities and their success in both WI and other states for future consideration of IPM activities on the Twins.

Strategy 7 Continue to monitor water clarity, phosphorus and other criteria in the Twins on an annual basis.

N Twin Table for possible management activities

Colony Size	Surface Matting	Highly Dominant	Dominant	Scattered	Highly Scattered
< 1 acre	1,2,3	1,2,3	2,3,	2,3,4	4
1 - 5 acres	1,2	1,2	1,2	2,3,4	3,4
5 - 10 acres	1	1,2	1,2	2,4	4
> 10 acres	1	1	1	2	4

Activity

1 Herbicide spot treatment
2 DASH
3 Hand Pulling
4 No active just monitor