

INTRODUCTION

The Three Lakes Chain is a flowage covering over 6,100 acres and 23 waterbodies in north-eastern Oneida County, Wisconsin (Figure 1). The chain is partially retained by the Burnt Rollways Dam at the northernmost end of Long Lake. Currently, the Three Lakes Waterfront Association (TLWA), along with partners the Town of Three Lakes, Oneida County, and Wisconsin Department of Natural Resources (WDNR) are pursuing a comprehensive management plan project which aims to complete ecological studies and management plans on all chain lakes over a time span of 2009-2017.

Before and during this planning process, Eurasian watermilfoil (EWM) was discovered on several Three Lakes Chain waterbodies. Eurasian watermilfoil is a non-native species, native to Europe, Asia and North Africa, that has spread to lakes throughout the mid-west. Eurasian watermilfoil is unique in that its primary mode of propagation is not by seed; instead, it spreads by shoot fragmentation, which has supported its transport between lakes via watercraft. In addition to its propagation method, EWM outcompetes native plants by growing early in the spring when water temperatures are too cold for most native plants to grow, and also by creating a canopy that blocks light from reaching native plants. Eurasian watermilfoil can create dense stands and dominate submergent communities, reducing important natural habitat for fish and other wildlife, and impeding recreational activities such as swimming, fishing, and boating.

Eurasian watermilfoil was first found on Virgin Lake during Phase I of the lake management planning project in late summer of 2010. First identified as a roughly 15-ft colony, aggressive efforts have been enacted on Virgin Lake to effectively manage the EWM population. These actions have included volunteer and professional hand-harvesting (2011, 2015-2017), Diver Assisted Suction Harvesting (D.A.S.H., 2014), herbicide treatments (2012, 2013 and 2015) and continued monitoring (2010-present). The monitoring associated with the hand-harvesting conducted in Virgin Lake during 2017 is discussed within this report.

During surveys conducted as a part of the Phase VI studies on Townline Lake, Onterra crews found a single EWM plant in the northeast side of the lake during a June 2015 survey. In August of 2015, WDNR AIS staff visited the lake on a scheduled survey and also located a single EWM plant. Since the initial EWM discovery in Townline Lake, several monitoring surveys were conducted in 2016 with no additional EWM being located. In 2017, monitoring continued on Townline Lake through an early and late-summer mapping survey, the results of which are discussed in this report.

A relatively small EWM population continued to be monitored closely in the channel area of Long Lake below the Burnt Rollways Dam during 2017. The final phase (Phase VIII) of the Three Lakes

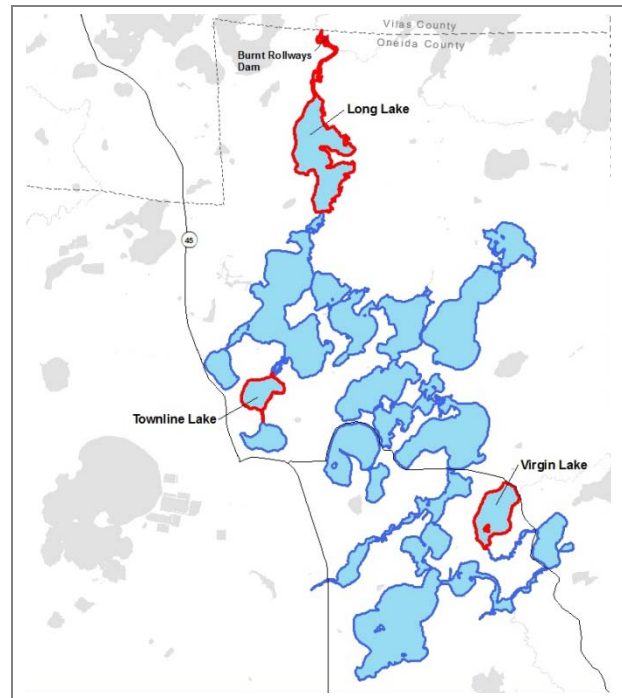


Figure 1. Three Lakes Chain of Lakes, Oneida County, WI.

Chain management planning process began in 2017, with a host of studies being completed on Long Lake including an Early Season AIS survey during which the entire lake was surveyed for AIS and the EWM population was assessed.

This report describes monitoring and control efforts that took place in 2017 on Virgin Lake, Townline Lake and Long Lake with guidance for 2018 actions.

MONITORING METHODOLOGIES

A set of EWM mapping surveys were used within this project to coordinate and qualitatively monitor the hand-harvesting efforts (Figure 2). The first monitoring event in 2017 was the Early Season Aquatic Invasive Species Survey (ESAIS). This late-spring/early-summer survey provides an early look at the lake to help guide the hand-harvesting management to occur on the system. Following the hand-harvesting, Onterra ecologists completed the Late-Summer EWM Peak-Biomass Survey, the results of which serve as a post-harvesting assessment of the hand-removal efforts. The hand-removal program would be considered successful if the density of EWM within the targeted areas was found to have remained approximately the same or decreased from the ESAIS Survey to the Late-Summer Peak-Biomass Survey.

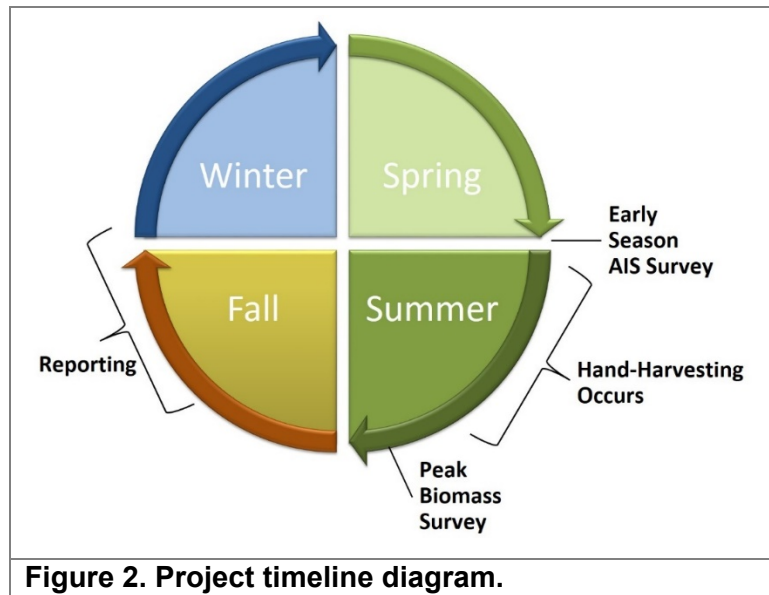


Figure 2. Project timeline diagram.

2017 EARLY SEASON AIS SURVEY (PRE-HAND HARVESTING)

Onterra ecologists completed Early-Season AIS (ESAIS) Surveys on June 19, 2017 on Virgin Lake, June 20, 2017 on Long Lake, and June 27, 2017 on Townline Lake. The EWM population was mapped by using either 1) point-based or 2) area-based methodologies. Large colonies >40 feet in diameter are mapped using polygons (areas) and were qualitatively attributed a density rating based upon a five-tiered scale from *Highly Scattered* to *Surface Matting*. Point-based techniques were applied to EWM locations that were considered as *Small Plant Colonies* (<40 feet in diameter), *Clumps of Plants*, or *Single or Few Plants*.

While EWM is usually not at its peak growth at this time of year, the water is typically clearer during the early summer allowing for more effective viewing of submersed plants, and EWM is often growing higher in the water column than many of the native aquatic plants at that time of year. The locations of EWM occurrences located during early summer are provided to professionals or volunteers to aid in their hand-removal efforts. Additionally, two other exotic plants commonly found in Wisconsin, Curly-leaf pondweed (CLP, *Potamogeton crispus*) and Pale Yellow Iris (*Iris pseudacorus*), are usually at their peak growth stage (or bloom) in early summer.

No EWM was located within the Burnt Rollways channel or anywhere else in Long Lake during the ESAIS survey in which the entire littoral zone of the lake was surveyed. Similarly, no EWM was located anywhere in the littoral areas of Townline Lake during the ESAIS survey.

The ESAIS survey on Virgin Lake found a similar EWM population as in previous surveys with all known occurrences consisting of either *single or few plants* or small *clumps of plants* (Map 1). All known EWM locations identified during the Virgin Lake survey were recommended for removal by professional divers with first priority given to the occurrences described as *clumps of plants*. Onterra provided the spatial data from the survey to the professional hand-harvesting firm to aid in the removal efforts.

2017 HAND-HARVESTING ACTIVITIES

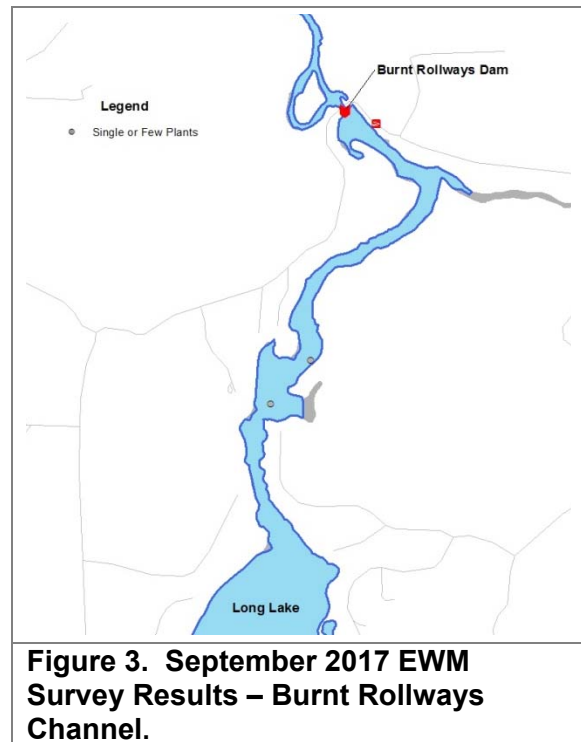
The TLWA adopted a two-tiered hand-harvesting strategy in 2017 utilizing both professional services and a volunteer effort with local divers. The TLWA contracted with Aquatic Plant Management, LLC (APM) to conduct professional hand-harvesting of EWM on Virgin Lake in 2017. Divers from APM visited Virgin Lake on June 27th and July 9th, 2017, and removed approximately 50 cubic feet of EWM from several work areas displayed on Map 1. Of the combined diver hours reported by APM, approximately 4.75 hours consisted of actively removing plants underwater by up to four divers. Details of the harvesting efforts are included in Appendix A along with APM staff comments.

The TLWA has developed a volunteer-based dive team from which greater efforts can be directed at controlling EWM in Virgin Lake as well as in other lakes in the Three Lakes Chain. The AIS Rapid Response Dive Team includes trained volunteer SCUBA divers that deploy from a dedicated TLWA pontoon boat. The Dive Team made two dives in Virgin Lake during 2017 and utilizing EWM coordinates provided by Onterra as well as buoys placed by volunteers, were able to harvest approximately 30 gallons of EWM from the lake. Additional information pertaining to the TLWA AIS Rapid Response Dive Team may be found on the association website at <http://tlwa.org/>.

2017 LATE-SUMMER EWM PEAK-BIOMASS SURVEY RESULTS (POST-HAND HARVESTING)

Onterra ecologists completed the Late-Summer EWM Peak-Biomass Survey on Virgin, Townline and the Long Lake Channel on September 6th & 8th, 2017. The entire littoral area of Townline Lake was surveyed during the September visit and no EWM was located in the lake. In the Long Lake channel below the dam, two individual EWM plants were located. (Figure 3). The coordinates of these occurrences were provided to the TLWA following the survey for integration into their GPS.

During the late-summer survey on Virgin Lake, the EWM population was found to be similar to the ESAIS Survey, with a relatively low population consisting of *Clumps of Plants* or *Single or Few Plants*. No large colonies that required area-based mapping were located anywhere in the lake. The majority of plants were again located along the northern shoreline, and in the southern portion of the lake near the island (Map 1). Within areas that were targeted for removal by APM, the EWM population was either lower or approximately the same as in the June survey (Map 1). Notably, several clumps of plants identified during the June survey were either completely removed or reduced to single or few plants after the harvesting efforts (Map 1).



CONCLUSIONS AND DISCUSSION

Professional monitoring surveys conducted in 2017 did not locate any EWM within Townline Lake and no EWM has been observed in the lake since 2015. It is possible that a small amount of EWM may be present in the lake in such low levels that it escapes detection. Continued monitoring in Townline Lake will be important to address any new EWM occurrences so that the population can be stopped from becoming established in the lake. Monitoring within the Long Lake channel below the dam found minimal EWM in 2017 with just two single plants located during the September survey. Future monitoring and removal actions in this area will help to contain this population as well.

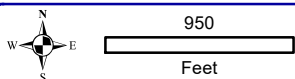
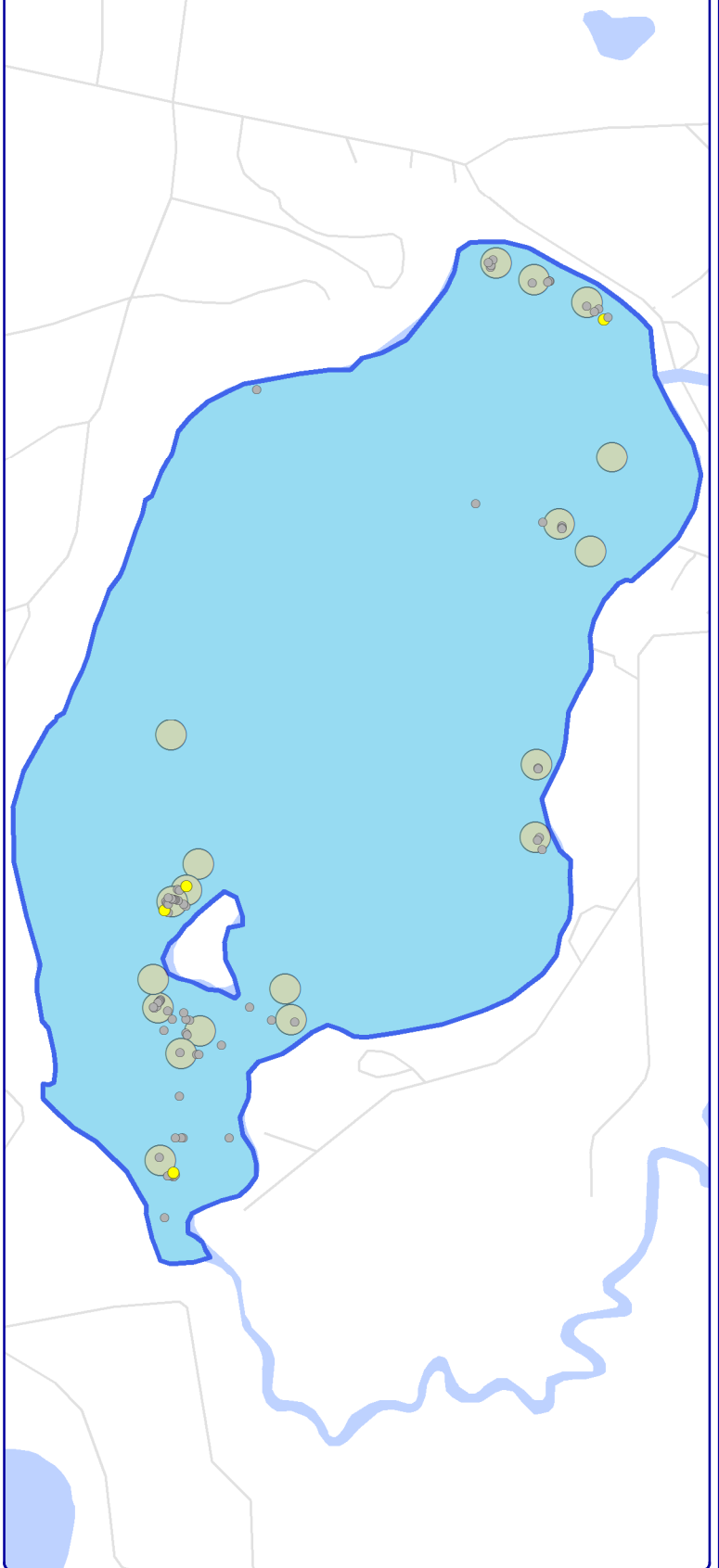
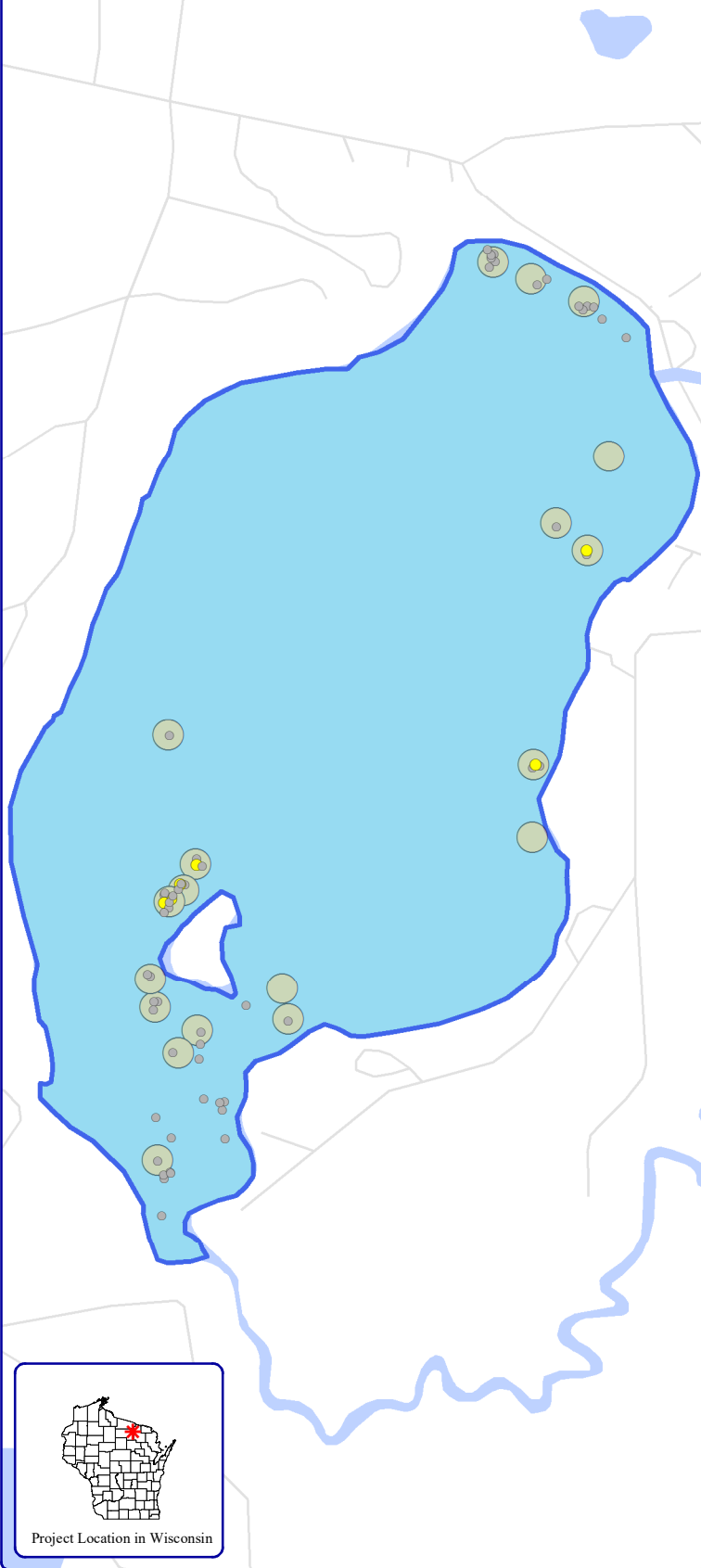
Professional hand-harvesting was implemented in several recent years on Virgin Lake with varying amounts of effort each year. Additional harvesting efforts were undertaken by the TLWA Dive Team in 2017 on Virgin Lake. Over the course of this project the EWM population in Virgin Lake has been relatively stable and kept at a low density lake-wide. It is likely that these efforts have worked to slow the spread and contain the EWM population within Virgin Lake. The known density and distribution of EWM in Virgin Lake is considered to be low and at current, the EWM population is likely not causing any negative ecological impacts within the lake. It will be important for the TLWA and Virgin Lake property owners to continue monitoring of EWM populations in Virgin Lake.

Funding is in place for professional EWM monitoring activities in Virgin Lake in 2018 from a December 2016 WDNR AIS Education, Planning and Prevention grant. Similar to recent years, this includes an ESAIS survey and late-summer EWM mapping survey. Hand-harvesting actions led by the TLWA Dive Team will occur following the early-summer ESAIS survey. Onterra will send the spatial data from the June 2018 EWM mapping survey to the TLWA for uploading onto their Garmin GPS unit.

The TLWA has applied for a WDNR grant during the December 2017 cycle which includes cost coverage for additional monitoring activities on Virgin, Long and Townline Lakes through 2020. The project would also allow for guidance and monitoring specific to the volunteer hand-harvesting efforts of the new Three Lakes Chain AIS rapid response team formed in 2016. By the end of this three-year project, the response team would be efficient, effective, and self-supporting. An ESAIS survey would be conducted during June of each year to produce the mapping data needed to guide volunteer hand-harvesting strategies during the summer. After hand-harvesting activities are completed, a Late-Season EWM Peak-Biomass mapping survey would be conducted to evaluate the control activities, understand the EWM population lake-wide, and guide further management guidance.

June 2017 ESAIS Survey Results

September 2017 Survey Results



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Sources:
 Roads and Hydro: WDNR
 Aquatic Plants: Onterra, 2017
 Map Date: January 24, 2018
 Filename: Virgin_EWM_June17-Sept17.mxd

Legend

- | | | | |
|--|-------------------------|--|-----------------------------------|
| | Highly Scattered (None) | | Single or Few Plants |
| | Scattered (None) | | Clumps of Plants |
| | Dominant (None) | | Small Plant Colony (None) |
| | Highly Dominant (None) | | Professional Harvesting Work Area |
| | Surface Matting (None) | | |

Map 1
 Virgin Lake
 Oneida County, Wisconsin
2017 EWM
Survey Results