INTRODUCTION

The Unified Lower Eagle River Chain of Lakes Commission (ULERCLC) successfully applied for a Wisconsin Department of Natural Resources (WDNR) Aquatic Invasive Species (AIS) Control Grant in August of 2011 to complete the fifth phase of a project aimed at reducing the Eagle River Chain's Eurasian water milfoil (EWM) infestation to manageable levels. This report discusses the fifth year of treatment under this grant-funded AIS control and prevention project. The chain-wide results will be presented first followed by results from each lake individually. Additional information regarding the treatments completed in 2008-2011 can be found in their respective reports. A separate report (available by February 2013) describes complete native aquatic vegetation inventories from whole-lake point-intercept surveys that were conducted on all ten lakes within the Eagle River Chain in 2012. Additionally, the report compares the 2012 aquatic plant inventories with similar assessments that were carried out in 2006 as part of a chain-wide lake management planning project.

Herbicide Control of Aquatic Invasive Plants

As a part of the current project, strategic herbicide treatments have been conducted on the Eagle River Chain since 2008 in an effort to control EWM. Herbicides that target submersed plant species are directly applied to the water, either as a liquid or an encapsulated granular formulation. Factors such as water depth, water flow, treatment area size, and plant density work to dilute herbicide concentration within aquatic systems. Understanding concentration-exposure times is an important consideration for aquatic herbicides. Successful control of the target plant is achieved when it is exposed to a lethal concentration of the herbicide for a specific duration of time. Much information on this issue has been gathered in recent years, largely as a result of a joint research project between the WDNR and US Army Corps of Engineers (USACE). Based on their preliminary findings, lake managers have adopted two main treatment strategies: 1) whole-lake treatments, and 2) spot treatments.

Whole-lake treatments are those where the herbicide is applied to specific sites, but when the herbicide reaches equilibrium within the entire volume of water (of the lake, lake basin, or within the epilimnion of the lake or lake basin); it is at a concentration that is sufficient to cause mortality to the target plant within that entire lake or basin. The application rate of whole-lake treatments is dictated by the volume of water in which the herbicide will reach equilibrium with. The target herbicide concentration for EWM treatments is typically between 0.225 and 0.350 parts per million (ppm) acid equivalent (ae) when exposed to the target plants for 7-14 days or longer. However, these same rates have been shown to impact some native plant species, particularly dicot species, some thin-leaved pondweeds, and naiad species. This strategy was implemented with success in 2010 on Scattering Rice Lake.

Spot treatments are a type of control strategy where the herbicide is applied to a specific area (treatment site) such that when it dilutes from that area, its concentrations are insufficient to cause significant effects outside of that area. This is the strategy that has historically and is currently being implemented on areas of EWM within the Eagle River Chain of Lakes. Spot treatments typically rely on a short exposure time (often hours) to cause mortality and therefore are applied at a much higher herbicide concentration than whole-lake treatments. For EWM, 2,4-D is typically applied between 2.25 and 4.0 ppm ae in spot treatment scenarios. A newly adopted term, 'micro-treatments' is being used to describe very small spot treatments (working definition is less than 5 acres). Because of their small size, it is extremely difficult to predict treatment effectiveness due to rapid dilution of the herbicide. Larger treatment areas tend to be able to hold effective concentrations for a longer time.

EAGLE RIVER CHAIN PRE-TREATMENT STUDIES

Following the 2011 peak-biomass survey, conditional treatment permit maps were created proposing 37.8 total acres of treatment on Cranberry, Catfish, Eagle, Otter, Yellow Birch, and Watersmeet Lakes (Table 1). It was determined that Duck and Lynx Lakes did not hold sufficient populations of EWM to warrant treatment. On April 25 and 26, 2012, Onterra staff visited the Eagle River Chain to survey the proposed treatment areas and refine their boundaries as appropriate, primarily through the use of a submersible video camera. As a result of the spring pre-treatment survey, the treatment strategy was increased to 40.2 acres in five of the six lakes slotted for treatment (Table 1). Several EWM colonies in Watersmeet Lake were removed from the treatment strategy due to concerns of their proximity to populations of wild rice.

Table 1. Eagle River Chain 2012 EWM Treatment Acreage.

Lake	Proposed Acres	Permit Acres
Catfish	6.2	9.4
Cranberry	6.8	8.4
Duck	-	-
Eagle	7.3	8.7
Lynx	-	-
Otter	1.5	2.2
Scattering Rice	-	-
Voyageur	-	-
Watersmeet	12.2	5.6
Yellow Birch	3.8	5.9
All Waterbodies	**37.8**	**40.2**

During this survey, temperature, dissolved oxygen, and pH profiles were also collected from areas in Cranberry, Catfish, Eagle, Otter, Yellow Birch and Watersmeet Lakes (Figure 1). Surface water temperatures ranged from 49°F to 51°F, and dissolved oxygen was greater than 9.6 mg/L at all depths sampled. Surface pH values ranged from 7.9 in Watersmeet Lake to 9.1 in Cranberry Lake (Figure 1).

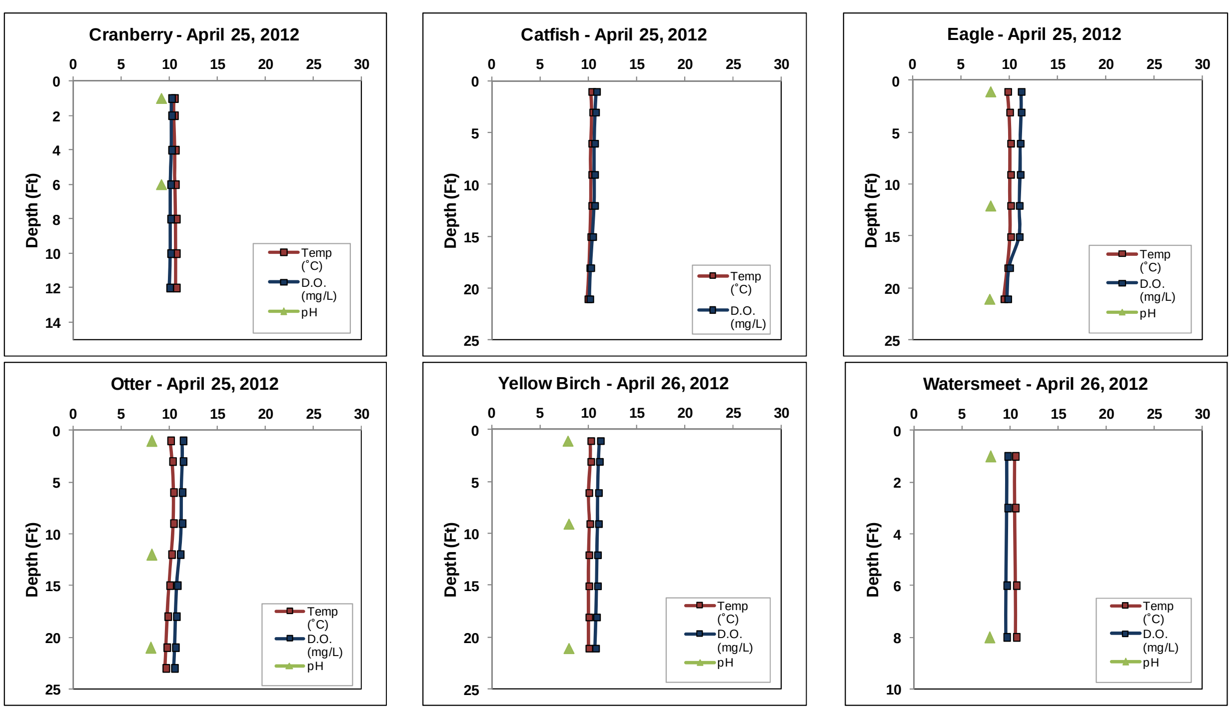


Figure 1. Temperature, dissolved oxygen, and pH profiles collected on six lakes in the Eagle River Chain. Collected April 25 & 26, 2012.

In 2010, both liquid and granular 2,4-D formulations were applied to EWM on the Eagle River Chain. Liquid 2,4-D (amine) was used in a large-scale treatment on Scattering Rice Lake while granular 2,4-D (ester) was applied to smaller treatment areas throughout the rest of the chain. Both strategies were shown to be successful at reducing the density and occurrence of EWM. No large-scale liquid treatments were proposed for 2011 or 2012. The strategy employed in 2012 involved spot-treatments on colonized EWM within six Eagle River Chain lakes, utilizing the granular form of 2,4-D.

While past successes were yielded using Navigate® (ester), the re-registration of this herbicide now accompanies a 1-day swimming restriction. Primarily for that reason, the ULERCLC decided that Sculpin G® (amine) would be the 2,4-D product used for the 2012 spot treatments. On May 9 and 10, 2012, the treatment sites were applied with Sculpin G® (SePRO) by Schmidt's Aquatic Plant Control at a rate to achieve target concentrations of 2.0 to 3.5 ppm ae. The applicator reported the following wind conditions: May 9 – calm, winds 0 to 10 mph and May 10 – calm, winds 0 to 5 mph.

2012 Treatment Monitoring

The goal of herbicide treatments is to maximize target species (EWM) mortality while minimizing impacts to valuable native aquatic plant species. Monitoring herbicide treatments and defining their success incorporates both quantitative and qualitative methods. As the name suggests, quantitative monitoring involves comparing number data (or quantities) such as plant frequency of occurrence before and after the control strategy is implemented. Qualitative monitoring is completed by comparing visual data such as EWM colony density ratings before and after the treatments.

EWM treatment quantitative evaluation methodologies follow WDNR protocols in which point-intercept data are collected within treatment areas before and after the treatment. On the Eagle River Chain of Lakes, data of this type was collected at over 360 point-intercept sub-sample locations during the summer of 2012 (Figure 2). However, not all of those points were located within the areas where herbicide was directly applied and therefore not all points are used in the analysis of the 2012 treatment.

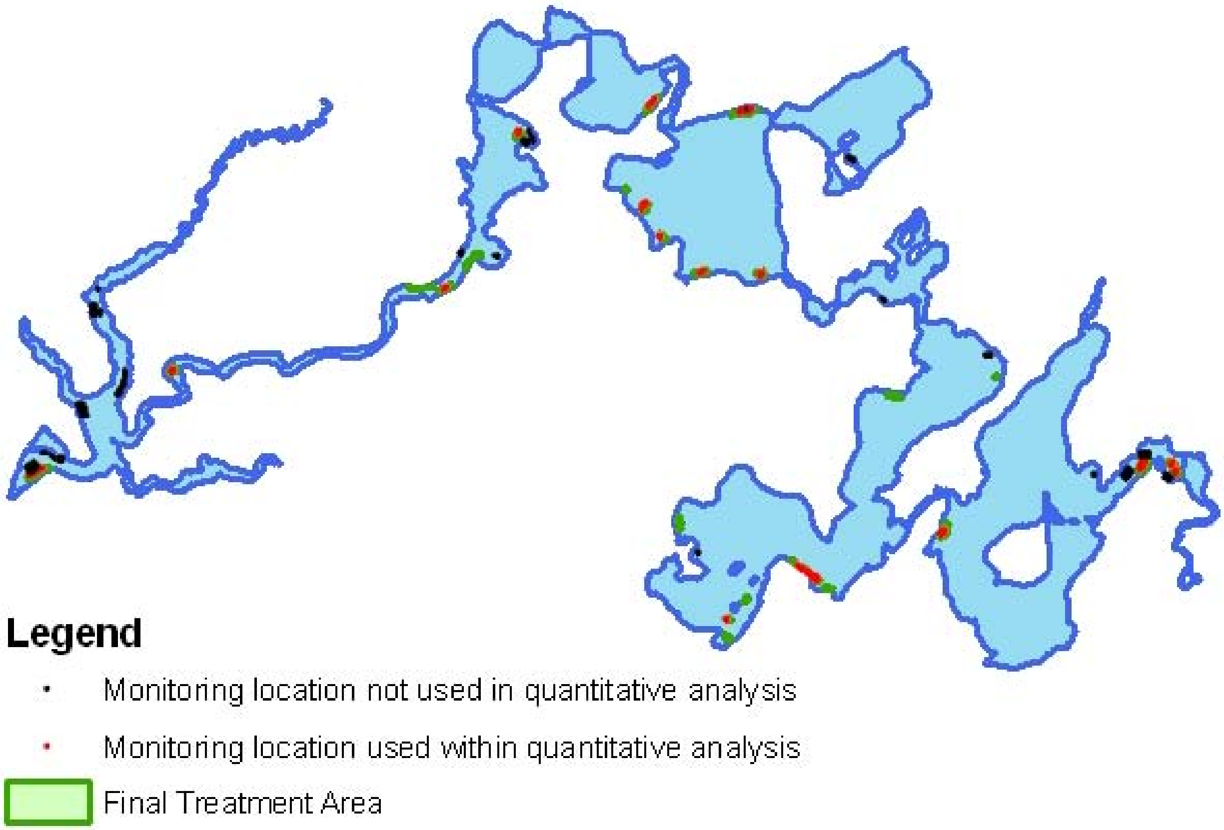


Figure 2. 2012 Quantitative monitoring plan for the Eagle River Chain of Lakes

The most comparative sub-sample data are those collected both the summer before (2011) and the summer immediately following the herbicide treatment (2012). On the Eagle River Chain of Lakes, 102 point-intercept sub-sample locations fell into this category (Figure 2). At these sampling locations, EWM and native aquatic plant species presence and rake-fullness (on a scale of 0 to 3) were documented along with water depth and substrate type. Specifically, these surveys aim to determine if significant differences in frequencies of occurrence and density of EWM and native species occur following the herbicide application.

Quantitatively, a specific treatment site is deemed to be successful if the EWM frequency following the treatments exhibits a statistically valid reduction by at least 50%. Evaluation of treatment-wide effectiveness follows the same criteria based upon pooled sub-sample data from all of the treatment sites. Further, a noticeable decrease in rake-fullness ratings within the fullness categories of 2 and 3 should be observed. Preferably, there would be no rake tows exhibiting a fullness of 2 or 3 during the post treatment surveys.

Spatial data reflecting EWM locations were collected using a sub-meter Global Positioning System (GPS) during the late summers of 2011 and 2012, when this plant is assumed to be at its peak-biomass or growth stage. Comparisons of these surveys are used to qualitatively evaluate the 2012 herbicide treatment on the Eagle River Chain. Qualitatively, a successful treatment on a particular site would include a reduction of EWM density as demonstrated by a decrease in density rating (e.g. highly dominant to dominant). In terms of a treatment as a whole (lake-wide), at least 75% of the acreage treated that year would decrease by one level of density as described above for an individual site.

Although it is never the intent of the treatments to impact native species, it is important to remember that in spot treatment scenarios, these non-target impacts can only be considered in the context of the areas treated and not on a lake-wide basis. In other words, the impact of the treatments on a non-target species in the treatment areas cannot be extrapolated to the entire population of that plant within the lake, unless the plant species is only found in locations where the herbicide applications took place. While product labeling indicates that 2,4-D is selective towards broad-leaf (dicot) species at the concentration and exposure times used during the 2012 treatment on the Eagle River Chain of Lakes, emerging research from the WDNR and USACE state that some narrow-leaf (monocot) species are also be impacted by this herbicide.

2012 Chain-wide Treatment Summary and Conclusions

Post treatment surveys were completed on the Eagle River Chain by Onterra on August 21, 22, 23 and 29, 2012. Over the course of annual treatments from 2007 to 2012, EWM colonial acreage has been reduced by 69% from 278.2 acres in 2007 to 86.4 acres in 2012. EWM density also decreased markedly over this period, from EWM mainly comprised of dominant, highly dominant, and surface matted areas in 2007 to scattered and highly scattered areas in 2012 (Figure 3).

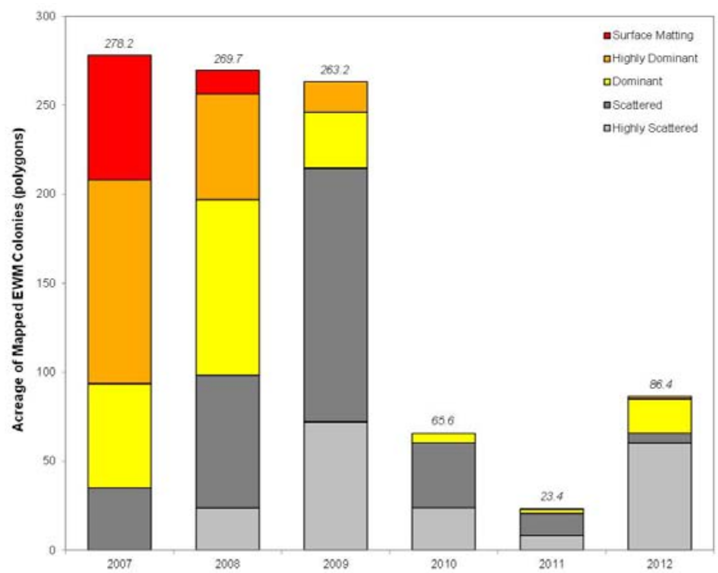


Figure 3. Acreage of mapped EWM colonies on the Eagle River Chain of Lakes from 2007-2012.

Chain-wide, approximately 90% of the EWM acreage treated in 2012 was reduced by at least one density rating, exceeding the qualitative success criteria (75% reduction). While Figure 3 shows that EWM acreage increased from 23.4 to 86.4 acres from 2011 to 2012, the majority of this acreage was comprised of areas of EWM that were not treated in 2012. In addition, this increase in EWM acreage in 2012 was not evenly spread across the chain as Figure 4 illustrates. Nearly 100% of the 63-acre increase in EWM in 2012 within the Eagle River Chain was located in Cranberry Lake and Watersmeet, while the EWM acreage within the other eight lakes remained virtually the same from 2011.

The EWM located in Cranberry Lake and Watersmeet in 2012 were largely new occurrences or colonial expansion from pre-existing colonies, some of which were targeted unsuccessfully in 2012. Of the 86.4 acres of EWM mapped in 2012, approximately 87% are located within Cranberry Lake and Watersmeet (Figure 4). The EWM in both of these lakes resides in areas with higher water exchange rates, making it more difficult to attain adequate herbicide concentration-exposure times to cause significant EWM mortality. In addition, the early ice-out and very warm temperatures in 2012 created very conducive conditions for the growth and

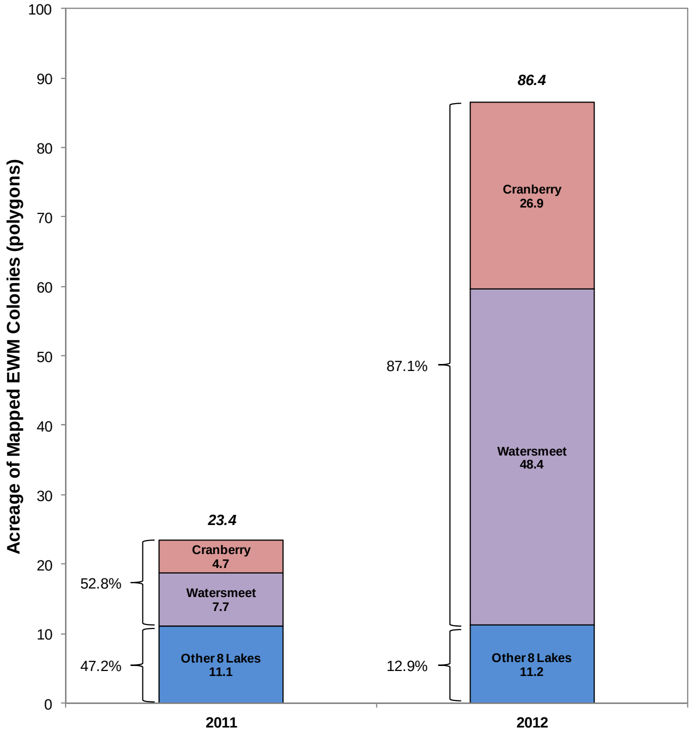


Figure 4. Acreage of mapped EWM colonies on the Eagle River Chain of Lakes, 2011 and 2012.

colonization of EWM. Colonization success rates of fragments dispersed in 2011 were likely higher due to the longer growing season and unusually warm weather in 2012, leading to a higher number of new areas of EWM.

During the summer of 2011, 11 (11%) of the 100 point-intercept locations within the 2012 treatment areas contained EWM compared to 22 (22% of 102 sample locations) in 2012, representing a statistically valid increase in occurrence of 96%, and not meeting the chain-wide quantitative success criteria (50% reduction in occurrence) (Figure 5). However, as will be discussed in the individual lake sections, most of this increase in EWM occurrence was within Cranberry Lake and Watersmeet. Of the 22 point-intercept locations that contained EWM in 2012, 18 of them were located in either Cranberry Lake or Watersmeet.

Individually, Watersmeet Lake was the only lake to show a statistically valid increase in EWM occurrence in 2012, while the increase observed in Cranberry Lake was not statistically valid (Figure 5). Catfish and Yellow Birch Lakes experienced decreases in EWM frequency of occurrence; these values were not statistically valid likely due to a small sample size (Yellow Birch Lake) or relatively low occurrences of EWM (Catfish Lake). Otter Lake could not be statistically analyzed due to insufficient point-intercept sampling size. On Eagle Lake no EWM was detected on 24 (2011) and 26 (2012) sub-sampling point intercept locations so therefore a statistical analysis could not be conducted.

A rake-fullness rating of 0-3 was used to determine the abundance of EWM at each of the 100 (2011) and 102 (2012) point-intercept locations. Figure 6 displays the chain-wide proportions of EWM rake-fullness ratings from the pre- and post-treatment surveys. Rake tows resulting in no incidence of EWM fell from 89% in 2011 to 78% in 2012, while increases in the number of rake fullness ratings of 1 and 2 increased between these two surveys. No occurrences of the top level rake fullness rating (3) were recorded in 2011 or 2012.

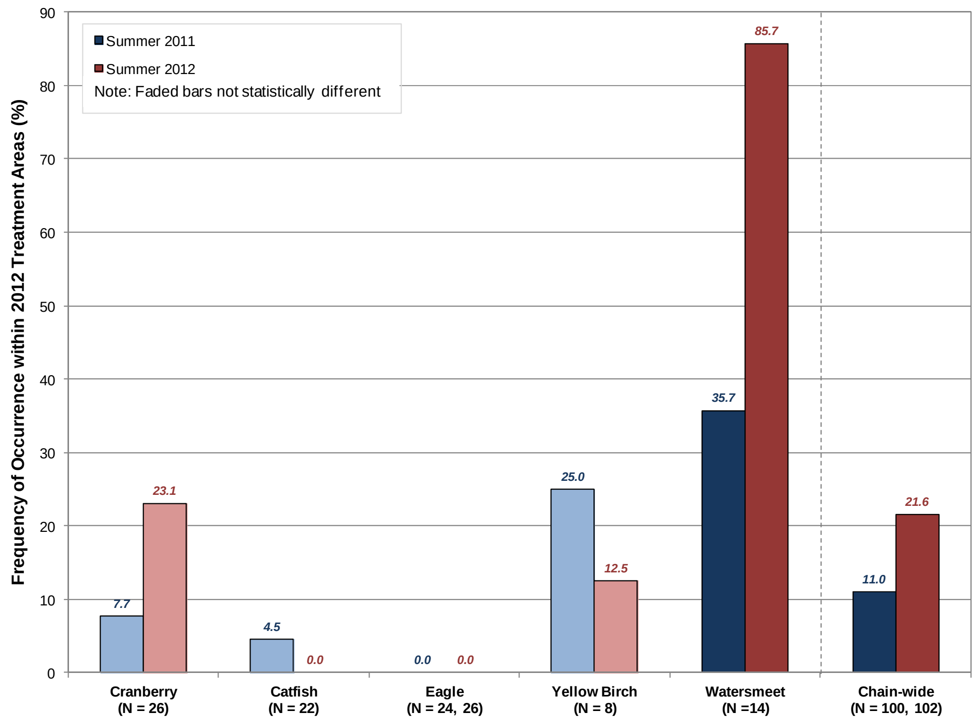


Figure 5. Eagle River Chain EWM percent occurrence in point-intercept locations, 2011 and 2012. Due to its small treatment area, Otter Lake did not have a sufficient sample size and is not graphed, while no treatments occurred on Duck and Lynx Lakes in 2012.

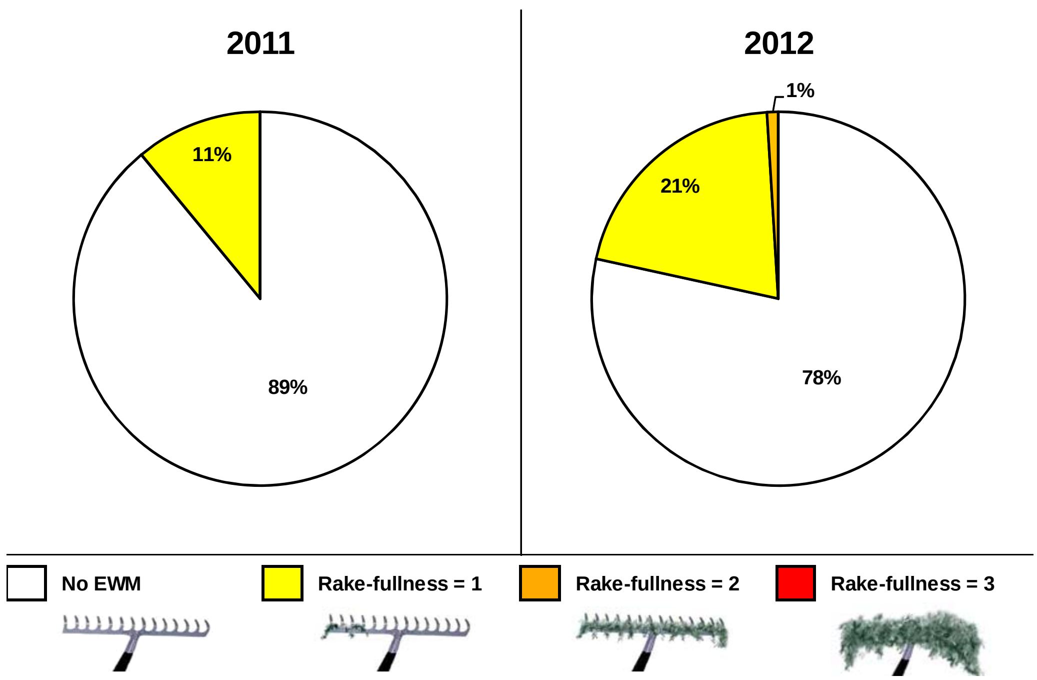


Figure 6. Eagle River Chain chain-wide proportions of EWM rake-fullness ratings. Data is derived from 100 pre-treatment (2011) and 102 post-treatment (2012) point-intercept sub-sampling locations within 2012 treatment areas.

Data concerning native aquatic plant species were also collected at the same point-intercept locations during the summers of 2011 and 2012. Table 2 shows that within the 2012 treatment areas, no native species exhibited statistically valid reductions in occurrence following the 2012 treatment, and seven native species actually saw statistically valid increases in occurrence. In fact, Onterra ecologists observed abundant native aquatic plant growth within the Eagle River Chain in 2012, and lake residents also noticed this increased growth. As discussed previously, the weather in 2012 was very conducive for supporting high levels of aquatic plant growth, and Onterra ecologists saw higher-than-normal plant growth on most of their project lakes in northern Wisconsin. Like EWM, native dicot species are particularly susceptible to 2,4-D herbicide applications; however, no dicot species exhibited statistically valid reductions in occurrence following the 2012 treatment (Table 2). Efforts are taken to minimize impacts to these species by applying herbicides early in the spring before these plants are actively growing.

Table 2. Statistical comparison of native aquatic plant frequency within 2012 treatment areas from 2011 pre- and 2012 post-treatment surveys on the Eagle River Chain. Only species with greater than 5.0% frequency of occurrence in at least one of the two surveys are applicable for analysis.

	Scientific Name	Common Name	2011 FOO	2012 FOO	Percent Change	Direction	Chi-square Analysis Statistically Valid	Chi-square Analysis p-value
Dicots	*Myriophyllum spicatum*	Eurasian water milfoil	11.0	21.6	96.1	▲	Yes	0.042
	Ceratophyllum demersum	Coontail	25.0	36.3	45.1	▲	No	0.082
	Nuphar variegata	Spatterdock	5.0	6.9	37.3	▲	No	0.576
	Brasenia schreberi	Watershield	4.0	5.9	47.1	▲	No	0.537
	Myriophyllum sibiricum	Northern water milfoil	4.0	6.9	71.6	▲	No	0.370
	Nymphaea odorata	White water lily	2.0	4.9	145.1	▲	No	0.260
Non-dicots	*Elodea canadensis*	Common waterweed	20.0	47.1	135.3	▲	Yes	0.000
	Potamogeton zosteriformis	Flat-stem pondweed	5.0	13.7	174.5	▲	Yes	0.034
	Potamogeton pusillus	Small pondweed	4.0	29.4	635.3	▲	Yes	0.000
	Potamogeton spirillus	Spiral-fruited pondweed	3.0	11.8	292.2	▲	Yes	0.018
	Potamogeton vaseyi	Vasey's pondweed	1.0	7.8	684.3	▲	Yes	0.018
	Nitella spp.	Stoneworts	0.0	9.8	100.0	▲	Yes	0.001
	Najas flexilis	Slender naiad	0.0	35.3	100.0	▲	Yes	0.000
	Vallisneria americana	Wild celery	29.0	42.2	45.4	▲	No	0.051
	Potamogeton robbinsii	Fern pondweed	24.0	17.6	-26.5	▼	No	0.266
	Potamogeton richardsonii	Clasping-leaf pondweed	8.0	12.7	59.3	▲	No	0.269
	Potamogeton epihydrus	Ribbon-leaf pondweed	6.0	2.0	-67.3	▼	No	0.141
	Potamogeton amplifolius	Large-leaf pondweed	3.0	5.9	96.1	▲	No	0.321

2011 N = 100, 2012 N = 102
FOO = Frequency of Occurrence
▲ or ▼ = Change Statistically Valid (Chi-square; α = 0.05)
▲ or ▼ = Change Not Statistically Valid (Chi-square; α = 0.05)

As discussed earlier, the changes in native species' occurrences from pre- and post-treatment can only be considered in the context of the areas treated and not extrapolated to a lake-wide basis. To determine if the annual herbicide treatments are impacting native plant species on lake-wide levels, whole-lake point-intercept surveys would need to be conducted on each lake within the chain. These studies were completed in 2006 by Northern Environmental, Inc. and were replicated again in 2012 by Onterra, LLC. Analyses describing any changes in the aquatic plant community of the Eagle River Chain are discussed thoroughly within a separate report that will be available in February 2013.

2013 CHAIN-WIDE TREATMENT STRATEGY

While the acreage and occurrence of EWM increased within the Eagle River Chain in 2012, as discussed earlier, most of this increase was within Cranberry Lake and Watersmeet. Overall, the 2012 treatment on the Eagle River Chain was very successful, with 90% of the acreage treated being reduced in density by at least one density rating. Qualitatively, EWM was reduced within treatment areas in four of the six lakes (Catfish, Eagle, Otter and Yellow Birch Lakes). Quantitatively, EWM was reduced in two of six lakes (Catfish and Yellow Birch), while a small sample size and lack of EWM presence hindered quantitative analyses on two other lakes (Eagle and Otter). In these

The substantial increases of EWM within Cranberry and Watersmeet Lakes includes EWM populations that were not targeted for treatment in 2012 and expansion of areas that were treated in 2012 that were met with limited success. These two lakes hold EWM populations in locations with similar morphology; narrow, corridor-like channels that have greater flow than the open spacious areas of lakes such as Eagle, Scattering Rice, Otter, etc. Thus, dilution of herbicide occurs at a faster rate than in areas where less flow exists. This problem is exacerbated when relatively small treatment areas are targeted.

For 2013, it is recommended that approximately 116.2 acres of EWM within the Eagle River Chain be targeted for herbicide control strategies (Table 3). The majority of this acreage can be found on Cranberry and Watersmeet Lakes. On these larger treatment areas, it is recommended that a liquid formulation of 2,4-D be applied. Because of the size of each treatment area, the concentration should hold for a sufficient amount of time to impact EWM. A benefit of using liquid 2,4-D is that the ULERCLC will see a drastic decrease in the cost of herbicide application at these locations. And, as discussed further in the next paragraph, increasing the concentration of herbicide within these treatment areas will be critical in achieving success in these high flow systems.

Table 3. Proposed 2013 EWM treatment acreage for the Eagle River Chain.

Lake	Proposed Acres
Catfish	4.5
Cranberry	34.3
Duck	-
Eagle	0.7
Lynx	-
Otter	-
Scattering Rice	1.6
Voyageur	1.2
Watersmeet	62.0
Yellow Birch	11.9
All Waterbodies	**116.2**

On most of the Eagle River Chain of Lakes, the EWM population has reached a point at which some of the herbicide application areas are too small to consistently predict if they will cause EWM mortality. As indicated earlier, it is extremely difficult in micro-treatment scenarios to keep a sufficient herbicide concentration exposed to the target plants long enough to be effective. Therefore, potential treatment sites less than 0.5 acres were not proposed for treatment due to their extremely small size and lack of probable success. Also, almost all proposed treatment areas include an expanded buffer (40 feet) as well as a higher granular 2,4-D application rate. In general, treatment sites greater than 1 acre are poposed for treatment at 3.0 ppm ae, whereas treatment sites less than one acre will be targeted at 3.5 ppm ae. For sites receiving a liquid dose of 2,4-D, an application rate of 3.0 ppm ae is proposed.

As mentioned in previous reports, one of the greatest successes of the Eagle River Chain control program is the commitment by volunteers. Some volunteers aid in coordination of the project, some provide data to the professional ecologists relating to EWM occurrences, some conduct EWM hand-removal, and others work to educate other stakeholders on the importance of aquatic invasive species and the Eagle River Chain system. Continued volunteer commitment will be needed for long-term success to continue.

Starting in 2013, the Eagle River Chain of Lakes Association (ERCLA) will be entering into a phased project that would produce a Comprehensive Lake Management Plan for the chain. As a portion of this project, the volunteer EWM monitoring program would be refreshed based upon the successes and shortfalls identified over the course of multi-year control project.

CRANBERRY LAKE SUMMARY AND CONCLUSIONS

Approximately 8.4 acres of EWM were treated in Cranberry Lake in 2012 with granular 2,4-D (Sculpin G®) at 2.5 ppm ae (Map Cran 1). Following the treatment, Cran A-12 experienced a full density reduction of EWM while increases in EWM density were observed in the two other treatment sites (Map Cran 2). In the summer of 2011, 7.7% of the 26 point-intercept locations within the 2012 treatment areas contained EWM compared to 23.1% in 2012 (Table 4). Despite this dramatic increase, statistical analysis shows that this change is not valid at the predetermined confidence level ($\alpha = 0.05$).

Data concerning native aquatic plant species within the 2012 treatment areas indicate that ribbon-leaf pondweed exhibited a statistically valid reduction in occurrence following the treatment (Table 4). Several species, including a Wisconsin species of special concern (Vasey's pondweed) exhibited statistically valid increases in their occurrence. Unlike EWM, ribbon-leaf pondweed is a non-dicot is not thought to be sensitive to dicot selective herbicides. However, emerging data gathered from lakes since 2010 with similar treatments indicate that some non-dicot species may be prone to decline after a treatment. As discussed earlier, the declines observed to native species within the treatment areas cannot be extrapolated to the entire lake-wide population. A lake-wide assessment of aquatic plants between 2006 and 2012 in Cranberry Lake is discussed in a separate report.

Table 4. Statistical comparison of aquatic plant frequency data within 2012 treatment areas on Cranberry Lake from 2011 pre- and 2012 post-treatment surveys. Only species with greater than 5.0% frequency of occurrence in at least one of the two surveys are applicable for analysis.

	Scientific Name	Common Name	2011 FOO	2012 FOO	Percent Change	Direction	Chi-square Analysis	
							Statistically Valid	p-value
Dicots	*Myriophyllum spicatum*	Eurasian water milfoil	7.7	23.1	200.0	▲	No	0.124
	Ceratophyllum demersum	Coontail	19.2	30.8	60.0	▲	No	0.337
	Nuphar variegata	Spatterdock	7.7	11.5	50.0	▲	No	0.638
	Brasenia schreberi	Watershield	3.8	7.7	100.0	▲	No	0.552
Non-dicots	*Potamogeton epihydrus*	Ribbon-leaf pondweed	23.1	3.8	-83.3	▼	Yes	0.042
	Nitella spp.	Stoneworts	0.0	19.2	100.0	▲	Yes	0.019
	Najas flexilis	Slender naiad	0.0	30.8	100.0	▲	Yes	0.002
	Potamogeton vaseyi	Vasey's pondweed	0.0	15.4	100.0	▲	Yes	0.037
	Elodea canadensis	Common waterweed	50.0	65.4	30.8	▲	No	0.262
	Potamogeton robbinsii	Fern pondweed	26.9	34.6	28.6	▲	No	0.548
	Vallisneria americana	Wild celery	15.4	30.8	100.0	▲	No	0.188
	Potamogeton richardsonii	Clasping-leaf pondweed	11.5	3.8	-66.7	▼	No	0.298
	Potamogeton spirillus	Spiral-fruited pondweed	11.5	3.8	-66.7	▼	No	0.298
	Potamogeton pusillus	Small pondweed	7.7	26.9	250.0	▲	No	0.067
	Potamogeton zosteriformis	Flat-stem pondweed	3.8	11.5	200.0	▲	No	0.298

2011 & 2012 N = 26
FOO = Frequency of Occurrence
▲ or ▼ = Change Statistically Valid (Chi-square; $\alpha = 0.05$)
▲ or ▼ = Change Not Statistically Valid (Chi-square; $\alpha = 0.05$)

Overall, the 2012 treatment on Cranberry Lake only had limited successes. As discussed within the chain-wide portion of this report, difficulties in controlling small EWM colonies within channelized, high flow regions of the lake were encountered in 2012. Several of these treatment areas, along with nearby colonial expansions, are proposed for re-treatment in 2013. The total proposed acreage for Cranberry Lake in 2013 is 34.3 acres (Map Cran 2). The majority of this acreage is targeting EWM within the channel that leads from the Three Lakes Chain of Lakes. This large and contiguous area is proposed to be targeted with liquid 2,4-D (Map Cran 2).

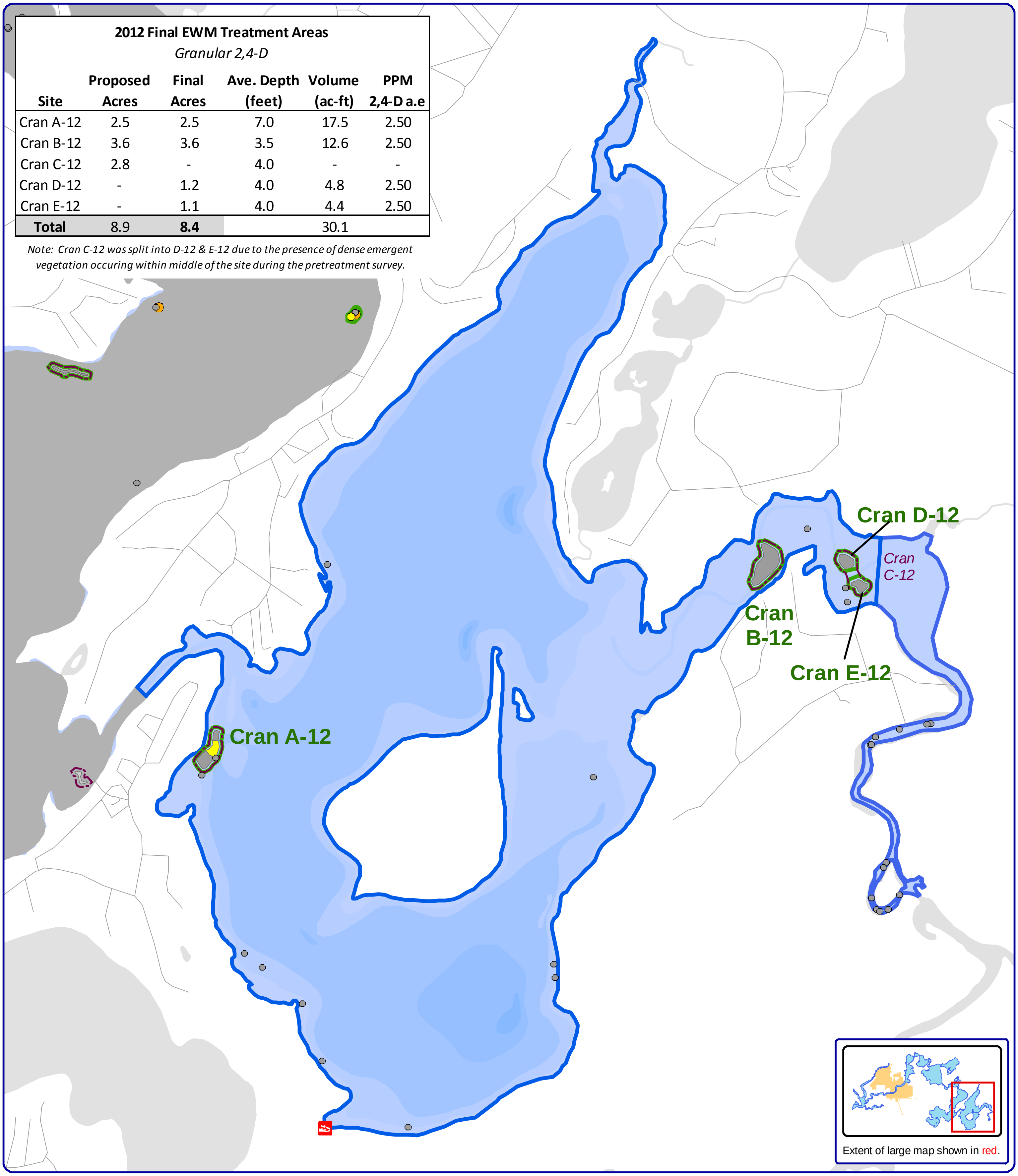
It is important to note that much of the data that has been collected by the WDNR, US Army Corps of Engineers, Onterra, and other lake management consultants regarding spot treatments (like the preliminary treatment strategy shown on the attached map) has not been able to detect significant differences in herbicide concentration nor exposure times in using either liquid or granular herbicides. Because liquid herbicides are significantly less expensive than granular herbicides, some lake groups decide to use liquid herbicides in larger spot-treatment scenarios. That being said, Onterra typically proposes the use of granular herbicides in spot treatment scenarios where precision application is important, such as Cran A-13 (Map Cran 2).

2012 Final EWM Treatment Areas

Granular 2,4-D

Site	Proposed Acres	Final Acres	Ave. Depth (feet)	Volume (ac-ft)	PPM 2,4-D a.e
Cran A-12	2.5	2.5	7.0	17.5	2.50
Cran B-12	3.6	3.6	3.5	12.6	2.50
Cran C-12	2.8	-	4.0	-	-
Cran D-12	-	1.2	4.0	4.8	2.50
Cran E-12	-	1.1	4.0	4.4	2.50
Total	8.9	**8.4**		30.1	

Note: Cran C-12 was split into D-12 & E-12 due to the presence of dense emergent vegetation occuring within middle of the site during the pretreatment survey.



1,600

Feet

2011 EWM Survey (August 2011)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2012 Conditional Treatment Area
- 2012 Final Treatment Area

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

Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra, 2011-2012
Map Date: September 24, 2012
Filename: Cran1_EWM_2011PB_T2012.mxd

Cran 1

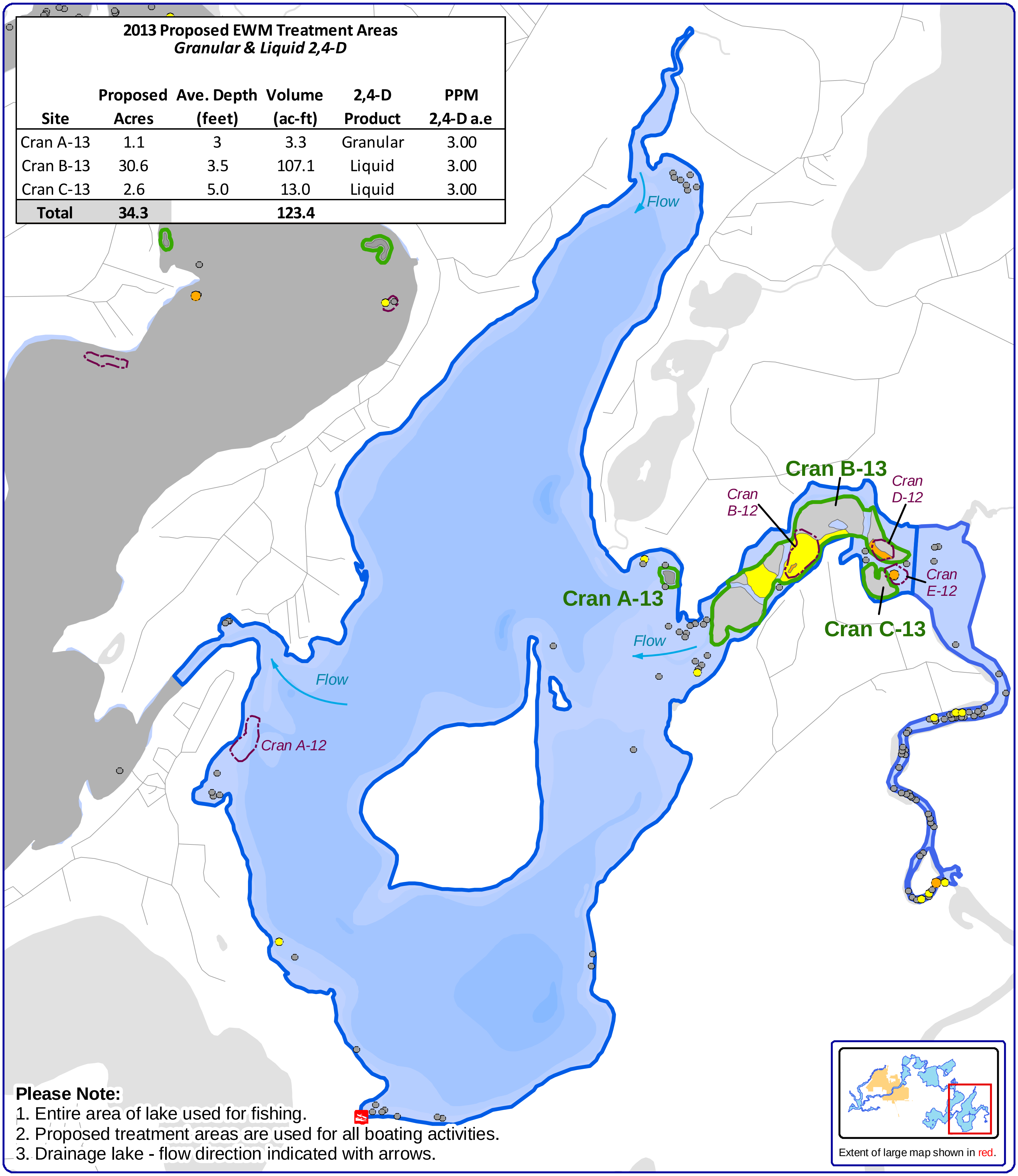
Cranberry Lake

Vilas County, Wisconsin

2011 EWM Locations & 2012 Treatment Areas

2013 Proposed EWM Treatment Areas
Granular & Liquid 2,4-D

Site	Proposed Acres	Ave. Depth (feet)	Volume (ac-ft)	2,4-D Product	PPM 2,4-D a.e
Cran A-13	1.1	3	3.3	Granular	3.00
Cran B-13	30.6	3.5	107.1	Liquid	3.00
Cran C-13	2.6	5.0	13.0	Liquid	3.00
Total	**34.3**		**123.4**		



Please Note:
1. Entire area of lake used for fishing.
2. Proposed treatment areas are used for all boating activities.
3. Drainage lake - flow direction indicated with arrows.

1,600 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
Aquatic Plants: Onterra, 2011-2012
Map Date: September 24, 2012
Filename: *Cran2_EWM_T2013_Cond1.mxd*

2012 EWM Survey (August 2012)
- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2012 Final Treatment Area
- 2013 Proposed Treatment Area

Cran 2
Cranberry Lake
Vilas County, Wisconsin
2012 EWM Locations & 2013 Proposed Treatment Areas v.1