1.0 INTRODUCTION

The Pike Chain of Lakes is comprised of 9 lake basins located near the Town of Iron River in Bayfield County, Wisconsin (Figure 1.0-1). The chain includes over 1,000 acres of surface water, and forms the headwaters of a drainage system that leads to the White River which flows through the Bad River Indian Reservation on its way to Lake Superior. Six of the lakes, sometimes referred to as the main lakes, are able to be boated between (colored blue on Figure 1.0-1). The other three lakes are hydrologically connected but cannot be reached by watercraft without portage.

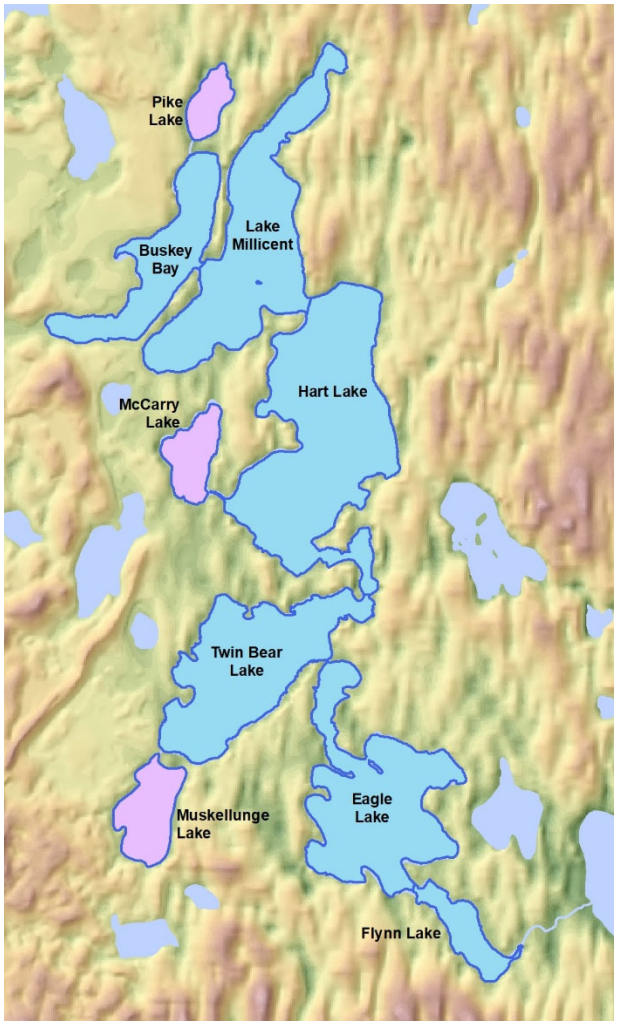


Figure 1.0-1 Pike Chain of Lakes, Bayfield County, WI.

All lakes within the chain are considered Priority Navigable Waterways by the Wisconsin Department of Natural Resources (WDNR), primarily for having waters with self-sustaining walleye and/or muskellunge populations. The six main lakes and Pike Lake are classified as Areas of Special Natural Resource Interest as outstanding or exceptional resource waters.

One non-native submergent plant species has been identified within the Pike Chain, Eurasian watermilfoil (*Myriophyllum spicatum*, EWM). EWM was first documented in the Twin Bear – Hart Channel in 2004. EWM populations were identified in Eagle Lake in 2005, Buskey Bay in 2007, and Millicent in 2008. Flynn Lake was the last lake for EWM to be identified within during surveys in 2014. The Iron River Pike Chain of Lakes Association (IRPCLA) and partners have historically managed EWM with spatially targeted herbicide spot treatments, whole-lake 2,4-D treatments, and hand-harvesting efforts (volunteer and contracted).

1.1 Historic AIS Management & Planning

The IRPCLA's *Comprehensive Management Plan* (Dec 2008) for the Pike Chain of lakes outlines an EWM management strategy that primarily uses herbicide spot treatments. An official addendum to the *Plan* was made in January 2016, following the completion of a 5-year AIS-Established Population Control Grant-funded project. The IRPCLA was awarded a proceeding WDNR AIS Established Population Control Grant in February 2016 (ACEI-180-16) that funded EWM management and monitoring from 2016-2018. Remaining funds from the grant allowed the project to extend to 2020. As a part of that project, the IRPCLA revisited their aquatic plant management-related Implementation Plan and updated its content based on the lessons learned during the EWM control project. The *Aquatic Plant*

Management Plan (Nov 2021) was created with the collaboration of multiple state, county, and tribal partners.

Within the *Plan* the IRPCLA outlined a management goal to "Manage Aquatic Invasive Species and Prevent Establishment of New Aquatic Invasive Species." This goal includes a management action to "conduct management actions towards Eurasian watermilfoil" including a density-based trigger of when herbicide use would be applicable. The *Plan* outlines herbicide formulation recommendations, treatment design constraints, and likely monitoring strategies. It is important to note that the management plan provides a framework to guide the management action, but does not include the specific control plan for a given year. As technology and best management practices evolve, they can be adopted into each annual control plan. The control and monitoring plan is useful for WDNR and tribal regulators when considering approval of the action, as well as to convey the control plan to IRPCLA members for their understanding. The *Plan* outlined a *Short-Term EWM Management* Plan for 2022 which is elaborated on within this control and monitoring plan.

Short-Term EWM Control Plan:
The IRPCLA aims to conduct a set of trial herbicide treatments in 2022 and seek grant funding to offset the costs of the management and monitoring. Initial discussions include targeting areas in Eagle Lake with florpyrauxifen-benzyl (ProcellaCOR™), understanding the area of potential impact (AOPI) would likely be greater in scale than just the application site. The IRPCLA is also considering this chemistry in other areas of the Chain, as well as the potential for using barrier curtains with ProcellaCOR™ or another chemical like 2,4-D in applicable smaller sites.

2.0 2021 LATE-SUMMER EWM PEAK-BIOMASS SURVEY RESULTS

Onterra conducted a 2021 Late-Summer EWM mapping survey to assess the current EWM population and to provide the necessary information for discussing and planning a potential 2022 herbicide treatment. The EWM mapping survey offers 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 (Photo 2.0-1). 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 AIS locations that were considered as *small plant colonies* (<35 feet in diameter), *clumps of plants*, or *single or few plants*.

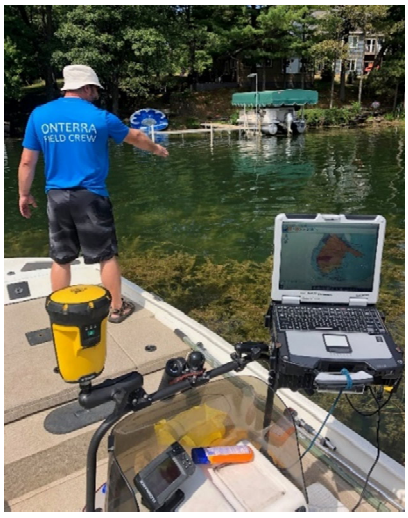


Photo 2.0-1. EWM mapping survey on a Waushara County, WI lake. Photo credit Onterra.

The Late-Summer EWM Peak-Biomass Survey was conducted on August 30-31, 2021 to qualitatively assess the peak growth (peak-biomass) of the EWM population throughout the lake and to consider management options for the following year. The entire littoral zone of the Pike Chain was systematically meandered and EWM populations were mapped by using the same methodology described above. Survey crews supplemented the survey with a submersible camera when applicable to investigate priority

locations including areas that were in deeper water depths. Conditions during the late-summer survey were noted as excellent with mostly sunny skies and calm winds.

The results of the late-summer survey are displayed on Maps 1-7. Many of the lakes continue to harbor relatively low EWM populations that are in the process of rebounding from the previous whole-lake 2,4-D treatments.

3.0 2022 EWM MANAGEMENT AND MONITORING STRATEGY

Few lakes in Bayfield County contain EWM, and the local WDNR has historically supported aggressive management of existing populations assuming this may lessen the chance of EWM spreading within the lake and to other nearby waterbodies. In other areas of the state that contain much higher and more prevalent EWM populations, lake-wide population management is often considered too aggressive by local WDNR regulators. Where EWM populations already have an established footprint in the lake and are already present in most nearby waterbodies, such as in the southeast part of Wisconsin, most populations are no-longer managed for containment purposes. In these instances, the nuisance conditions are targeted for management and other areas are tolerated or avoided.

The IRPCLA understands that EWM is established within at least the six main lakes of the Pike Chain, but wants to continue managing with the goal of maintaining a low lake-wide population within the system. The IRPCLA wants to minimize areas of dense vegetation that are preferred by largemouth bass species and promote more habitat for walleye and smallmouth bass.

The *Plan* indicates that when a Late Season EWM Mapping Survey documents colonized EWM populations that are *dominant or greater in density*, an herbicide spot treatment would be considered for the following early-spring. Herbicide spot treatment techniques would be implemented if the colonies have a size/shape/location where management is anticipated to be effective. These treatment design parameters are admittedly vague to account for the evolving research on the subject. While some herbicide spot treatments show promise, the unpredictability of spot treatments state-wide has resulted in less favorability of this strategy with some WDNR regulators and lake managers. This is particularly true in areas of increased water exchange via flow, exposed and offshore EWM colonies, or when traditional weak-acid herbicides like 2,4-D are used. The length of exposure time required for herbicides like 2,4-D are unachievable in spot treatment scenarios. Future spot herbicide treatments would need to consider herbicides (diquat, florpyrauxifen-benzyl, etc) or herbicide combinations (2,4-D/endothall, diquat/endothall, etc) thought to be more effective under short exposure situations, Advancements in research into new herbicides and use patterns will be integrated into future management strategies, including effectiveness, native plant selectivity, and environmental risk profile.

3.1 2022 EWM Management Strategy

The IRPCLA understands that the small size and exposed/off-shore nature of the EWM colonies on the chain make them difficult scenarios to hold sufficient herbicide concentrations and exposure times (CETs) to result in multi-year control. Some lake groups have attempted to "contain" the herbicide in place with the use of barrier curtains. The majority of research trials that have typically taken place in Wisconsin utilized an economical-priced herbicide like 2,4-D and areas already contained by a bay or shoreline were chosen to minimize the amount of curtain material needed. Barrier curtain construction

and placement is the responsibility of the lake group, requiring advance planning efforts and a formidable volunteer base.

ProcellaCOR™ is currently the state's most popular spot-treatment strategy for EWM management when barrier curtains are not used. Onterra's experience monitoring over three dozen ProcellaCOR™ treatments within the state during 2019-2021 indicates that EWM control has been high with almost no EWM being located during the summer post treatment surveys. Within these treatments, native plant impacts have been almost exclusive contained to sensitive dicot species such as northern watermilfoil and water marigold.

Lake managers continue to learn how to successfully implement this form of treatment after being registered for use in Wisconsin only a couple of years ago. ProcellaCOR™ has a high sediment/organic binding affinity (Koc) and relatively short persistence (half-life of < 6 days), so it is thought to stay where applied better than other chemistries. However; in many of the treatment Onterra has monitored, EWM impacts have been observed extending outside of the application area (i.e through herbicide dissipation), as this chemical has shown activity at even low concentrations and exposure times as it mixes into an area of perceived impact. For some lakes, this could be a bay or basin. The WDNR's fact sheet on this chemistry can be found here:

https://dnr.wi.gov/water/wsSWIMSDocument.ashx?documentSeqNo=164039981

Following subsequent conversations with Onterra and the WDNR, the IRPCLA aims to conduct a series of trial treatments in 2022 with follow-up hand-harvesting/DASH in 2023. Eagle Lake contains the highest EWM population and will be targeted with ProcellaCOR spot treatments that will consider potential lake/basin-wide impacts (Map 8). A problematic site in an area of flow on Hart will also be targeted with ProcellaCOR (Map 9). A specific area of Twin Bear initially appears conducive to enclosure with a barrier curtain and 2,4-D (Map 10). Herbicide product shortages in 2022, specifically 2,4-D, may inhibit this strategy from being implemented as originally intended. One option would be to convert this site into another ProcellaCOR treatment, in which a barrier curtain would likely not be needed. Early season herbicide treatment would occur in mid-June 2022; fisheries managers and Tribal partners favor the slightly later treatment date to avoid overlap with sensitive stages of larval fish development.

3.2 2022 Monitoring Strategy

The IRPCLA recently learned that their WDNR AIS Control Grant application was successful, providing state cost-share funding for the 2022 management strategy and 2022-2023 monitoring program. Both quantitative and qualitative surveys are incorporated into the IRPCLA's EWM management and monitoring strategy. These data will be collected *prior to treatment*, *year of treatment*, and *year after treatment*. Onterra believes comparing data from *prior to treatment* to the *year after treatment* allows for the best assessment of the treatment outcome. Many treatment impacts during the *year of treatment* may be short-lived, so understanding how populations stabilize during the *year after treatment* is important within evaluations.

Qualitative EWM Monitoring

A Late Season AIS (LSAIS) Survey would be conducted each year on the six main lakes to produce the mapping data to document a census of the EWM population within the chain at the perceived peak

growth stage. Comparing these data to previous surveys will help lake stakeholders understand management outcomes. The EWM mapping data are also valuable to direct follow-up management, such as contracted hand-harvesting, aimed to maintain the gains made. McCarry and Muskellunge Lakes will be surveyed in this fashion periodically, with 2023 being the next scheduled event unless volunteer-based findings prompt an earlier investigation.

Quantitative Aquatic Plant Monitoring

A preliminary quantitative monitoring plan is being considered for this trial treatment site in which a total of 171 sub-sample point-intercept sampling locations are contained within the five trial treatment sites (Figure 3.2-1). The quantitative assessment would be completed through the comparison of the sub point-intercept survey from mid-June 2022 (*year of pre-treatment*), late-season 2022 (*year of post-treatment*), and late-season 2023 (*year after treatment*). The 2022 herbicide treatment is planned for roughly the middle of June. This slight delay in implementation will allow the pretreatment sub-sample point-intercept survey to take place after many native plants have emerged from winter dormancy and be documented by the pretreatment survey.

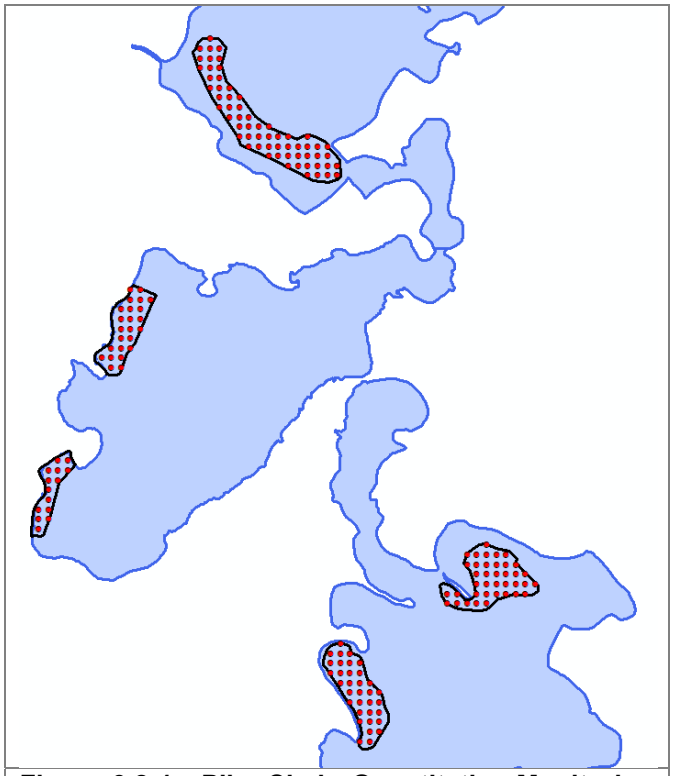


Figure 3.2-1. Pike Chain Quantitative Monitoring Plan for Proposed 2022 Herbicide Treatments. 30m spacing, n=171.

Herbicide Concentration Monitoring

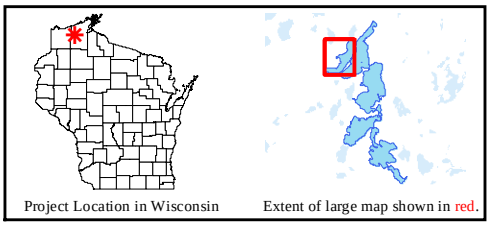
IRPCLA volunteers would collect herbicide concentration monitoring during the hours/days following treatment following a sampling regime created through collaborative efforts of the WDNR and Onterra. The 2021 monitoring structure mainly investigated herbicide concentrations within the first few days of treatment, but is likely to expand to a few sampling intervals at weeks after treatment in 2022. This plan will continue to develop up until the time of treatment.

Whole-Lake Point-Intercept Survey

Additional aquatic plant monitoring is planned in 2023 through the completion of a whole-lake point-intercept surveys on the six main lakes. The whole-lake point-intercept survey will be valuable in assessing the lake-wide aquatic plant population and results are compared to previous or future surveys to monitor aquatic plant populations in the lake. Point-intercept surveys were last completed on Eagle and Flynn in 2020 as part of a whole-lake treatment monitoring. PI surveys were last completed on Buskey Bay, Millicent, Hart, and Twin Bear in 2018. This would be a 5-year interval between surveys, which is outlined as a target within the IRPCLA's Plan and required for future eligibility for grant funds.

3.3 Integrated Pest Management Planning

Hand-harvesting would occur as an Integrated Pest Management tool, mainly targeting rebounding EWM. This could occur in both 2022 and 2023, but anticipation of this effort is more likely for 2023. The IRPCLA has targeted dense EWM colonies in the past with hand-harvesting/DASH without great success. The IRPCLA would focus hand-harvesting/DASH as a mechanism for following up after areas are targeted with herbicide treatment, as this is perceived to be a more scale-appropriate amount of EWM to be tackled with this management technique. Based on the lessons learned by the 2022 trial treatments, the IRPCLA will investigate implementing additional herbicide treatments in future years.



BB-20

Lake Millicent

N
W E
S

430
Feet

Legend

EWM Survey Results (Aug 30-31, 2021)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2020 Herbicide Treatment Site

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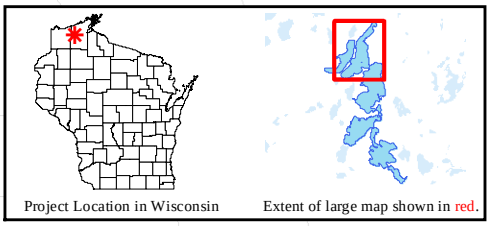
920.338.8860
www.onterra-eco.com

Sources:
Roads & Hydro: WDNR
Bathymetry: Onterra 2016,
Aquatic Plants: Onterra, 2021

Map Date: September 28, 2021 AMS

Map 1 - Buskey Bay
Pike Chain of Lakes
Bayfield County, Wisconsin

2021 Late-Season EWM Survey Results



Buskey Bay

Hart Lake

720
Feet

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W
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Aquatic Plants: Onterra, 2021
Map Date: September 28, 2021 AMS

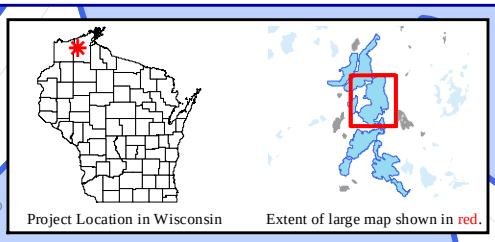
Legend

EWM Survey Results (Aug 30-31, 2021)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2020 Herbicide Treatment Site

Map 2 - Lake Millicent
Pike Chain of Lakes
Bayfield County, Wisconsin

2021 Late-Season EWM Survey Results



Hart A1-20

630
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Sources:
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Aquatic Plants: Onterra, 2021
Map Date: September 29, 2021 AMS

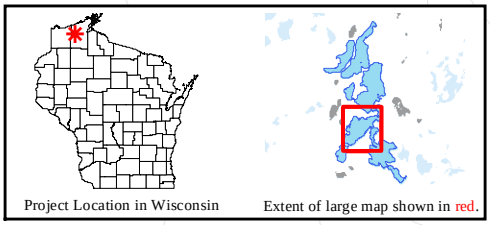
Legend

EWM Survey Results (Aug 30-31, 2021)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2020 Herbicide Treatment Site

Map 3 - Hart Lake
Pike Chain of Lakes
Bayfield County, Wisconsin

2021 Late-Season EWM Survey Results



Hart Lake

TB-20

Eagle Lake

N
W E
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550
Feet

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Aquatic Plants: Onterra, 2021

Map Date: September 28, 2021 AMS

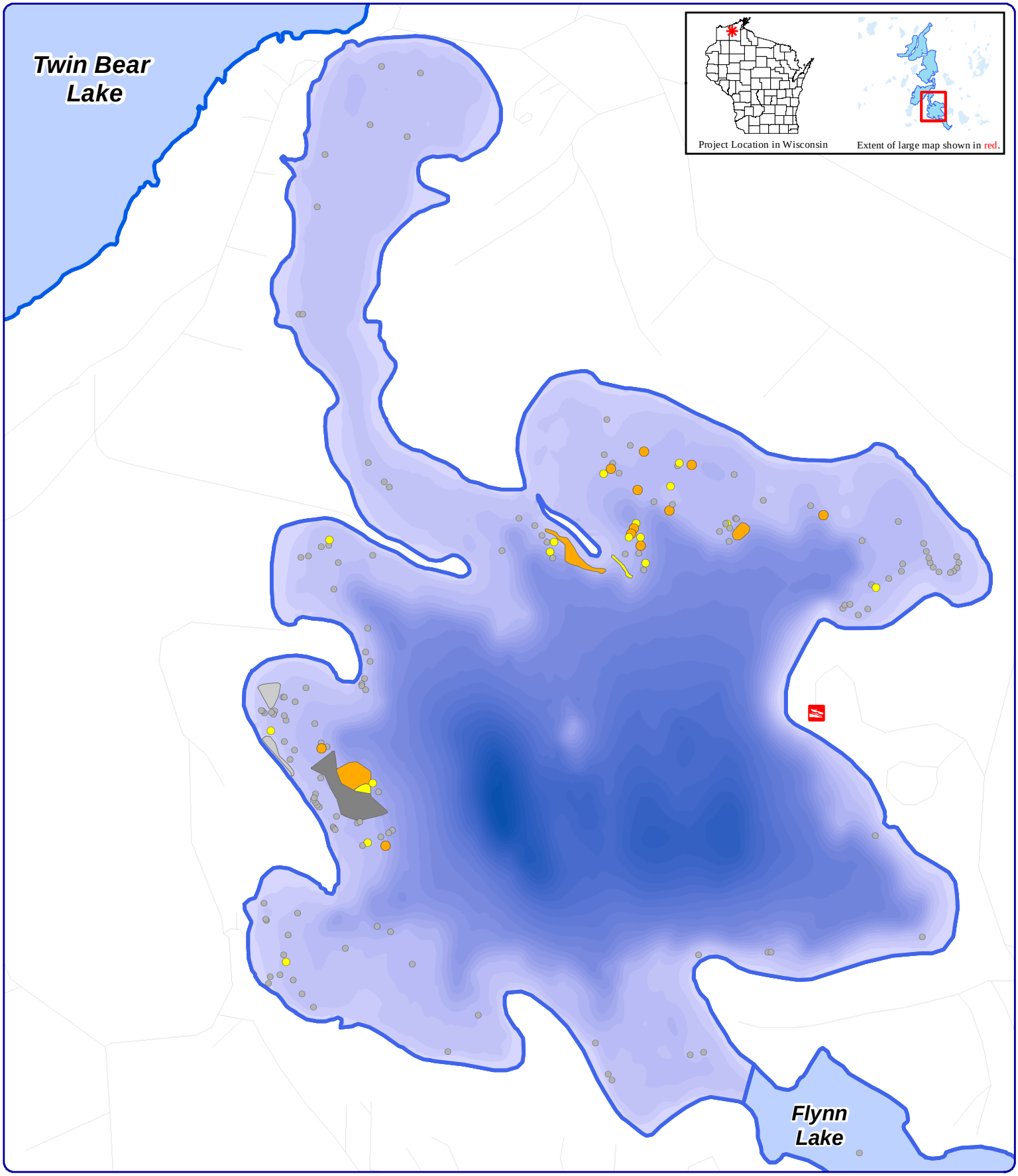
Legend

EWM Survey Results (Aug 30-31, 2021)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2020 Herbicide Treatment Site

Map 4 - Twin Bear Lake
Pike Chain of Lakes
Bayfield County, Wisconsin

2021 Late-Season EWM Survey Results



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Feet

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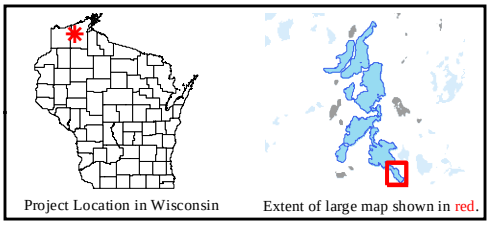
Legend

EWM Survey Results (Aug 30-31, 2021)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2020 Herbicide Treatment Site

Map 5 - Eagle Lake
Pike Chain of Lakes
Bayfield County, Wisconsin
2021 Late-Season EWM Survey Results



N
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280
Feet

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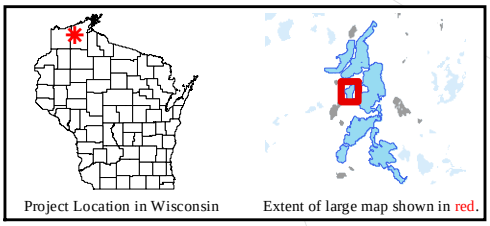
Legend

EWM Survey Results (Aug 30-31, 2021)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2020 Herbicide Treatment Site

Map 6 - Flynn Lake
Pike Chain of Lakes
Bayfield County, Wisconsin

2021 Late-Season EWM Survey Results



Hart Lake

240
Feet

Legend

EWM Survey Results (Aug 30-31, 2021)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- 2020 Herbicide Treatment Site

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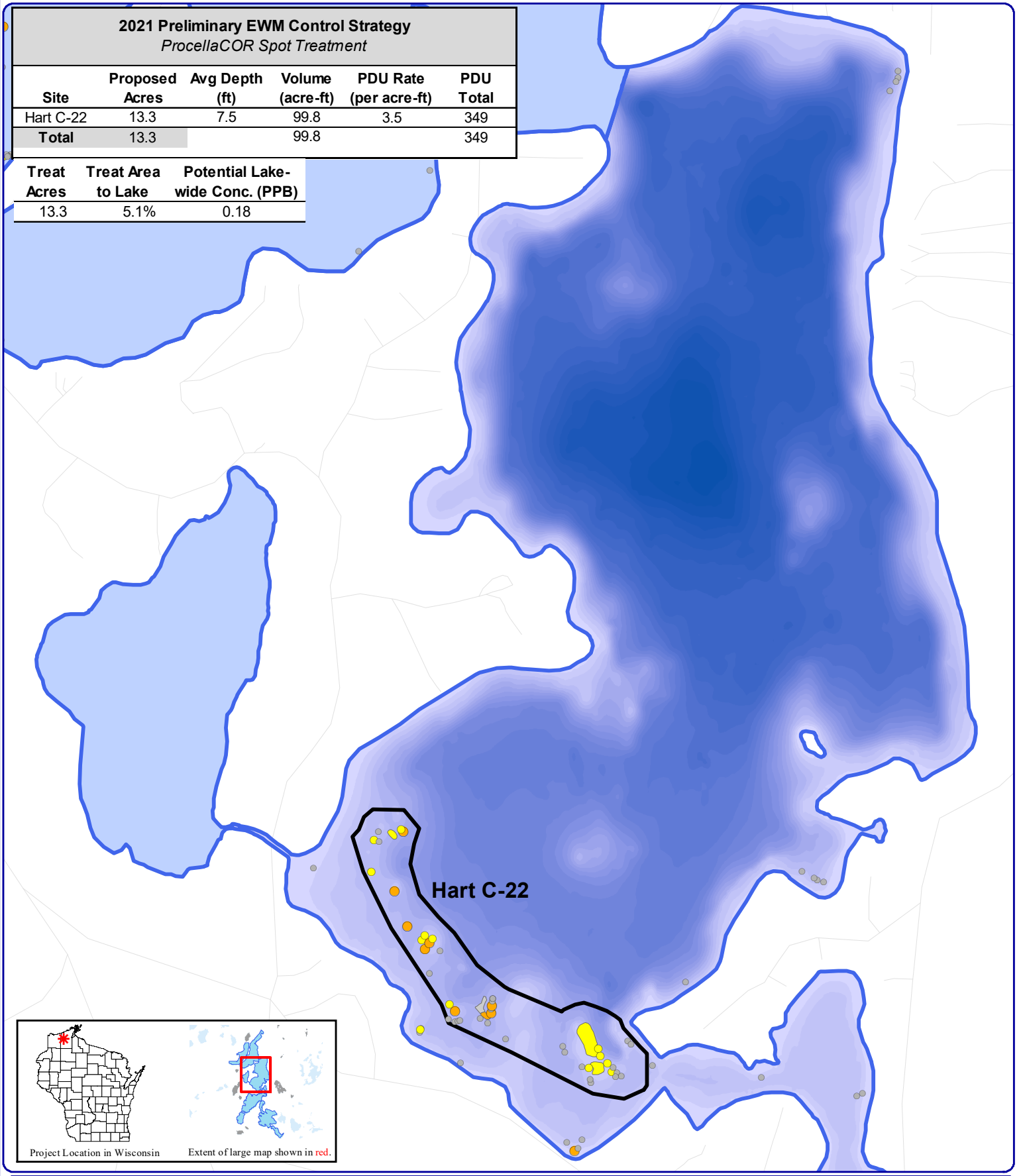
Map 7 - McCarry Lake
Pike Chain of Lakes
Bayfield County, Wisconsin

2021 Late-Season EWM Survey Results

2021 Preliminary EWM Control Strategy
ProcellaCOR Spot Treatment

Site	Proposed Acres	Avg Depth (ft)	Volume (acre-ft)	PDU Rate (per acre-ft)	PDU Total
Hart C-22	13.3	7.5	99.8	3.5	349
Total	13.3		99.8		349

Treat Acres	Treat Area to Lake	Potential Lake-wide Conc. (PPB)
13.3	5.1%	0.18



N
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Feet

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Legend

EWM Survey Results (Aug 30-31, 2021)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- Prelim 2022 Herbicide Treatment Site

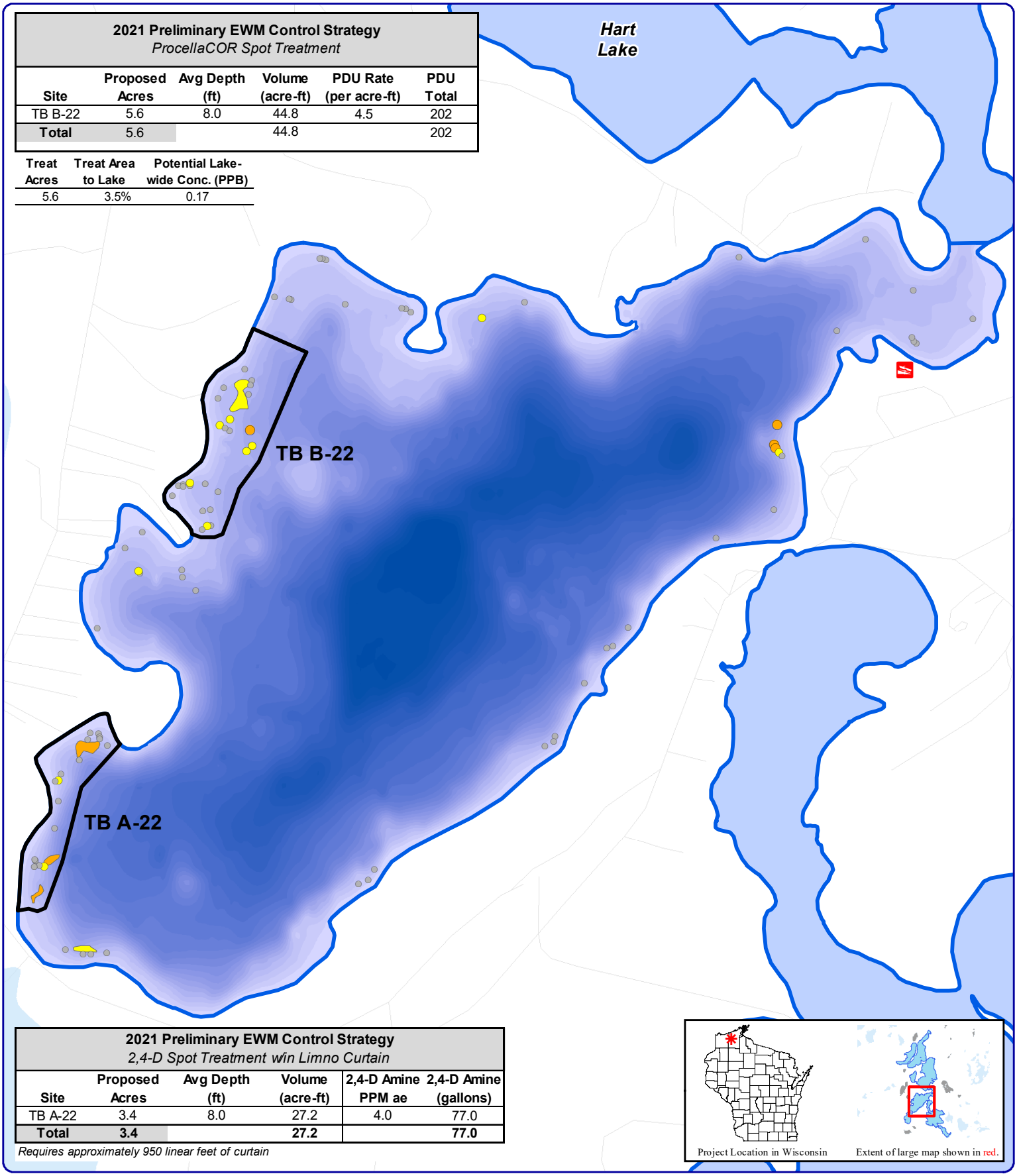
Map 8 - Hart Lake
Pike Chain of Lakes
Bayfield County, Wisconsin

2021 Late-Season EWM Survey Results

2021 Preliminary EWM Control Strategy
ProcellaCOR Spot Treatment

Site	Proposed Acres	Avg Depth (ft)	Volume (acre-ft)	PDU Rate (per acre-ft)	PDU Total
TB B-22	5.6	8.0	44.8	4.5	202
Total	5.6		44.8		202

Treat Acres	Treat Area to Lake	Potential Lake-wide Conc. (PPB)
5.6	3.5%	0.17



2021 Preliminary EWM Control Strategy
2,4-D Spot Treatment w/in Limno Curtain

Site	Proposed Acres	Avg Depth (ft)	Volume (acre-ft)	2,4-D Amine PPM ae	2,4-D Amine (gallons)
TB A-22	3.4	8.0	27.2	4.0	77.0
Total	**3.4**		**27.2**		**77.0**

Requires approximately 950 linear feet of curtain

N W E S
550
Feet

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Legend

EWM Survey Results (Aug 30-31, 2021)

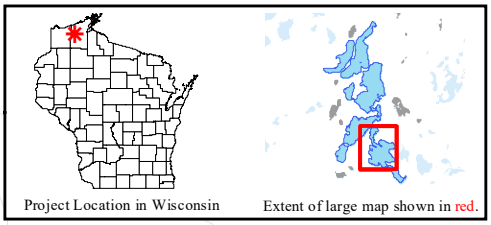
- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- Prelim 2022 Herbicide Treatment Site

Map 9 - Twin Bear Lake
Pike Chain of Lakes
Bayfield County, Wisconsin
2021 Late-Season EWM Survey Results

2021 Preliminary EWM Control Strategy
ProcellaCOR Spot Treatment w/ Whole-Lake Potential

Site	Proposed Acres	Avg Depth (ft)	Volume (acre-ft)	PDU Rate (per acre-ft)	PDU Total
Eagle E-22	7.4	7.0	51.8	3.0	155
Eagle F-22	8.0	7.0	56.0	3.0	168
Total	15.4		107.8		323

Treat Acres	Treat Area to Lake	Potential Lake-wide Conc. (PPB)
15.4	9.2%	0.41



Eagle F-22

Eagle E-22

Flynn Lake

N
W E
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530
Feet

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Legend

EWM Survey Results (Aug 30-31, 2021)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- Prelim 2022 Herbicide Treatment Site

Map 10 - Eagle Lake
Pike Chain of Lakes
Bayfield County, Wisconsin
2021 Late-Season EWM Survey Results