

INTRODUCTION

The Manitowish Waters Chain of Lakes includes 10 lakes located in the Towns of Manitowish Waters and Boulder Junction in Vilas County as well as three lakes located below the Rest Lake Dam. Curly-leaf pondweed was first discovered in the Manitowish Waters Chain of Lakes in June 2010 in the northwestern area of Island Lake. In 2011, monitoring conducted by (North Lakeland Discovery Center (NLDC) staff, Manitowish Waters Lakes Association (MWLA) volunteers, and Vilas County staff mapped approximately 22 acres of curly-leaf pondweed in Rice Creek and located additional occurrences in southeastern Island Lake as well as in the channel between Island and Spider lakes.

The curly-leaf pondweed discoveries in 2010 and 2011 spurred the NLDC's first AIS-Early Detection and Response (AIS-EDR) Grant in February 2012. AIS-EDR Grants were also received in 2013 and 2014, followed by a 3-year AIS-Established Population Control (AIS-EPC) Grant in 2015. These grants helped to fund the management of curly-leaf pondweed on the chain from 2012-2017, which are elaborated on below. Continued and expanded monitoring of all chain lakes was completed by professionals and volunteers as a part of this multi-phased management planning project. These efforts located additional curly-leaf pondweed occurrences in Manitowish and Stone lakes during 2013, Rest Lake in 2015, and Fawn Lake during 2017 (Figure 1).

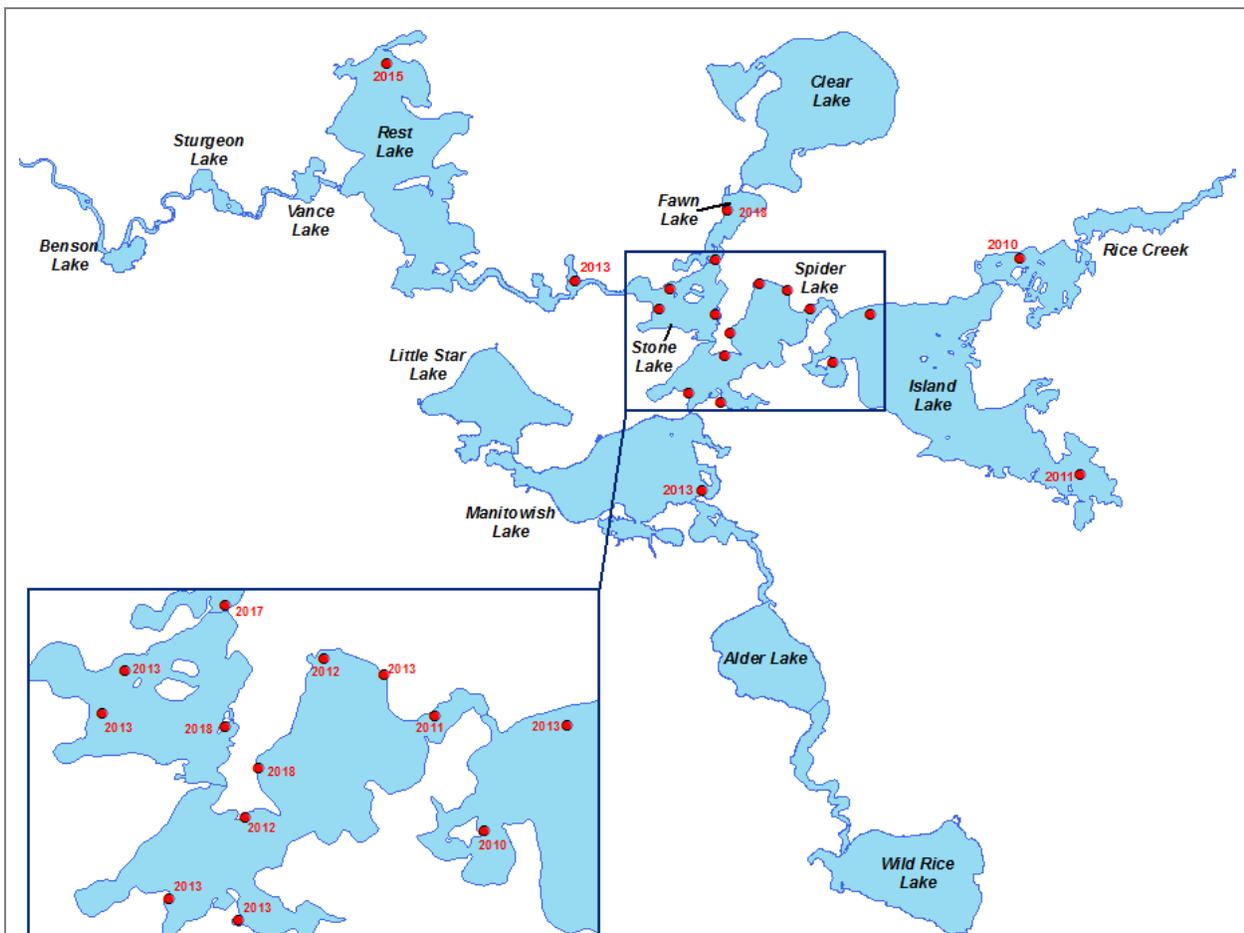


Figure 1. Curly-leaf pondweed discoveries in the Manitowish Waters Chain of Lakes. Created using data from Onterra, MWLA volunteers and the NLDC.

Historic CLP Management Summary

Over the course of the seven years between 2012 and 2018, two methods have been used to manage curly-leaf pondweed in the Manitowish Waters Chain of Lakes; herbicide treatments and hand-harvesting. The latter method has included volunteer, NLDC staff, and professionals using traditional hand-harvesting techniques. Herbicide treatments have been completed on five sites on the chain, including the Spider-Island channel (2012-2016), Manitowish River (2014), and three areas on the western side of Island Lake (2012-2013). Two areas on the chain that contain curly-leaf pondweed have been monitored by professionals since 2012, but have had no control actions completed on them. These areas include Rice Creek near its entrance to Island Lake and an area in far eastern Island Lake. Specifics regarding the year-to-year efforts can be found in the annual reports produced as a part of the AIS grant projects. No herbicide control actions were recommended in 2017-2019, however a coordinated hand-harvesting effort was undertaken to manage the population in select areas of the system.

2019 MONITORING RESULTS

The CLP monitoring program in 2019 was a combined effort between Onterra field crews and the NLDC staff. Onterra crews surveyed all lakes that were known to have CLP in previous surveys which included Island Lake, Rice Creek, Spider Lake, Manitowish Lake, Fawn Lake, Stone Lake, Manitowish River connecting to Rest Lake, and Rest Lake. Onterra's surveys were completed on June 18-19, 2019 during which up to four survey vessels were on the Chain at a time. A secchi disk reading of 10.0' was taken during the survey which indicates water clarity was relatively high.

The results of Onterra's survey are displayed on Map 1. The CLP that was located was mostly within areas where it had been mapped in previous surveys.

Rest Lake: Just one single plant was located in Rest Lake on the northern end of the lake approximately in the same area as where CLP had been targeted for removal during the past two years. A submersible camera was lowered into the area where CLP had been marked in previous years and no additional plants were spotted.

Manitowish River: No CLP was located in the Manitowish River between Rest Lake and Stone Lake.

Manitowish Lake: The littoral area of the lake was surveyed and additional focus was given to the historic CLP location from 2013. No CLP was found in Manitowish Lake.

Stone Lake: One single or few plants occurrence was marked on the west side of Stone Lake.

Spider Lake: Survey crews marked a number of single plant occurrence growing in a row within the Spider-Island Channel. CLP was not found elsewhere in Spider Lake.

Island Lake: A clump of plants and three single or few plant occurrences were marked in the southeast end of the lake in an area that has historically harbored a modest population of CLP.

Rice Creek: Crews mapped colonized CLP consisting of highly scattered, scattered, or highly dominant density ratings in approximately the same areas where it has been present in the past. Additional clumps, singles, and small plant colonies were marked within Rice Creek including at two locations further upstream from the main colonies.

Fawn Lake: A CLP population in Fawn Lake was first identified in 2018 by NLDC surveyors. Onterra crews mapped two relatively small colonized areas as well as a number of additional singles and clumps in the lake. A colonized area that was described as dominant in density was approximately 90' x 70'. A scattered CLP colony was approximately 85' x 40' in size.

The NLDC crews surveyed all remaining lakes in the Chain and were searching for new, pioneering CLP populations. No new CLP populations were found during the course of the NLDC surveys; however, they did observe additional plants in the vicinity of a known location in Stone Lake.

2019 CLP HAND-HARVESTING ACTIVITIES

The CLP hand-harvesting strategy included a combination of professional and NLDC-led efforts. The NLDC contracted with Aquatic Plant Management, LLC (APM) to conduct professional hand-harvesting services of CLP in 2019. Onterra provided the spatial data for the CLP locations in the form of a Garmin GPS compatible basemap to APM to aid in the removal efforts. Plant removal specialists from APM visited the Manitowish Waters Chain of Lakes on June 20-21 & 24, 2019. Over a combined 19.74 hours of time under water, approximately 158 cubic feet of CLP was harvested using traditional removal techniques (Table 1). A summary report authored by APM provides details of the professional hand-harvesting efforts and is included with this report as an appendix.

Table 1. Summary of 2019 Professional Hand-Harvesting Efforts. Data compiled from APM, LLC Dive Summary Report.

Site	Time (Hours)	Harvest (Cubic Feet)
A-19	9.33	105.5
B-19	7.07	32.5
Other	3.34	20
Total	19.74	158

The NLDC led a CLP harvesting effort on other select areas of the Chain. Removal efforts took place in Rest Lake, the Spider-Island Channel, Island Lake, and Stone Lake. A summary of the NLDC-led CLP monitoring and pulling efforts is included in a report authored by NLDC and is included as an appendix to this report.

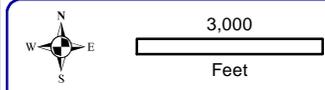
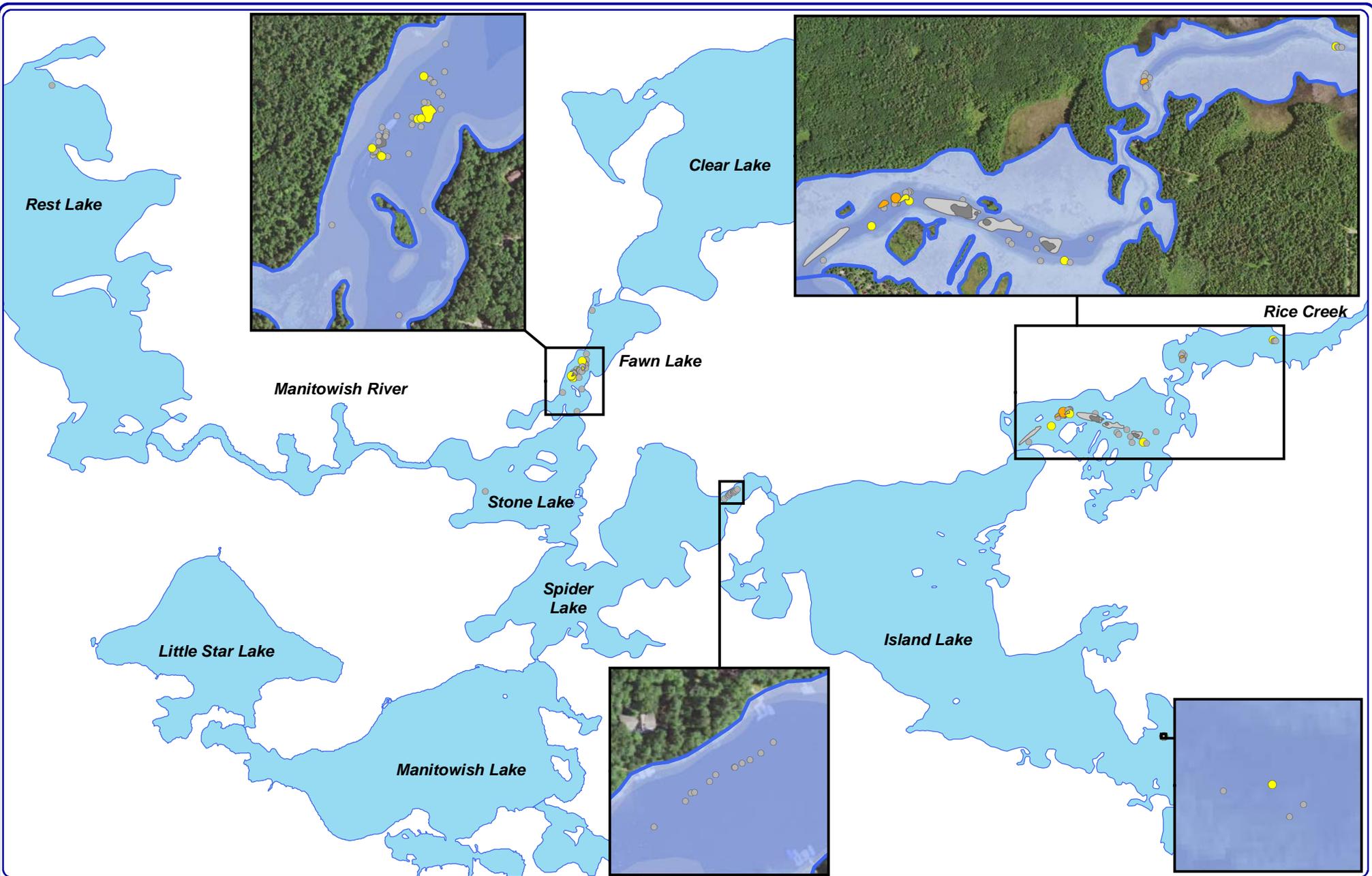
DISCUSSION & CONCLUSIONS

The CLP monitoring surveys completed in 2019 on the Manitowish Chain indicate that the majority of the population is of relatively low densities. A combination of professional and volunteer-based CLP hand-harvesting efforts in recent years has likely helped to maintain the low populations and helped to inhibit CLP from becoming established in new areas of the system. Early detection and swift removal of pioneer CLP plants in the system is critical in limiting the expansion of the species in the Chain. Examples of this point are the fact that no CLP has been located in Manitowish Lake since the discovery and removal of a single plant in 2013. The early indication in Rest Lake also suggests that the timely removal efforts helped to stop CLP from becoming established. Like-wise, harvesting efforts seemed to have helped to maintain a low population in the Spider-Island channel in recent years.

The largest known population of CLP in the Chain remains the unmanaged colonies in Rice Creek. This area has been monitored through mapping surveys in most years since the initial discovery and shows the population fluctuates from year-to-year. The main CLP population in Rice Creek is not scale appropriate for a hand-harvesting based control strategy. The population is simply too large and well established with a significant turion base likely present in the sediments. The amount of effort required to manage this particular population with hand-harvesting is believed to be cost and time prohibitive. An herbicide control strategy would likely be the only management option that could result in CLP control in this area. Controlling CLP in Rice Creek with herbicides was briefly considered in the first few years after the initial discovery, however was never implemented due in part to the fact that wild rice is present in Rice Creek. A few isolated occurrences of CLP upstream of the main colonies in Rice Creek are of a much more reasonable size to be applicable to a potential hand removal effort. Hand harvesting the upstream occurrences might reduce the chances of CLP expanding further within this area of Rice Creek. In the absence of management, the fact remains that the CLP population in Rice Creek functions as a source population for other parts of the Chain as water flows into Island Lake from Rice Creek.

A coordinated hand-harvesting CLP control program is likely the most appropriate form of management to consider once again for 2020. The NLDC is likely to solicit professional CLP hand-harvesting services once again for 2020 in the Chain. Similar to recent years, the harvesting efforts will be based on the results of early season surveys that will be conducted by Onterra or NLDC staff. Based on the 2019 survey and the comments from the professional hand-harvesting firm, consideration for the use of a Diver Assisted Suction Harvest (DASH) will be made for targeting the CLP in Fawn Lake. The DASH methodology is considered a form of mechanical harvesting and thus requires a permit from the WDNR to implement. DASH is thought to be more efficient than traditional harvesting efforts in certain conditions. The DASH operation allows divers to manually feed the harvested plants into a suction hose for delivery to the deck of the harvesting vessel. This allows divers to remain under water for longer periods of time and is thought to help minimize the risk for plant fragmentation. The scattered and dominant CLP colonies mapped in Fawn Lake during 2019 are believed to be good candidates for the use of DASH in 2020 and are included on Map 2 as a preliminary control strategy. Soft sediments in these areas help to achieve complete root extraction and the relatively dense areas allow for minimal need to constantly re-position the DASH vessel.

In 2020, Onterra will survey all of the known CLP lakes in the Chain and NLDC staff will search the remaining areas of the Chain where CLP is not currently known to exist. Specifically, Onterra would survey Rest Lake, the Manitowish River between Rest and Stone, Stone, Fawn, Spider, Island, Rice Creek, and Manitowish Lake. The final 2020 hand-harvesting strategy will be developed following the ESAIS surveys including determining the most appropriate areas to focus professional harvesting actions and any NLDC removal efforts. Following the ESAIS survey, hand-harvesting should occur as early as possible, so that the plants can be removed before they are able to produce and deposit their reproductive structures (turions).



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Sources:
 Roads and Hyrd: WDNR
 Aquatic Plants: Onterra, June 2019
 Map Date: June 27, 2019 JMB
 Filename: Manitowish_CLP_June19.mxd



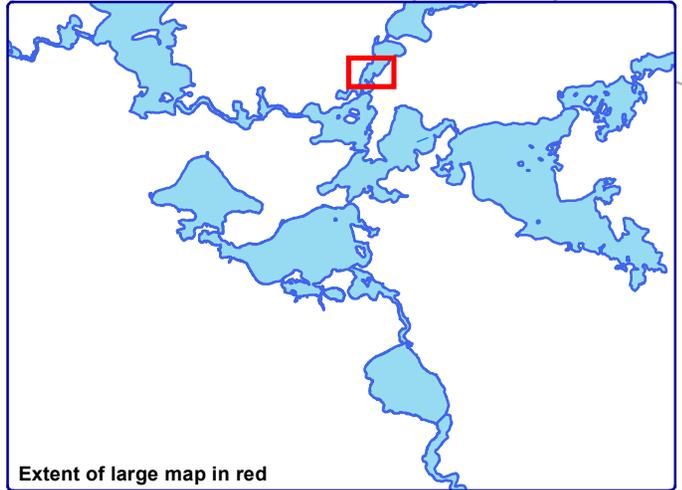
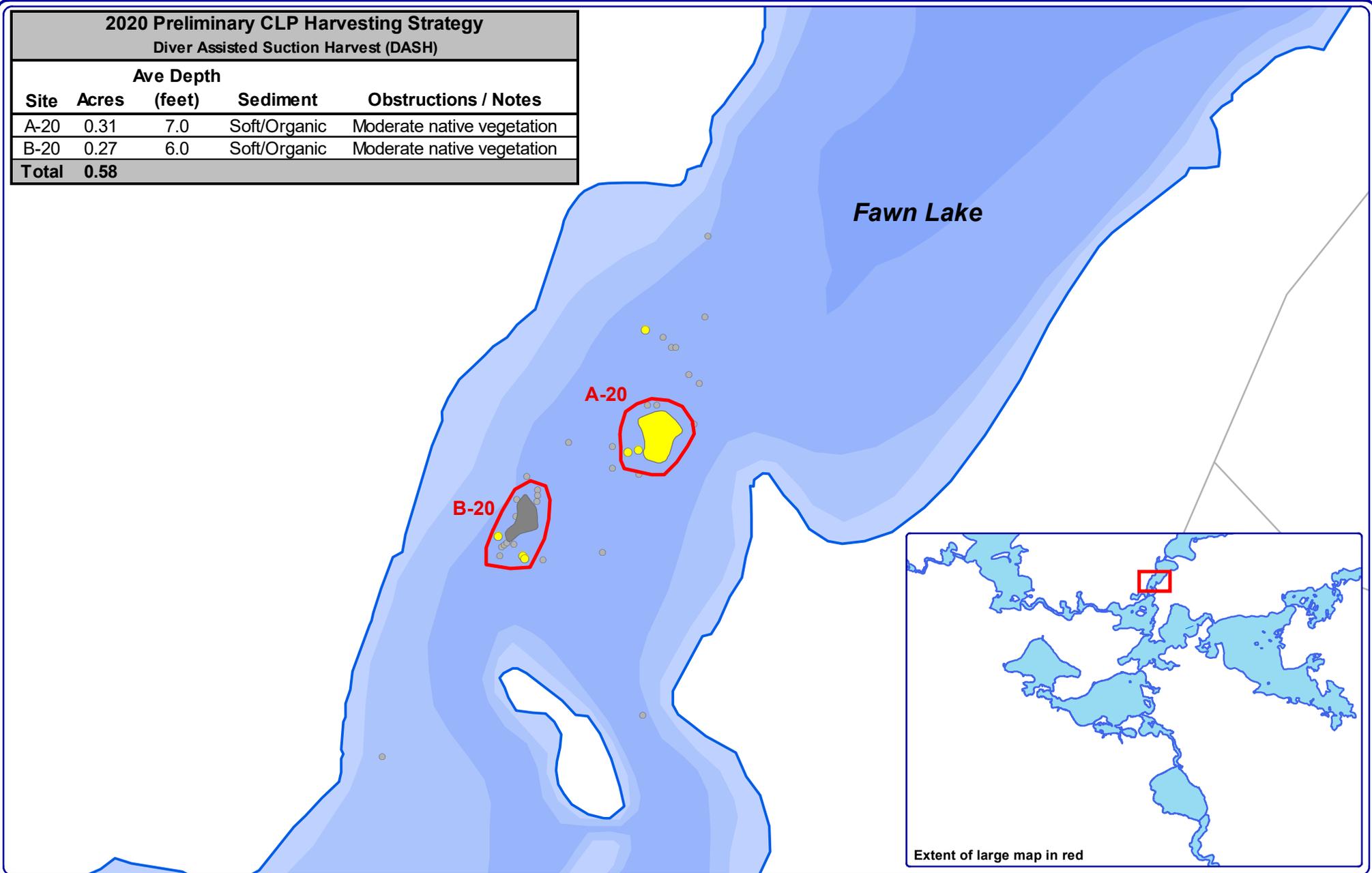
- Curly-leaf Pondweed (June 2019)**
- Highly Scattered
 - Scattered
 - Dominant
 - Highly Dominant
 - Surface Matting
 - Single or Few Plants
 - Clumps of Plants
 - Small Plant Colony

Map 1
 Manitowish Chain of Lakes
 Vilas County, Wisconsin
**June 2019 Curly-leaf
 Pondweed Survey Results**

2020 Preliminary CLP Harvesting Strategy

Diver Assisted Suction Harvest (DASH)

Site	Acres	Ave Depth (feet)	Sediment	Obstructions / Notes
A-20	0.31	7.0	Soft/Organic	Moderate native vegetation
B-20	0.27	6.0	Soft/Organic	Moderate native vegetation
Total	0.58			



250



Feet

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Sources:
 Roads and Hydro: WDNR
 Bathymetry: WDNR, digitized by Onterra
 Aquatic Plants: Onterra, 2019
 Map Date: October 31, 2019 TWH
 Filename: Manitowish_CLP_T2020_DASH_Prelim



Project Location in Wisconsin

Curly-leaf Pondweed (June 2019)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- Preliminary DASH Work Site

Map 2
 Fawn Lake:
 Manitowish Waters Chain
 Vilas County, Wisconsin
**2020 Preliminary CLP
 Control Strategy: DASH**