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 2010 to complete the fourth phase of a project aimed at reducing the Eagle River Chain's Eurasian water milfoil (EWM) infestation to manageable levels. This report discusses the fourth year of treatment under this grant-funded AIS control and prevention project. The chain-wide results will be presented first followed by the results from each lake individually. Additional information regarding the treatments completed in 2008, 2009, and 2010 can be found in their respective reports.

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 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 in 2010 on Scattering Rice.

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 affects outside of that area. This is the strategy currently and historically implemented on 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.

Following the 2010 peak-biomass survey, conditional treatment permit maps were created proposing 145.2 total acres of treatment on Cranberry, Catfish, Voyageur, Eagle, Scattering Rice, Otter, Yellow Birch, and Watersmeet Lakes (Table 1). On May 23 and 24, 2011, Onterra staff visited the Eagle River Chain to survey the proposed treatment areas and refine their boundaries as appropriate, primarily through the use of submersible video technology. As a result of the spring pre-treatment survey, the treatment strategy was reduced to 93 acres after little or no EWM was observed in a number of the originally proposed areas (Table 1). It is possible that the EWM within these areas was injured from the 2010 treatment to a point where it could not overwinter and continue growth in the spring.

Table 1. Eagle River Chain 2011 EWM Treatment Acreage.

Lake	Proposed Acres	Permit Acres
Cranberry	33.3	18.3
Catfish	18.6	11.8
Voyageur	2.7	0.6
Eagle	18.1	9.4
Scattering Rice	4.7	4.7
Otter	8.3	9.7
Lynx	0.0	0.0
Duck	0.0	0.0
Yellow Birch	6.9	5.8
Watersmeet	52.6	32.7
Total	**145.2**	**93.0**

During this survey, temperature, dissolved oxygen, and pH profiles were also collected from areas in Cranberry, Catfish, Eagle, Yellow Birch, and Watersmeet Lakes (Figure 1). Surface water temperatures ranged from 59°F in Eagle Lake to 64°F in Cranberry, and dissolved oxygen was greater than 5 mg/L at all depths sampled. Surface pH values ranged from 7.6 in Watersmeet to 8.1 in Yellow Birch Lake (Figure 1).

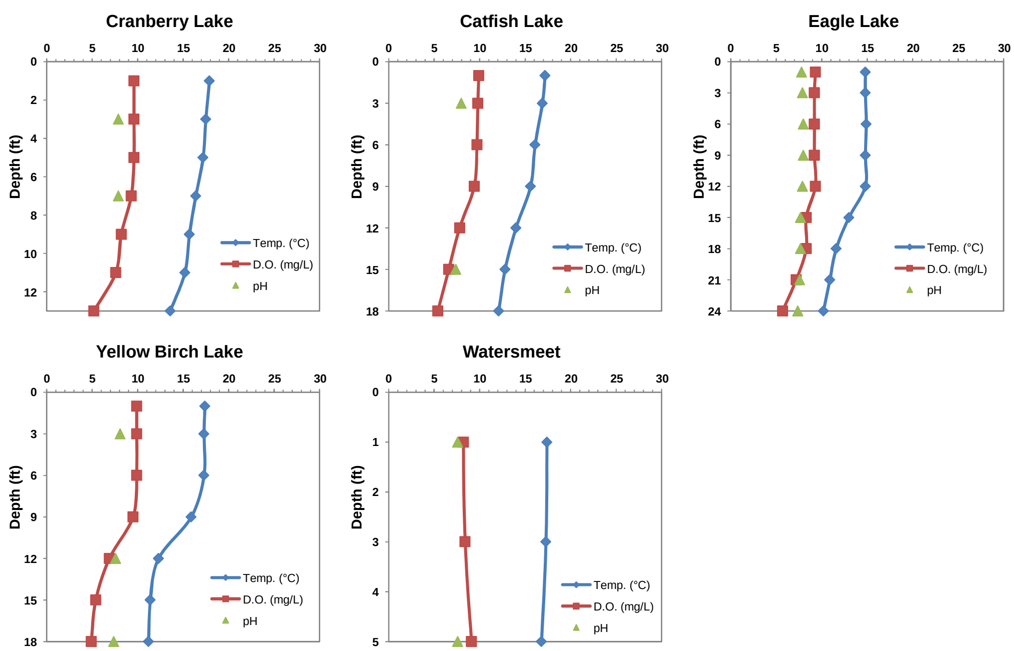


Figure 1. Temperature, dissolved oxygen, and pH profiles collected on five lakes in the Eagle River Chain. Collected May 24, 2011.

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.

While no large-scale liquid treatments were proposed for 2011, it was recommended that the treatment sites be applied with granular 2,4-D because of the success observed in 2010. After discussions with their herbicide applicator, the ULERCLC decided that Navigate (ester) would the 2,4-D product used again for the 2011 spot treatments. On May 26 to June 2, 2011, the treatment sites were applied with granular 2,4-D 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 26 – calm, May 27 – calm to 3 mph, May 31 – 5 to 15 mph, June 2 – 5 mph.

2010 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 300 point-intercept sub-sample locations during the summer of 2011 (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 2011 treatment.

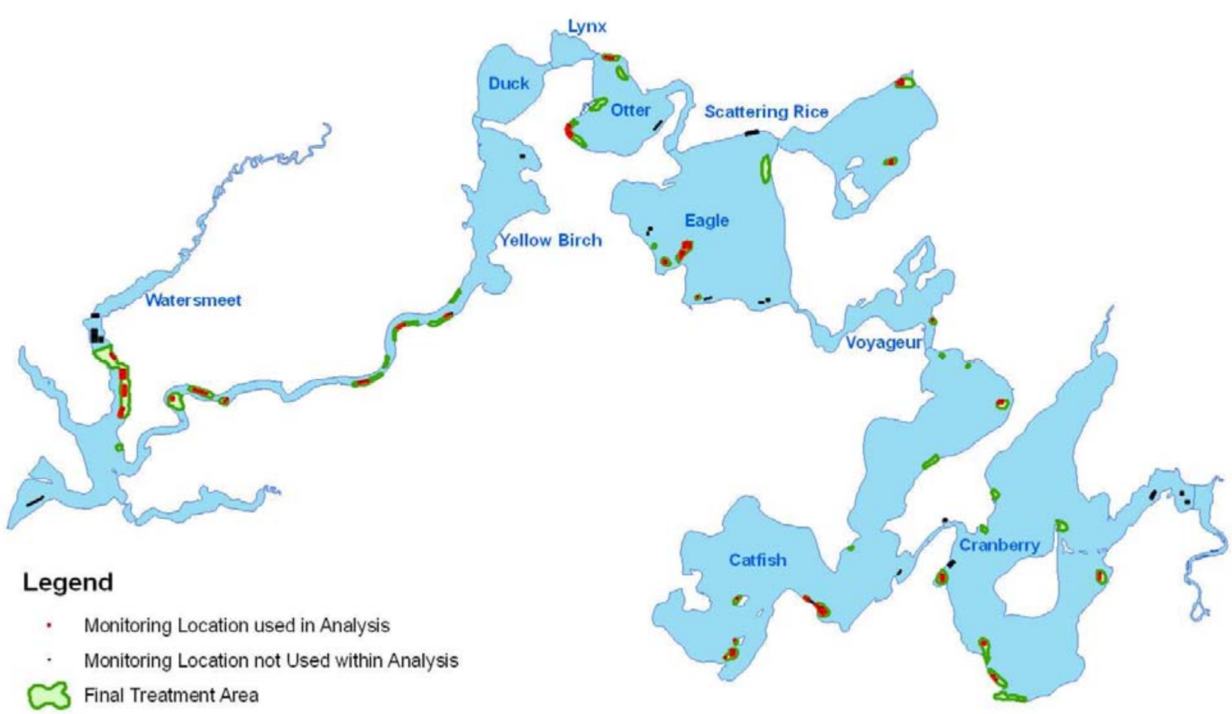


Figure 2. 2011 Quantitative monitoring plan for the Eagle River Chain of Lakes

The most comparative sub-sample data are those collected both the summer before and the summer immediately following the herbicide treatment. On the Eagle River Chain of Lakes, 162 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 were documented along with water depth and substrate type. Specifically, these surveys aim to determine if significant differences in frequencies of occurrence 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 and 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 2010 and 2011, when this plant is assumed to be at its peak-biomass or growth stage. Comparisons of these surveys are used to qualitatively evaluate the 2011 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 2011 treatment on the Eagle River Chain of Lakes, emerging conclusions from the WDNR and USACE state that some narrow-leaf (monocot) species are also be impacted by this herbicide.

2011 CHAIN-WIDE TREATMENT SUMMARY AND CONCLUSIONS

Post treatment surveys were completed on the Eagle River Chain by Onterra on September 6 and 7, 2011. Chain-wide, 100% of the treatment acreage was observed to have reduced by at least one density rating, exceeding the qualitative success criteria (75% reduction) for the 2011 treatment. Figure 3 shows that over the course of annual treatments from 2008 to 2011, EWM colonial acreage has been reduced by 92% from 278 acres in 2007 to 23 acres in 2011. 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 2011 (Figure 1).

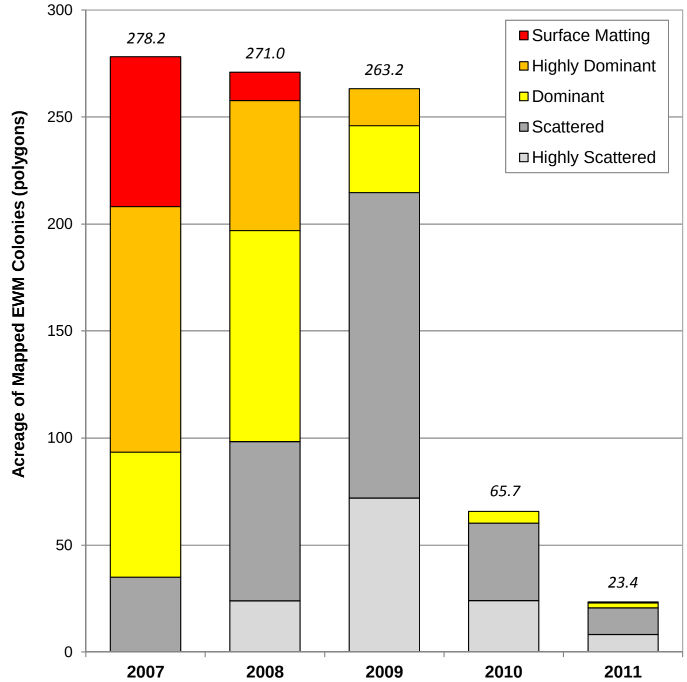


Figure 3. Acreage of mapped EWM colonies on the Eagle River Chain of Lakes from 2007-2011.

During the summer of 2010, 14.2% of the 162 point-intercept locations within the 2011 treatment areas contained EWM compared to 1.9% in 2011, representing a statistically valid reduction in occurrence of 87% and exceeding the chain-wide quantitative success criteria (50% reduction in occurrence) (Figure 4). Individually, Scattering Rice and Otter Lakes were the only lakes to show a statistically valid reduction in EWM occurrence in 2011 (Figure 4). While the other lakes saw reductions in EWM occurrence, these were not statistically valid and is likely a result of small sample size and relatively low occurrences of EWM in 2010 and 2011. Yellow Birch and Voyageur Lakes could not be statistically analyzed due to insufficient point-intercept sampling sizes.

A rake-fullness rating of 1-3 was used to determine the abundance of EWM at each of the 162 point-intercept locations. Figure 5 displays the chain-wide proportions of EWM rake-fullness ratings from the pre- and post-treatment surveys. This figures shows both the decline in EWM occurrence and that there were no rake-fullness ratings of 2 or 3 in 2011.

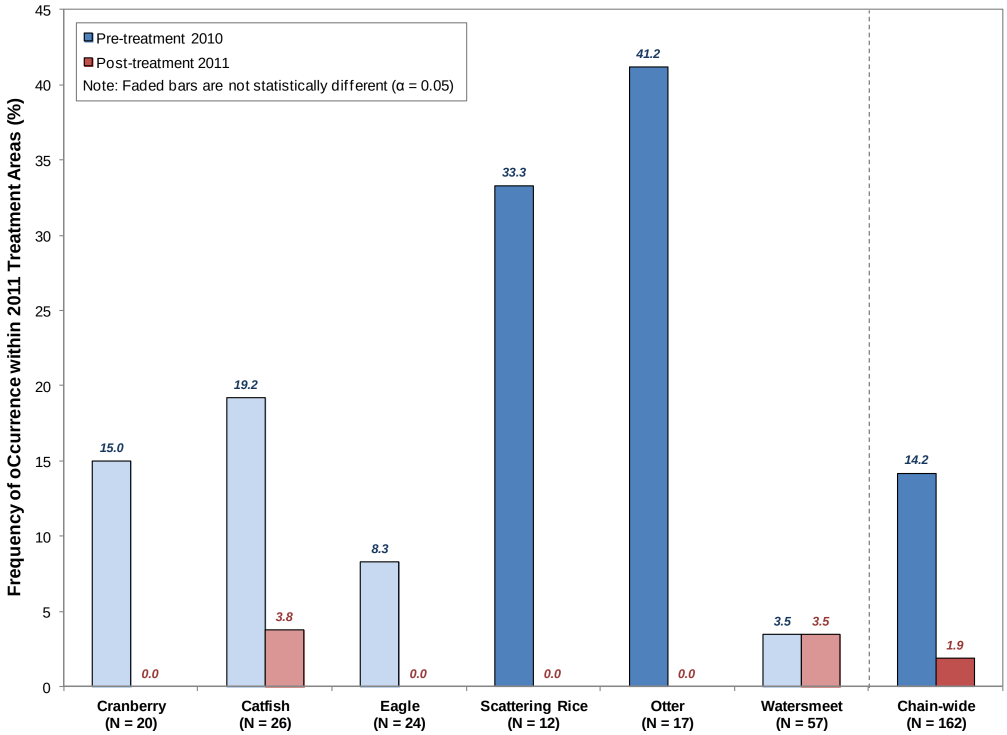


Figure 4. Eagle River Chain EWM percent occurrence in point-intercept locations displayed by lake comparing summer 2010 to summer 2011. Please note that Voyageur and Yellow Birch Lakes did not have sufficient sample sizes, and are not graphed, while no treatments occurred on Duck and Lynx Lakes in 2011.

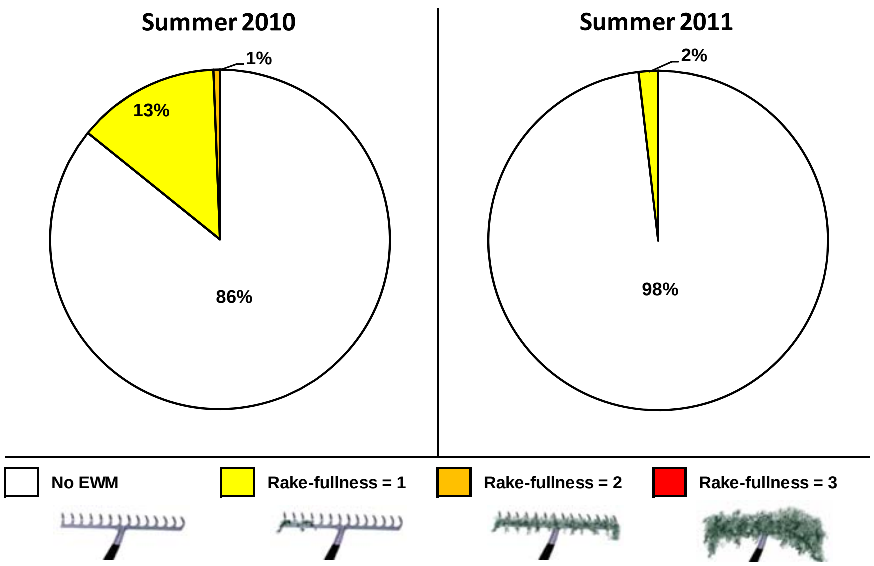


Figure 5. Eagle River Chain chain-wide proportions of EWM rake-fullness ratings from 162 point-intercept sub-sampling locations within 2011 treatment areas. Created using data from 2010 pre-treatment and 2011 post-treatment surveys.

Data concerning native aquatic plant species were also collected at the same 162 point-intercept locations during the summers of 2010 and 2011. Table 2 shows that within the 2011 treatment areas, coontail, northern water milfoil, and common waterweed exhibited statistically valid reductions in occurrence following the 2011 treatment. Like EWM, coontail and northern water milfoil are dicots and are particularly susceptible to herbicide treatments. Efforts are taken to minimize impacts to these species by applying herbicides early in the spring before these plants are actively growing. Unlike EWM, common waterweed is a non-dicot and was previously not thought to be sensitive to dicot-selective herbicides. However, data from 2010 and 2011 on the Eagle River Chain and other lakes in the northern region with similar treatments indicate that these species may be prone to decline following treatment.

Table 2. Statistical comparison of native aquatic plant frequency data within 2011 treatment areas on the Eagle River Chain from 2010 pre- and 2011 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	2010 FOO	2011 FOO	Percent Change	Direction	Chi-square Analysis	
							Statistically Valid	p-value
D	*Ceratophyllum demersum*	Coontail	36.4	17.9	-50.8	▼	Yes	0.000
D	*Myriophyllum sibiricum*	Northern w ater milfoil	6.2	0.0	-100.0	▼	Yes	0.001
Non-dicots	*Elodea canadensis*	Common w aterw eed	43.2	9.9	-77.1	▼	Yes	0.000
Non-dicots	*Potamogeton robbinsii*	Fern pondw eed	33.3	25.3	-24.1	▼	No	0.113
Non-dicots	*Vallisneria americana*	Wild celery	19.8	29.0	46.9	▲	No	0.052
Non-dicots	*Potamogeton zosteriformis*	Flat-stem pondw eed	10.5	5.6	-47.1	▼	No	0.102
Non-dicots	*Potamogeton richardsonii*	Clasping-leaf pondw eed	2.5	4.9	100.0	▲	No	0.239
Non-dicots	*Potamogeton pusillus*	Small pondw eed	1.9	4.9	166.7	▲	No	0.125

2010 & 2011 N = 162
FOO = Frequency of Occurrence; D = Dicots
▲ or ▼ = Change Statistically Valid (Chi-square; α = 0.05)
▲ or ▼ = Change Not Statistically Valid (Chi-square; α = 0.05)

As discussed earlier, the observed declines to native species within the treatment areas cannot be extrapolated to the entire lake-wide population of these species as data was only analyzed from sample locations within treatment sites (Figure 2). 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. Whole-lake point-intercept surveys were last conducted on the Eagle River Chain of Lakes in 2006 by Northern Environmental, Inc. The WDNR recommends that a replication of the whole-lake point-intercept survey occur approximately every 3-5 years when large scale manipulations are occurring. Whole-lake point-intercept surveys are scheduled to occur on each lake within the Eagle River Chain during the summer of 2012. Comparing these surveys to the ones conducted in 2006 will reveal if any long-term, lake-wide impacts to native aquatic plant species are occurring or if the declines observed are confined to areas being actively treated.

2012 CHAIN-WIDE TREATMENT STRATEGY

The 2011 treatment on the Eagle River Chain of Lakes was extremely successful in terms of reducing the density and occurrence of EWM. Chain-wide, both the qualitative and quantitative success criteria were met. The 93 acres of EWM that were treated in 2011 have been reduced to a proposed treatment of 50.5 acres for 2012.

At the start of this control project, only EWM colonies that were dominant or greater were targeted for treatment on the Eagle River Chain of Lakes. After numerous successful treatments, the threshold (trigger) for determining which areas warranted treatment was relaxed to include any colonized (polygon-based mapping techniques) area of EWM. The majority of the EWM that was observed in 2011 following the treatment was comprised of either low density colonies (highly scattered or scattered) or EWM mapped with point-based methods.

On the Eagle River Chain of Lakes, the EWM population is approaching a point at which the herbicide application areas are too small to consistently predict if they will cause EWM mortality. As indicated within the Introduction Section, 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 0.3 acres were not proposed for treatment due to their extremely small size and unlikely nature of being successful. Also, almost all proposed treatment areas include an expanded buffer (40 feet) as well as a higher granular 2,4-D application rate. For treatment sites greater than 1 acre, 2.5 ppm ae is proposed, whereas treatment sites less than one acre, 2.75 ppm ae is proposed. A slightly higher 2,4-D concentration (3.0 ppm ae) is proposed for the small treatment sites within the Eagle River downstream of Yellow Birch Lake.

Two granular 2,4-D products are widely used in Wisconsin: Navigate and Sculpin G. Sculpin G has an EPA-approved product label that sets the herbicide's maximum application rates volumetrically (up to 4.0 ppm ae). Up until recently, Navigate's EPA-approved label stated that it could only be applied at rates up to 200 lbs/acre. In deeper water treatments, this did not provide sufficient active ingredient to reach desired herbicide concentrations and therefore Sculpin G was often used on many lakes in these situations. An updated EPA approved label now allows Navigate to be dosed volumetrically up to 4.0 ppm ae. Because of Navigate's ester formulation, the updated label also includes a 24-hour swimming restriction, which is not included as a part of the amine-formulated Sculpin G label.

As mentioned in previous reports, one of the greatest successes of the Eagle River Chain control program is the commitment by volunteers to aid in this process. 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.

CRANBERRY LAKE SUMMARY AND CONCLUSIONS

Approximately 18.3 acres of EWM were treated in Cranberry Lake in 2011 with granular 2,4-D (Navigate) at concentrations between 2.1 and 2.8 ppm ae (Map Cran 1). Following the treatment, all of the treatment areas were reduced by at least one EWM density rating, exceeding the qualitative success criteria (75% of acreage reduced) (Map Cran 2). In the summer of 2010, 15% of the 20 point-intercept locations within the 2011 treatment areas contained EWM compared to none in 2011 (Table 3). Despite a 100% reduction in occurrence, statistic analysis shows that this change is not valid at the predetermined confidence level ($\alpha = 0.05$), but was extremely close (valid at $\alpha = 0.10$).

Data concerning native aquatic plant species within the 2011 treatment areas indicate that one species, common waterweed, exhibited a statistically valid reduction in occurrence following the treatment (Table 3). Unlike EWM, common waterweed is a non-dicot and was previously not thought to be sensitive to dicot-selective herbicides. However, emerging data gathered from lakes in 2010 and 2011 with similar treatments indicate that some of these species may be prone to decline following a treatment. As discussed earlier, the declines observed to native species within the treatment areas cannot be extrapolated to the entire lake-wide population as data was only collected from areas within treatment sites. Comparing the upcoming 2012 whole-lake point-intercept survey with the 2006 survey will allow an understanding of how the aquatic plant community changed over this time period.

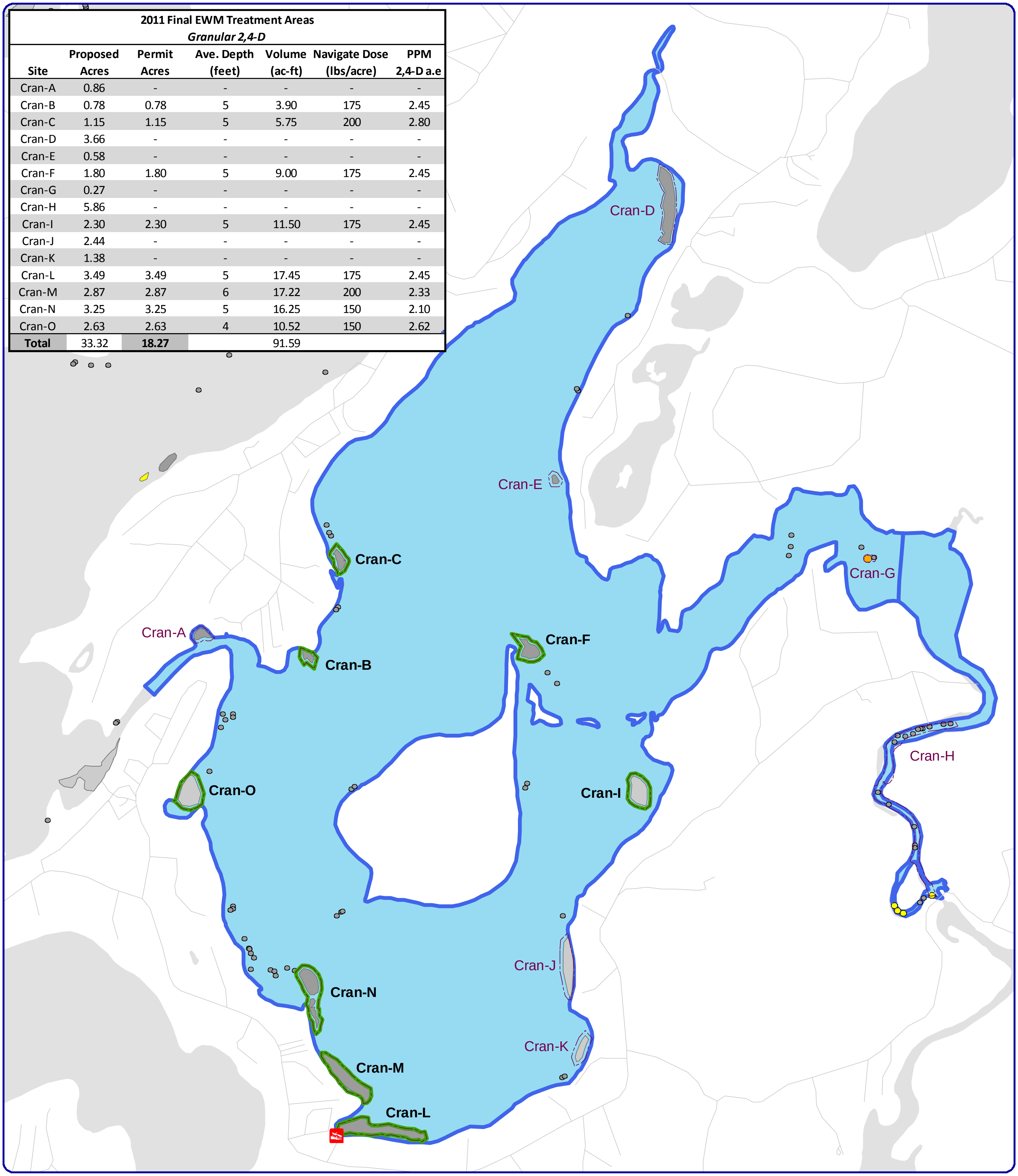
Table 3. Statistical comparison of aquatic plant frequency data within 2011 treatment areas on Cranberry Lake from 2010 pre- and 2011 post-treatment surveys. Only species with greater than 5.0% frequency of occurrence in at least one of the two surveys are applicable for analysis.

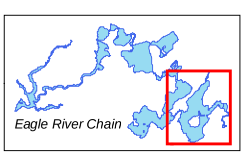
	Scientific Name	Common Name	2010 FOO	2011 FOO	Percent Change	Direction	Chi-square Analysis	
							Statistically Valid	p-value
Dicots	*Myriophyllum spicatum*	Eurasian water milfoil	15.0	0.0	-100.0	▼	No	0.072
	Ceratophyllum demersum	Coontail	45.0	20.0	-55.6	▼	No	0.091
	Bidens beckii	Water marigold	5.0	0.0	-100.0	▼	No	0.311
	Myriophyllum sibiricum	Northern water milfoil	5.0	0.0	-100.0	▼	No	0.311
Non-dicots	*Elodea canadensis*	Common waterweed	75.0	0.0	-100.0	▼	Yes	0.000
	Potamogeton robbinsii	Fern pondweed	60.0	50.0	-16.7	▼	No	0.525
	Potamogeton zosteriformis	Flat-stem pondweed	15.0	0.0	-100.0	▼	No	0.072
	Vallisneria americana	Wild celery	15.0	20.0	33.3	▲	No	0.677
	Najas flexilis	Slender naiad	5.0	0.0	-100.0	▼	No	0.311
	Potamogeton epihydrus	Ribbon-leaf pondweed	5.0	0.0	-100.0	▼	No	0.311
	Potamogeton pusillus	Small pondweed	5.0	0.0	-100.0	▼	No	0.311
	Potamogeton vaseyi	Vasey's pondweed	5.0	0.0	-100.0	▼	No	0.311
	Potamogeton amplifolius	Large-leaf pondweed	0.0	5.0	100.0	▲	No	0.311

2010 & 2011 N = 20
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 2011 treatment on Cranberry Lake was successful. None of the 2011 treatment areas on Cranberry Lake are proposed to be re-treated, and only 8.9 acres of EWM comprised of three treatment areas are proposed for treatment in 2012 (Map Cran 2). It is recommended that these sites be treated using granular 2,4-D at 2.5 ppm ae, similar to concentrations that were shown to be effective in 2011 (Map Cran 2).

2011 Final EWM Treatment Areas *Granular 2,4-D*						
Site	**Proposed Acres**	**Permit Acres**	**Ave. Depth (feet)**	**Volume (ac-ft)**	**Navigate Dose (lbs/acre)**	**PPM 2,4-D a.e**
Cran-A	0.86	-	-	-	-	-
Cran-B	0.78	0.78	5	3.90	175	2.45
Cran-C	1.15	1.15	5	5.75	200	2.80
Cran-D	3.66	-	-	-	-	-
Cran-E	0.58	-	-	-	-	-
Cran-F	1.80	1.80	5	9.00	175	2.45
Cran-G	0.27	-	-	-	-	-
Cran-H	5.86	-	-	-	-	-
Cran-I	2.30	2.30	5	11.50	175	2.45
Cran-J	2.44	-	-	-	-	-
Cran-K	1.38	-	-	-	-	-
Cran-L	3.49	3.49	5	17.45	175	2.45
Cran-M	2.87	2.87	6	17.22	200	2.33
Cran-N	3.25	3.25	5	16.25	150	2.10
Cran-O	2.63	2.63	4	10.52	150	2.62
Total	33.32	**18.27**		91.59		





Extent of large map shown in red.

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Conditional Treatment Area
- 2011 Final Treatment Area

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Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Cran1_EWM_2010PB_T2011.mxd*

Cran 1

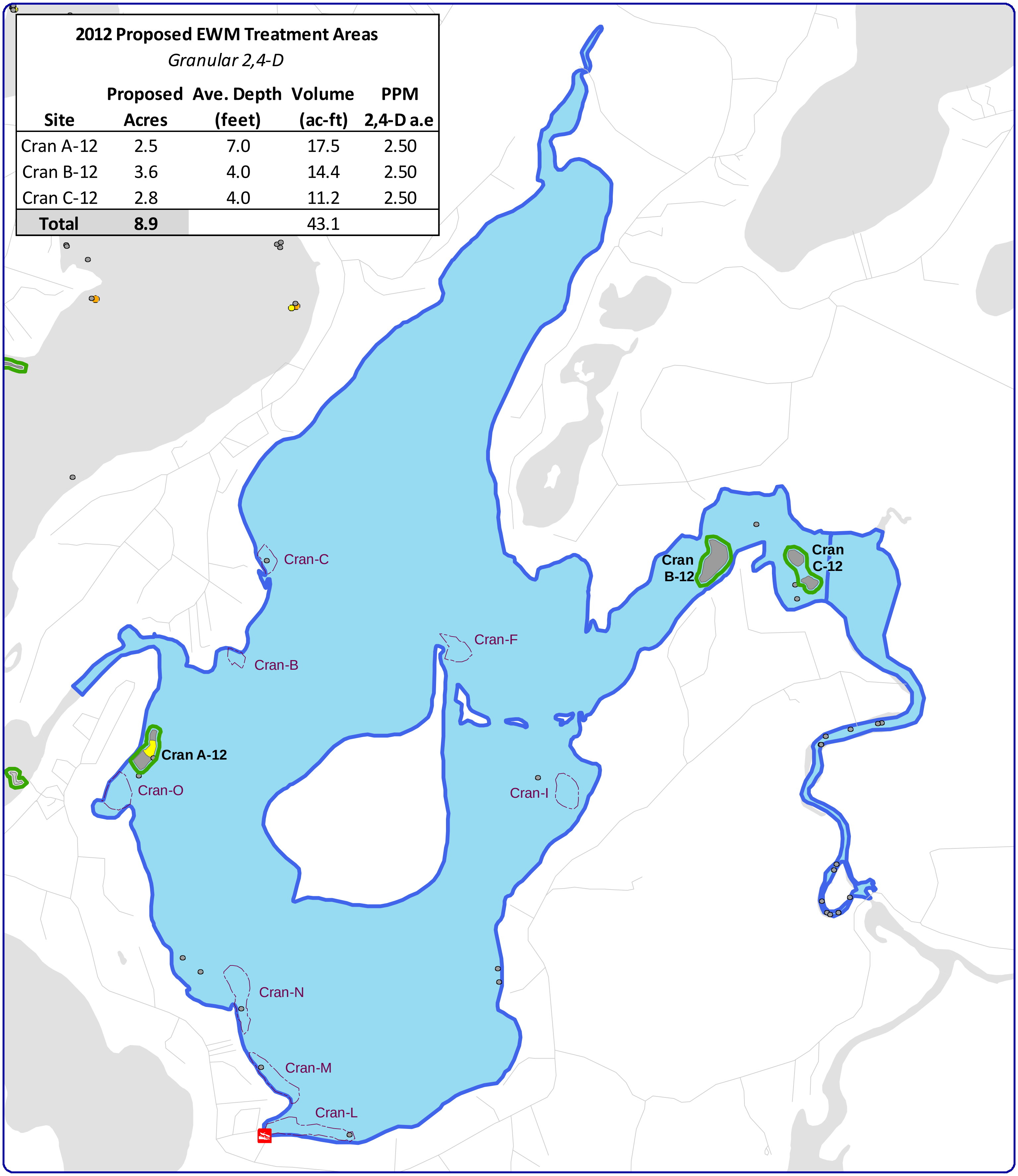
Cranberry Lake
Oneida & Vilas Counties, Wisconsin

2010 EWM Locations & 2011 Treatment Areas

2012 Proposed EWM Treatment Areas

Granular 2,4-D

Site	Proposed Acres	Ave. Depth (feet)	Volume (ac-ft)	PPM 2,4-D a.e
Cran A-12	2.5	7.0	17.5	2.50
Cran B-12	3.6	4.0	14.4	2.50
Cran C-12	2.8	4.0	11.2	2.50
Total	**8.9**		43.1	



1,600

Feet

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Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Cran2_EWM_T2012_Cond1.mxd*

Eagle River Chain

Extent of large map shown in red.

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Final Treatment Area
- 2012 Proposed Treatment Area

Cran 2
Cranberry Lake
Oneida & Vilas Counties, Wisconsin

2011 EWM Locations & 2012 Proposed Treatment Areas v.2

CATFISH LAKE SUMMARY AND CONCLUSIONS

Approximately 11.8 acres of EWM were treated in Catfish Lake in 2011 with granular 2,4-D (Navigate) at this product's maximum label rate (200 lbs/acre) yielding concentrations between 2.0 and 2.33 ppm ae (Map Cat 1). Following the treatment, all of the treatment areas were reduced by at least one EWM density rating, exceeding the qualitative success criteria (75% of acreage reduced) (Map Cat 2). In the summer of 2010, 19.2% of the 26 point-intercept locations within the 2011 treatment areas contained EWM compared to 3.8% in 2011 (Table 4). Despite an 80% reduction in occurrence, statistic analysis shows that this change is not valid at the predetermined confidence level ($\alpha = 0.05$), but was extremely close (valid at $\alpha = 0.10$).

Data concerning native aquatic plant species within the 2011 treatment areas indicate that no native aquatic plant species saw statistically valid changes in occurrence following the treatment. As discussed earlier, comparing the upcoming 2012 whole-lake point-intercept survey with the 2006 survey will allow an understanding of how the aquatic plant community changed over this time period.

Table 4. Statistical comparison of aquatic plant frequency data within 2011 treatment areas on Catfish Lake from 2010 pre- and 2011 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	2010 FOO	2011 FOO	Percent Change	Direction	Chi-square Analysis	
							Statistically Valid	p-value
D	*Myriophyllum spicatum*	Eurasian water milfoil	19.2	3.8	-80.0	▼	No	0.083
D	*Ceratophyllum demersum*	Coontail	46.2	26.9	-41.7	▼	No	0.150
Non-dicots	*Elodea canadensis*	Common waterweed	34.6	26.9	-22.2	▼	No	0.548
Non-dicots	*Vallisneria americana*	Wild celery	26.9	50.0	85.7	▲	No	0.087
Non-dicots	*Potamogeton robbinsii*	Fern pondweed	15.4	26.9	75.0	▲	No	0.308
Non-dicots	*Najas flexilis*	Slender naiad	7.7	3.8	-50.0	▼	No	0.552
Non-dicots	*Potamogeton pusillus*	Small pondweed	3.8	7.7	100.0	▲	No	0.552
Non-dicots	*Potamogeton zosteriformis*	Flat-stem pondweed	3.8	11.5	200.0	▲	No	0.298

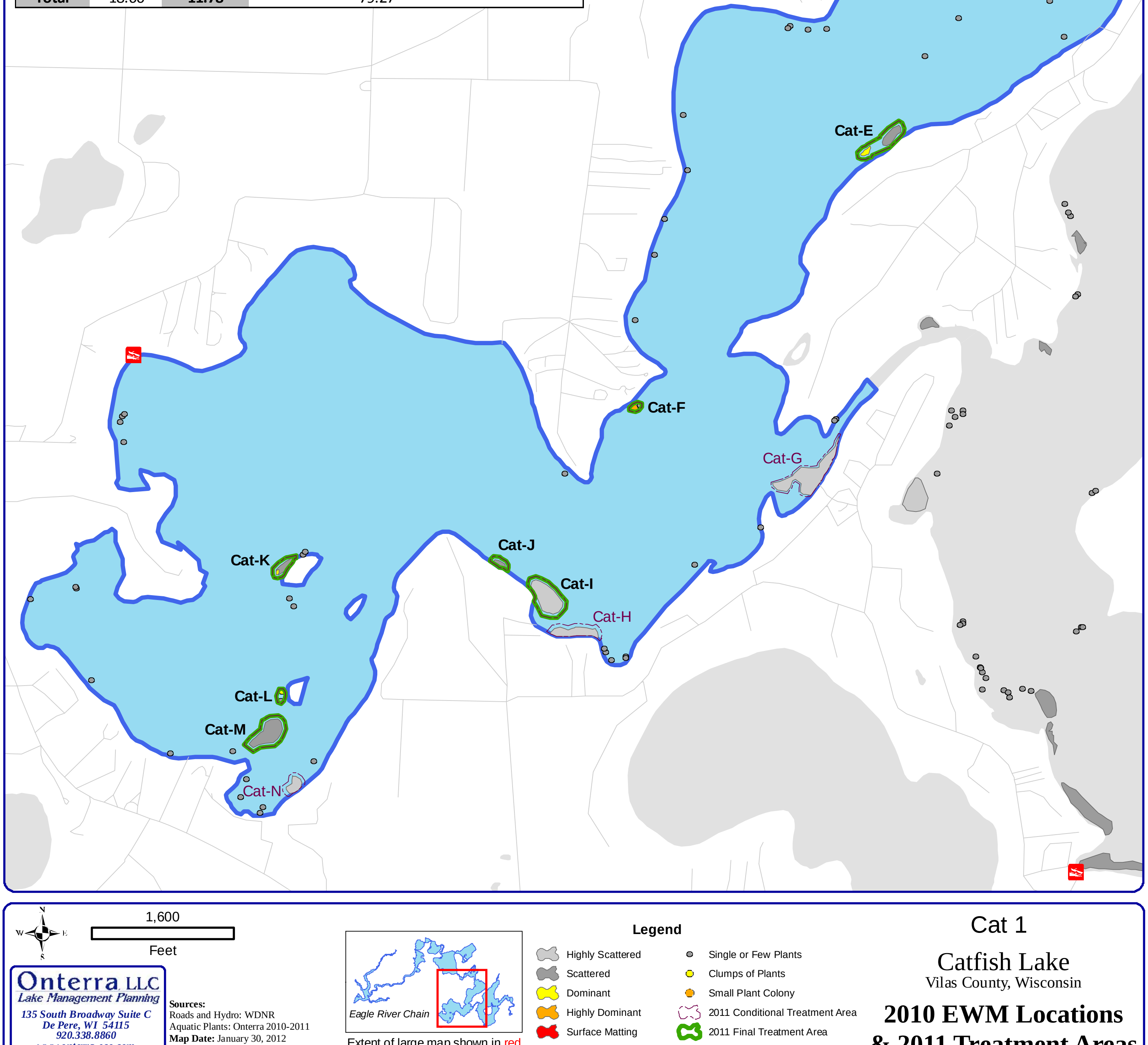
2010 & 2011 N = 26
FOO = Frequency of Occurrence; D = Dicots
▲ or ▼ = Change Statistically Valid (Chi-square; $\alpha = 0.05$)
▲ or ▼ = Change Not Statistically Valid (Chi-square; $\alpha = 0.05$)

The 2011 treatment on Catfish Lake was successful at reducing the density of EWM within the 2011 treatment sites; however most of these sites still contain low levels of EWM. Approximately 9.7 acres of EWM is proposed to be treated on Catfish Lake in 2012 (Map Cat 2). Except for treatment site Cat E-12 which contains a colony of dominant EWM, all of the treatment areas contain EWM with scattered or highly scattered density ratings. It is recommended that sites under 1 acre be treated with granular 2,4-D at 2.75 ppm ae and sites greater than 1 acre be treated with granular 2,4-D at 2.5 ppm ae. These levels are slightly higher than applied in 2011.

2011 Final EWM Treatment Areas

Granular 2,4-D

Site	Proposed Acres	Permit Acres	Ave. Depth (feet)	Volume (ac-ft)	Navigate Dose (lbs/acre)	PPM 2,4-D a.e
Cat-A	0.18	0.22	7	1.54	200	2.00
Cat-B	0.18	0.23	7	1.61	200	2.00
Cat-C	0.54	-	-	-	-	-
Cat-D	1.95	1.95	7	13.65	200	2.00
Cat-E	2.09	2.09	6	12.54	200	2.33
Cat-F	0.26	0.26	7	1.82	200	2.00
Cat-G	3.65	-	-	-	-	-
Cat-H	1.77	-	-	-	-	-
Cat-I	2.90	2.90	7	20.30	200	2.00
Cat-J	0.45	0.45	7	3.15	200	2.00
Cat-K	0.80	0.80	6	4.80	200	2.33
Cat-L	0.30	0.30	6	1.80	200	2.33
Cat-M	2.58	2.58	7	18.06	200	2.00
Cat-N	0.95	-	-	-	-	-
Total	18.60	**11.78**		79.27		



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Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Cat1_EWM_2010PB_T2011.mxd*

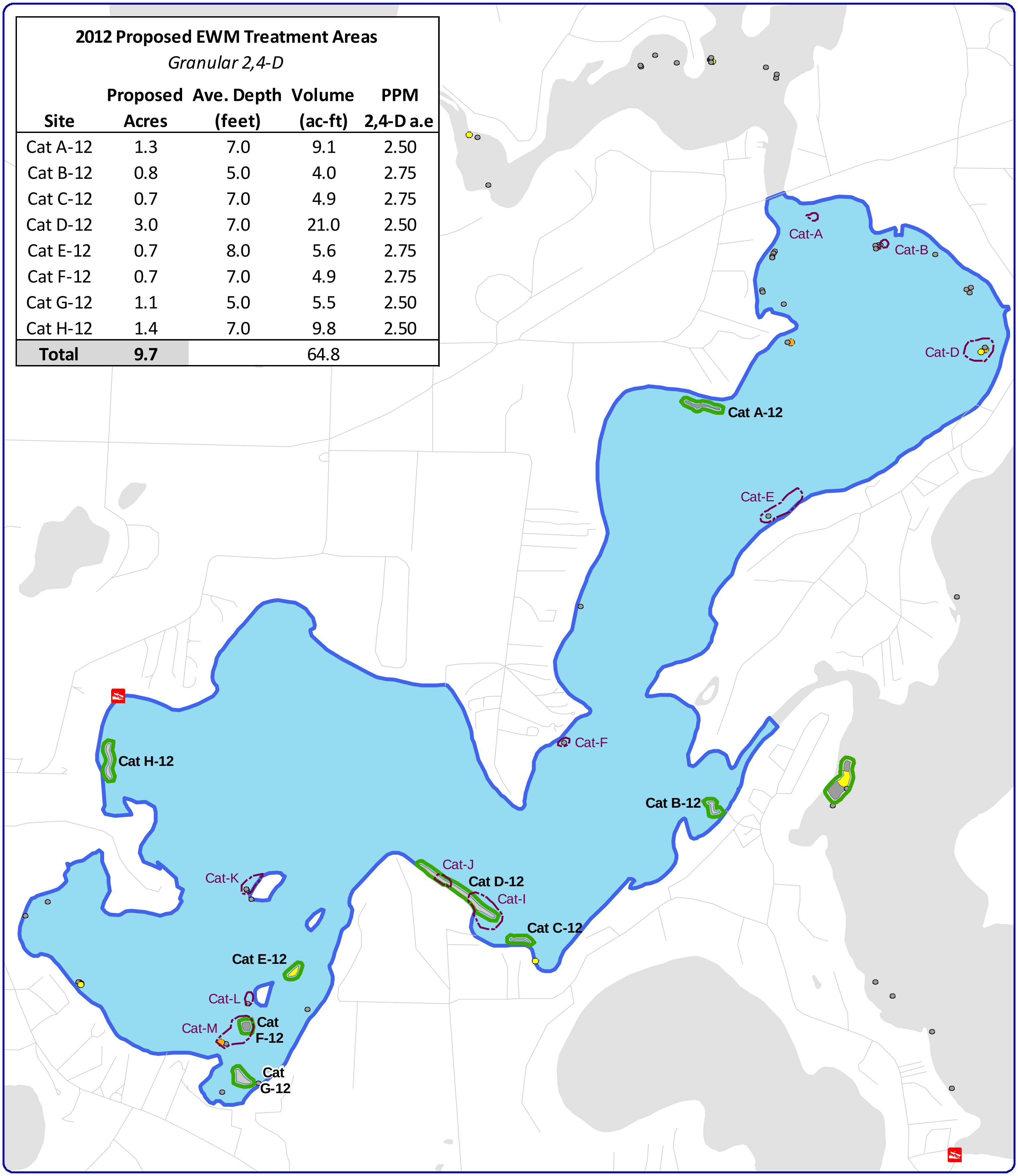
Cat 1

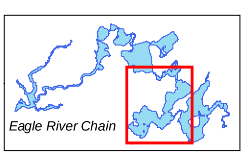
Catfish Lake
Vilas County, Wisconsin

2010 EWM Locations & 2011 Treatment Areas

Site	Proposed Acres	Ave. Depth (feet)	Volume (ac-ft)	PPM 2,4-D a.e
Cat A-12	1.3	7.0	9.1	2.50
Cat B-12	0.8	5.0	4.0	2.75
Cat C-12	0.7	7.0	4.9	2.75
Cat D-12	3.0	7.0	21.0	2.50
Cat E-12	0.7	8.0	5.6	2.75
Cat F-12	0.7	7.0	4.9	2.75
Cat G-12	1.1	5.0	5.5	2.50
Cat H-12	1.4	7.0	9.8	2.50
Total	**9.7**		64.8	

2012 Proposed EWM Treatment Areas
Granular 2,4-D





Extent of large map shown in red.

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Final Treatment Area
- 2012 Proposed Treatment Area

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Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: Cat2_EWM_T2012_Cond1.mxd

Cat 2
Catfish Lake
Vilas County, Wisconsin
2011 EWM Locations & 2012 Proposed Treatment Areas v.2

VOYAGEUR LAKE SUMMARY AND CONCLUSIONS

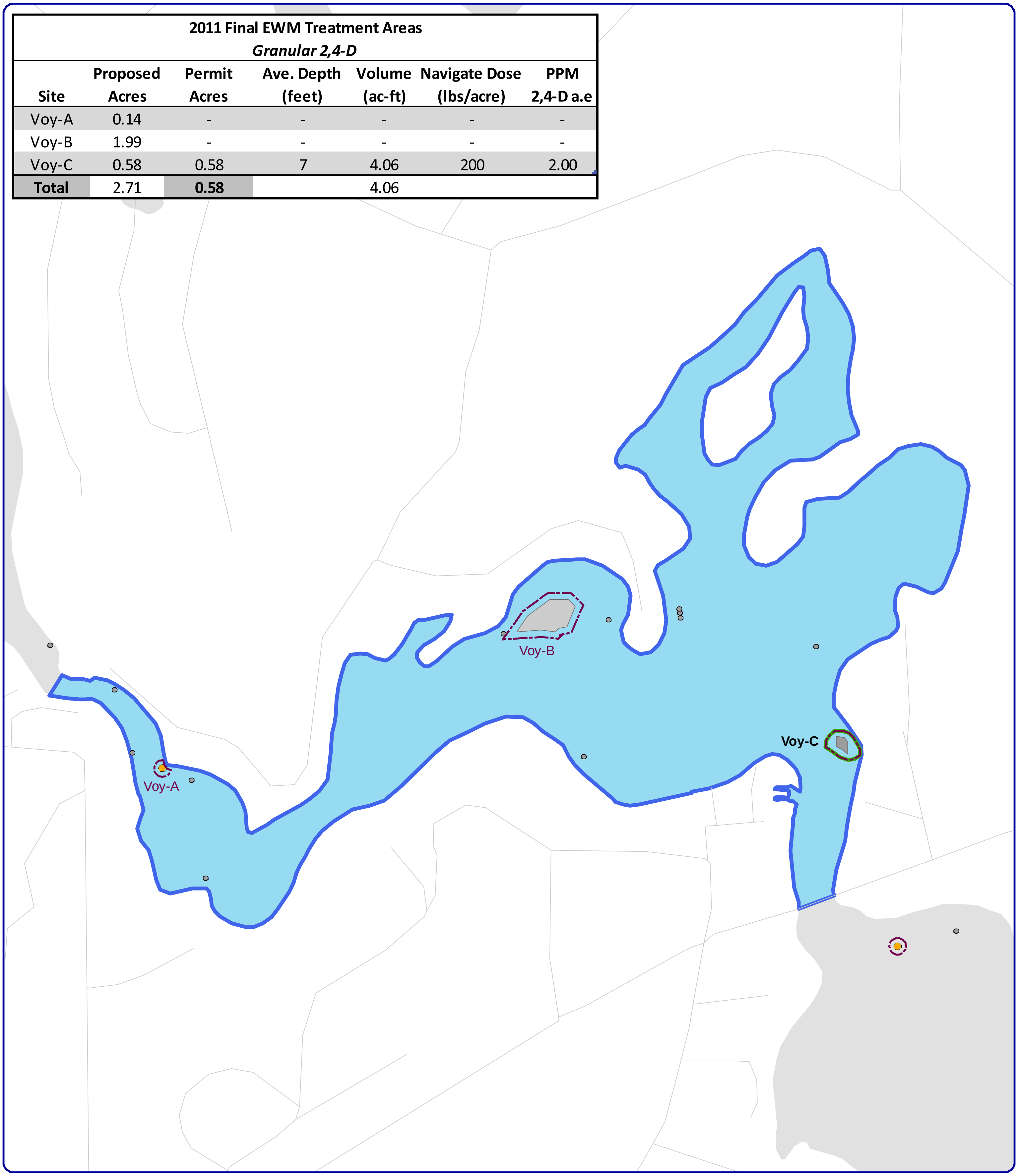
Approximately 0.6 acres of EWM comprised of one site was treated in Voyageur Lake in 2011 using granular 2,4-D (Navigate) at this product's maximum label rate (200 lbs/acre) yielding a concentration of 2.0 ppm ae (Map Voy 1). Two proposed treatment sites were removed following the pretreatment survey, as insufficient EWM was located within these areas to warrant a treatment. Both these areas were treated during the spring of 2010 and it is possible that the EWM located during the 2010 late-summer surveys was injured by those treatments to the point where it was unable to survive through the winter.

Following the treatment, no EWM was observed within Voy-C (Map Voy 2). Quantitative evaluation of the frequency of occurrence of EWM could not be conducted as this small treatment did not have a sufficient number if point-intercept sampling locations.

During the 2011 peak-biomass survey, only single scattered EWM plants and clumps of plants could be located in Voyageur Lake (Map Voy 2). The treatment on Voyageur Lake in 2011 was successful, and no treatments are proposed for Voyageur Lake in 2012. However, the areas of EWM located in 2011 will be visited in the spring of 2012 to determine if any of these areas have expanded and warrant treatment.

During the 2011 peak-biomass survey on the Eagle River Chain, a couple lake users indicated that they believed Voyageur Lake was still "full of EWM." Upon completing the survey on Voyageur Lake, it is believed that what these individuals believed to be EWM was actually the native northern water milfoil (*Myriophyllum sibiricum*). Voyageur Lake has an abundant population of northern water milfoil growing in relatively shallow water which exposes it to higher amounts of solar radiation. To protect itself from getting a 'sun burn', the leaves of northern water milfoil towards the top of the plant turn red making it appear more like EWM. Another native milfoil, whorled water milfoil (*Myriophyllum verticillatum*) was also observed to a lesser extent in Voyageur Lake.

2011 Final EWM Treatment Areas *Granular 2,4-D*						
Site	Proposed Acres	Permit Acres	Ave. Depth (feet)	Volume (ac-ft)	Navigate Dose (lbs/acre)	PPM 2,4-D a.e
Voy-A	0.14	-	-	-	-	-
Voy-B	1.99	-	-	-	-	-
Voy-C	0.58	0.58	7	4.06	200	2.00
Total	2.71	**0.58**		4.06		



N
W E
S
750
Feet

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Sources:
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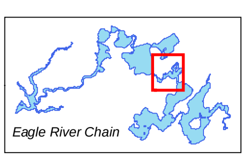
Map Date: January 30, 2012
Filename: *Voy1_EWM_2010PB_T2011.mxd*



Extent of large map shown in red.

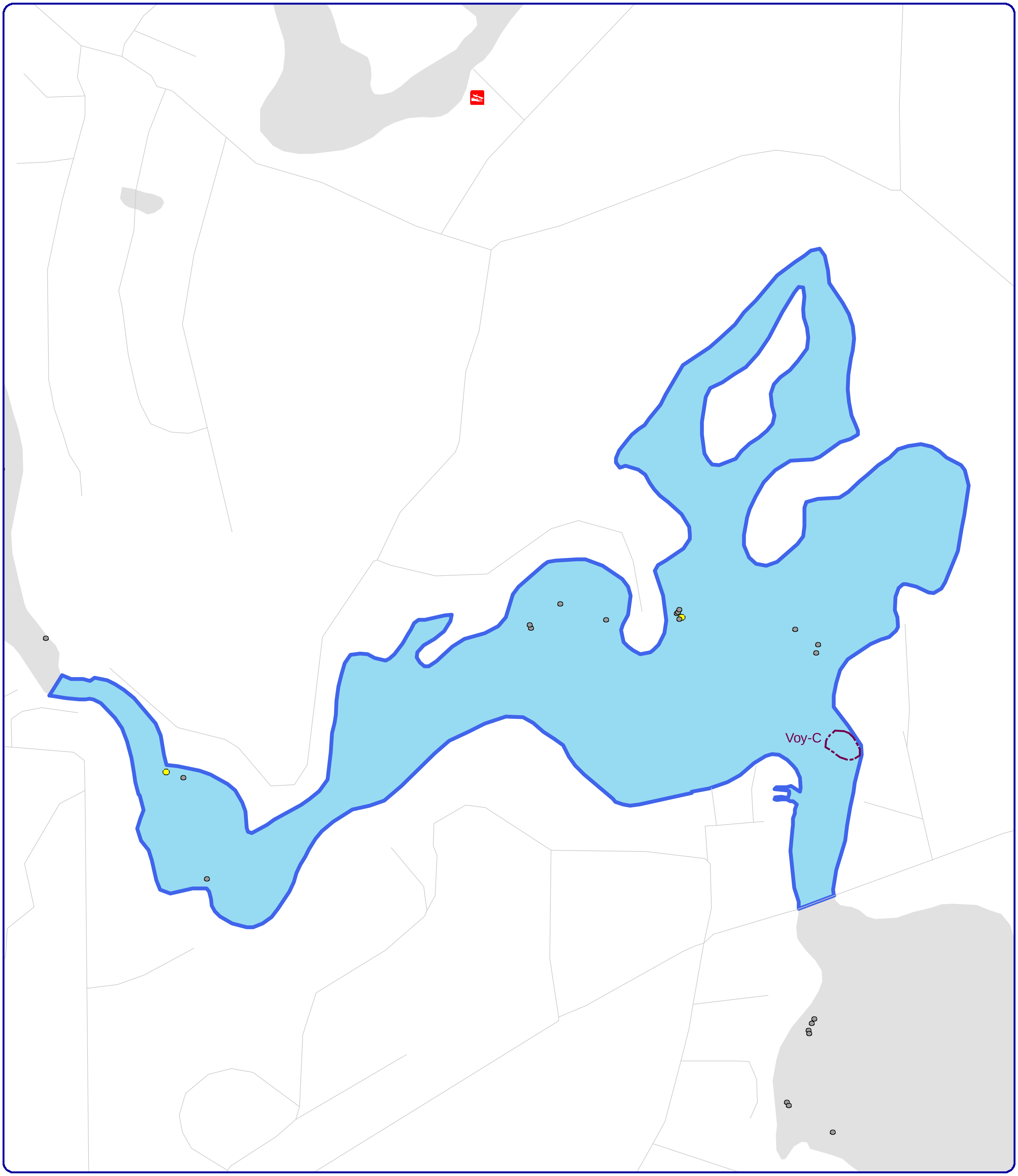
Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Conditional Treatment Area
- 2011 Final Treatment Area

Voy 1

Voyageur Lake
Vilas County, Wisconsin

2010 EWM Locations & 2011 Treatment Areas



750

Feet

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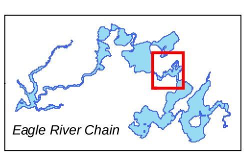
Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Voy2_EWM_2011PB.mxd*



Extent of large map shown in red.

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Final Treatment Area

Voy 2

Voyageur Lake

Vilas County, Wisconsin

2011 EWM Locations

EAGLE LAKE SUMMARY AND CONCLUSIONS

Approximately 9.4 acres of EWM were treated in Eagle Lake in 2011 with granular 2,4-D (Navigate) at this product's maximum label rate (200 lbs/acre) yielding concentrations between 1.75 and 2.0 ppm ae (Map Eagle 1). Following the treatment, all of the treatment areas were reduced by at least one EWM density rating, exceeding the qualitative success criteria (75% of acreage reduced) (Map Eagle 2). In the summer of 2010, 8.3% of the 24 point-intercept locations within the 2011 treatment areas contained EWM compared to none in 2011 (Table 5). Despite a 100% reduction in occurrence, this decline was not statistically valid due to the small sample size.

Data concerning native aquatic plant species within the 2011 treatment areas indicate that northern water milfoil and common waterweed exhibited statistically valid reductions in occurrence following the treatment (Table 5). Like EWM, northern water milfoil is a dicot and is particularly sensitive to herbicide treatments. Efforts are taken to minimize impacts to these species by applying herbicides early in the spring before these plants are actively growing. Eagle-B (Map Eagle 1) is known to contain large northern water milfoil colonies and was not originally proposed for treatment due to valid concerns about potential impact to this species. Because of that fact, no point-intercept sub-sample locations were sampled within Eagle-B during the summer of 2010 and therefore quantitative evaluation of Eagle-B is not included within the analysis on Table 5 (Figure 2).

Table 5. Statistical comparison of aquatic plant frequency data within 2011 treatment areas on Eagle Lake from 2010 pre- and 2011 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.

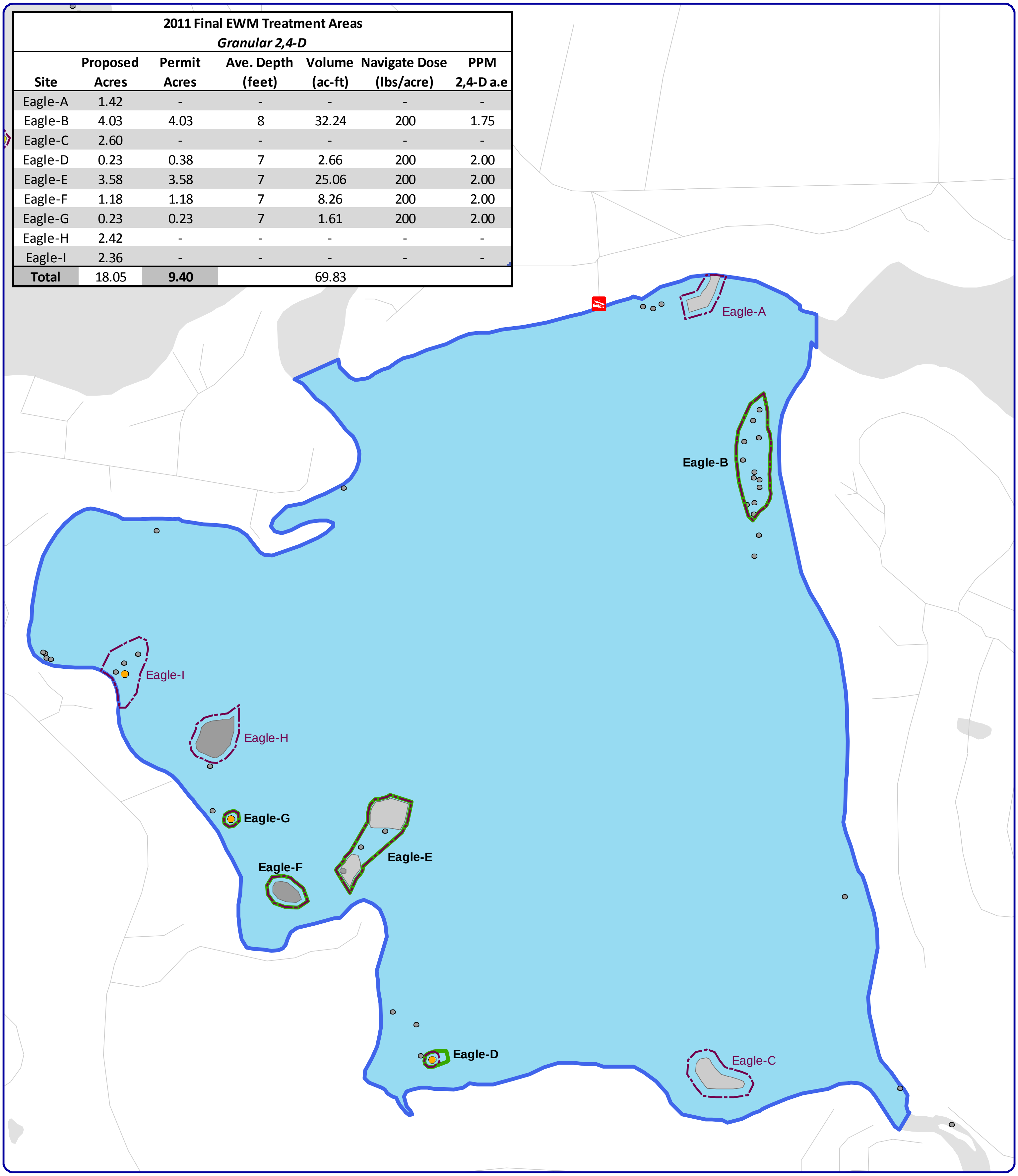
	Scientific Name	Common Name	2010 FOO	2011 FOO	Percent Change	Direction	Chi-square Analysis	
							Statistically Valid	p-value
Dicots	*Myriophyllum spicatum*	Eurasian water milfoil	8.3	0.0	-100.0	▼	No	0.149
	Myriophyllum sibiricum	Northern water milfoil	20.8	0.0	-100.0	▼	Yes	0.018
	Ceratophyllum demersum	Coontail	37.5	16.7	-55.6	▼	No	0.104
Non-dicots	*Elodea canadensis*	Common waterweed	54.2	16.7	-69.2	▼	Yes	0.007
	Potamogeton zosteriformis	Flat-stem pondweed	25.0	8.3	-66.7	▼	No	0.121
	Vallisneria americana	Wild celery	16.7	20.8	25.0	▲	No	0.712
	Potamogeton richardsonii	Clasping-leaf pondweed	8.3	8.3	0.0	-	No	1.000
	Potamogeton robbinsii	Fern pondweed	8.3	8.3	0.0	-	No	1.000
	Potamogeton pusillus	Small pondweed	4.2	20.8	400.0	▲	No	0.081

2010 & 2011 N = 24
FOO = Frequency of Occurrence
▲ or ▼ = Change Statistically Valid (Chi-square; α = 0.05)
▲ or ▼ = Change Not Statistically Valid (Chi-square; α = 0.05)

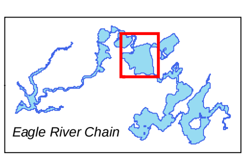
Unlike EWM, common waterweed is a non-dicot and was previously not thought to be sensitive to dicot-selective herbicides. However, emerging data gathered from lakes in 2010 and 2011 with similar treatments indicate that some of these species may be prone to decline following a treatment. As discussed earlier, the declines observed to native species within the treatment areas cannot be extrapolated to the entire lake-wide population as data was only collected from areas within treatment sites. Comparing the upcoming 2012 whole-lake point-intercept survey with the 2006 survey will allow an understanding of how the aquatic plant community changed over this time period.

The 2011 treatment on Eagle Lake was successful. Approximately 10.0 acres of EWM is proposed to be treated on Eagle Lake in 2012 (Map Eagle 2). All of the EWM observed on Eagle Lake in 2011 was classified as either scattered or highly scattered. It is recommended that sites under 1 acre be treated with granular 2,4-D at 2.75 ppm ae and sites greater than 1 acre be treated with granular 2,4-D at 2.5 ppm ae. These levels are higher than applied in 2011.

2011 Final EWM Treatment Areas *Granular 2,4-D*						
Site	Proposed Acres	Permit Acres	Ave. Depth (feet)	Volume (ac-ft)	Navigate Dose (lbs/acre)	PPM 2,4-D a.e
Eagle-A	1.42	-	-	-	-	-
Eagle-B	4.03	4.03	8	32.24	200	1.75
Eagle-C	2.60	-	-	-	-	-
Eagle-D	0.23	0.38	7	2.66	200	2.00
Eagle-E	3.58	3.58	7	25.06	200	2.00
Eagle-F	1.18	1.18	7	8.26	200	2.00
Eagle-G	0.23	0.23	7	1.61	200	2.00
Eagle-H	2.42	-	-	-	-	-
Eagle-I	2.36	-	-	-	-	-
Total	18.05	**9.40**		69.83		



880
Feet



Extent of large map shown in red.

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Conditional Treatment Area
- 2011 Final Treatment Area

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Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Eagle1_EWM_2010PB_T2011.mxd*

Eagle 1

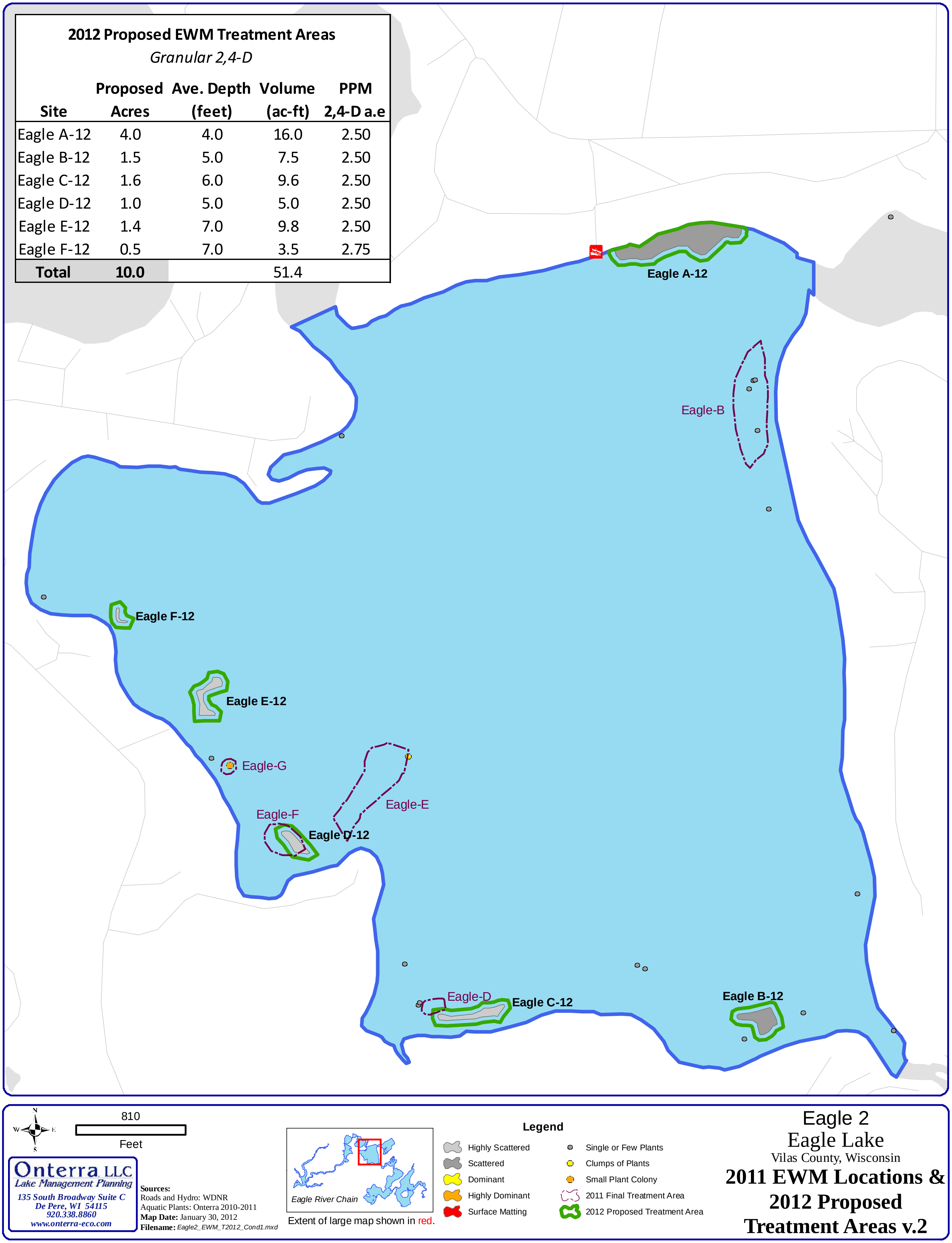
Eagle Lake
Vilas County, Wisconsin

2010 EWM Locations & 2011 Treatment Areas

2012 Proposed EWM Treatment Areas

Granular 2,4-D

Site	Proposed Acres	Ave. Depth (feet)	Volume (ac-ft)	PPM 2,4-D a.e
Eagle A-12	4.0	4.0	16.0	2.50
Eagle B-12	1.5	5.0	7.5	2.50
Eagle C-12	1.6	6.0	9.6	2.50
Eagle D-12	1.0	5.0	5.0	2.50
Eagle E-12	1.4	7.0	9.8	2.50
Eagle F-12	0.5	7.0	3.5	2.75
Total	**10.0**		51.4	



Extent of large map shown in red.

Eagle 2
Eagle Lake
Vilas County, Wisconsin

2011 EWM Locations & 2012 Proposed Treatment Areas v.2

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Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Eagle2_EWM_T2012_Cond1.mxd*

SCATTERING RICE LAKE SUMMARY AND CONCLUSIONS

Approximately 4.7 acres of EWM were treated using granular 2,4-D (Navigate) in Scattering Rice Lake in 2011 at between 2.33 and 2.62 ppm ae (Map Scat 1). In 2010, the majority of the EWM within these treatment areas consisted of single scattered plants, and following the 2011 treatment, only one EWM plant was observed within treatment site Scat-A and no EWM could be located within treatment site Scat-B (Map Scat 2). In the summer of 2010, 33.3% of the 12 point-intercept locations within the 2011 treatment areas contained EWM compared to none in 2011, representing a statistically valid reduction in occurrence of 100% and exceeding the quantitative success criteria (50% reduction in occurrence) (Table 6).

Data concerning native aquatic plant species within the 2011 treatment areas indicate that common waterweed exhibited a statistically valid reduction in occurrence following the treatment (Table 6). Unlike EWM, common waterweed is a non-dicot and was previously not thought to be sensitive to dicot-selective herbicides. However, emerging data gathered from lakes in 2010 and 2011 with similar treatments indicate that some of these species may be prone to decline following a treatment. As discussed earlier, the declines observed to native species within the treatment areas cannot be extrapolated to the entire lake-wide population as data was only collected from areas within treatment sites. Comparing the upcoming 2012 whole-lake point-intercept survey with the 2006 survey will allow an understanding of how the aquatic plant community changed over this time period.

Table 6. Statistical comparison of aquatic plant frequency data within 2011 treatment areas on Scattering Rice Lake from 2010 pre- and 2011 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	2010 FOO	2011 FOO	Percent Change	Direction	Chi-square Analysis: Statistically Valid	Chi-square Analysis: p-value
Dicots	*Myriophyllum spicatum*	Eurasian water milfoil	33.3	0.0	-100.0	▼	Yes	0.028
Dicots	*Ceratophyllum demersum*	Coontail	41.7	8.3	-80.0	▼	No	0.059
Dicots	*Utricularia vulgaris*	Common bladderwort	0.0	8.3	100.0	▲	No	0.307
ND	*Elodea canadensis*	Common waterweed	66.7	0.0	-100.0	▼	Yes	0.001
ND	*Potamogeton robbinsii*	Fern pondweed	83.3	66.7	-20.0	▼	No	0.346
ND	*Potamogeton zosteriformis*	Flat-stem pondweed	25.0	0.0	-100.0	▼	No	0.064
ND	*Heteranthera dubia*	Water stargrass	8.3	0.0	-100.0	▼	No	0.307

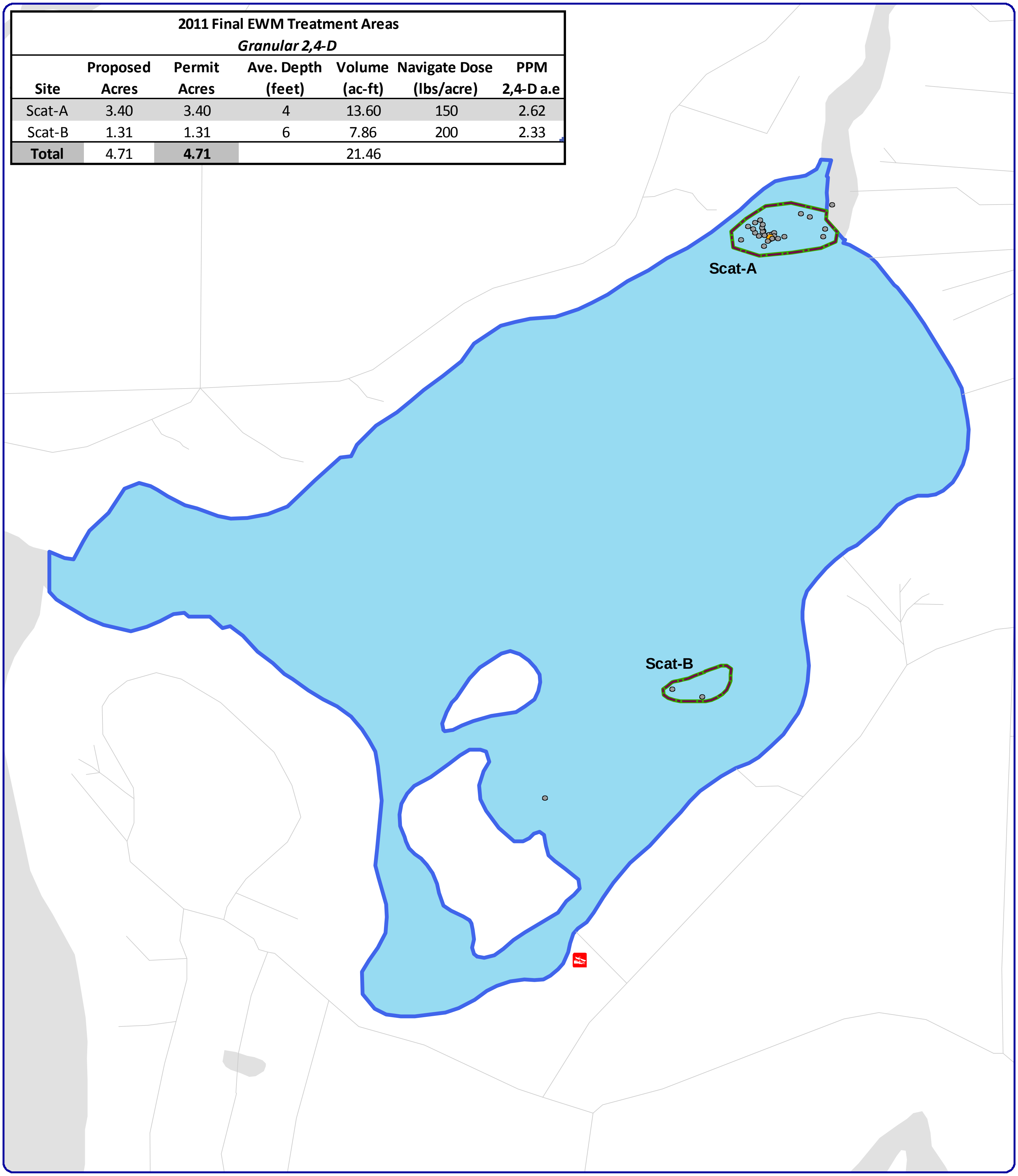
2010 & 2011 N = 12
FOO = Frequency of Occurrence; ND = Non-dicots
▲ or ▼ = Change Statistically Valid (Chi-square; α = 0.05)
▲ or ▼ = Change Not Statistically Valid (Chi-square; α = 0.05)

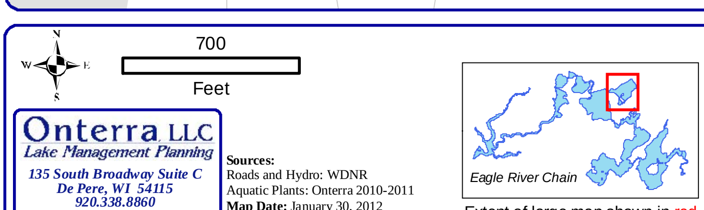
The 2011 treatment on Scattering Rice Lake was successful, and over the course of this project, the treatments on Scattering Rice Lake have been extremely successful at reducing the density and occurrence of EWM. At this time no treatments are proposed for 2012 (Map Scat 2). However, areas where a few EWM plants were located in 2011 will be visited in during the spring 2012 pre-treatment survey and assessed to determine if the EWM has expanded and warrants treatment. If a treatment is proposed, it will most likely be a very small spot treatment using a high dose of granular 2,4-D.

2011 Final EWM Treatment Areas

Granular 2,4-D

Site	Proposed Acres	Permit Acres	Ave. Depth (feet)	Volume (ac-ft)	Navigate Dose (lbs/acre)	PPM 2,4-D a.e
Scat-A	3.40	3.40	4	13.60	150	2.62
Scat-B	1.31	1.31	6	7.86	200	2.33
Total	4.71	**4.71**		21.46		





Extent of large map shown in red.

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Conditional Treatment Area
- 2011 Final Treatment Area

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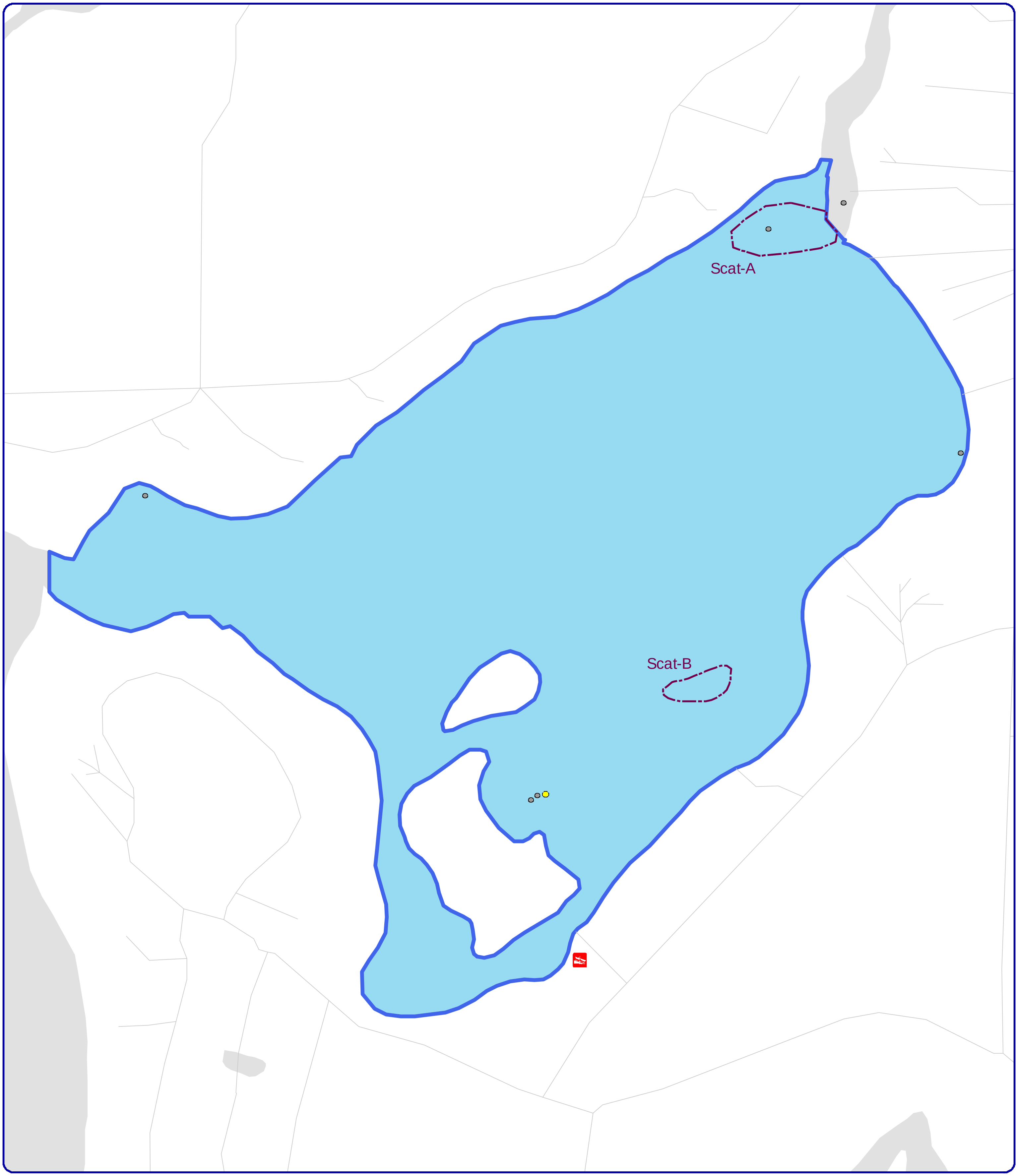
Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: Scat1_EWM_2010PB_T2011.mxd

Scat 1

Scattering Rice Lake

Vilas County, Wisconsin

2010 EWM Locations & 2011 Treatment Areas



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Feet

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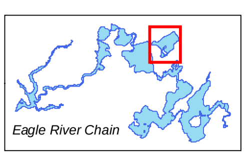
Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Scat2_EWM_2011PB.mxd*



Extent of large map shown in red.

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Final Treatment Area

Scat 2
Scattering Rice Lake
Vilas County, Wisconsin

2011 EWM Locations

OTTER LAKE SUMMARY AND CONCLUSIONS

Approximately 9.7 acres of EWM were treated in Otter Lake in 2011 with granular 2,4-D (Navigate) at this product's maximum label rate (200 lbs/acre) yielding concentrations between 1.75 and 2.33 ppm ae (Map Otter 1). In 2010, the majority of the EWM within these treatment areas consisted of scattered and dominant EWM colonies. Following the 2011 treatment, no EWM could be located within any of the treatment areas, exceeding the qualitative success criteria (75% of treatment acreage reduced) (Map Scat 2). In the summer of 2010, 41.2% of the 17 point-intercept locations within the 2011 treatment areas contained EWM compared to none in 2011, representing a statistically valid reduction in occurrence of 100% and exceeding the quantitative success criteria (50% reduction in occurrence) (Table 7).

Data concerning native aquatic plant species within the 2011 treatment areas indicate that common waterweed exhibited a statistically valid reduction in occurrence following the treatment (Table 7). Unlike EWM, common waterweed is a non-dicot and was previously not thought to be sensitive to dicot-selective herbicides. However, emerging data gathered from lakes in 2010 and 2011 with similar treatments indicate that some of these species may be prone to decline following a treatment. As discussed earlier, the declines observed to native species within the treatment areas cannot be extrapolated to the entire lake-wide population as data was only collected from areas within treatment sites. Comparing the upcoming 2012 whole-lake point-intercept survey with the 2006 survey will allow an understanding of how the aquatic plant community changed over this time period.

Table 7. Statistical comparison of aquatic plant frequency data within 2011 treatment areas on Otter Lake from 2010 pre- and 2011 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.

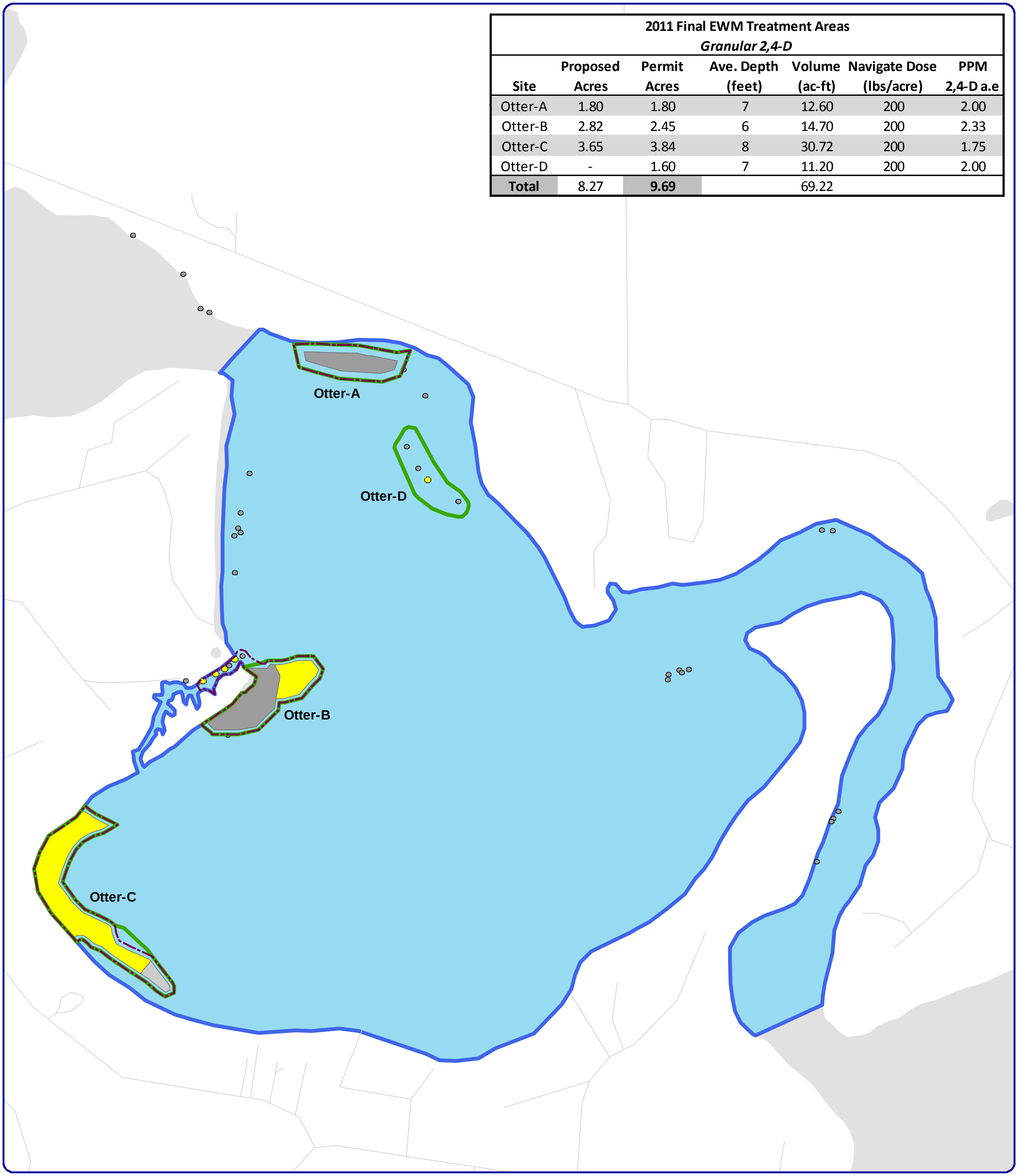
	Scientific Name	Common Name	2010 FOO	2011 FOO	Percent Change	Direction	Chi-square Analysis	
							Statistically Valid	p-value
Dicots	*Myriophyllum spicatum*	Eurasian water milfoil	41.2	0.0	-100.0	▼	Yes	0.003
	Ceratophyllum demersum	Coontail	29.4	11.8	-60.0	▼	No	0.203
	Myriophyllum sibiricum	Northern water milfoil	17.6	0.0	-100.0	▼	No	0.070
Non-dicots	*Elodea canadensis*	Common waterweed	70.6	0.0	-100.0	▼	Yes	0.000
	Vallisneria americana	Wild celery	29.4	35.3	20.0	▲	No	0.714
	Potamogeton robbinsii	Fern pondweed	11.8	11.8	0.0	-	No	1.000
	Potamogeton zosteriformis	Flat-stem pondweed	5.9	5.9	0.0	-	No	1.000
	Najas flexilis	Slender naiad	0.0	5.9	100.0	▲	No	0.310
	Potamogeton gramineus	Variable pondweed	0.0	5.9	100.0	▲	No	0.310
	Potamogeton pusillus	Small pondweed	0.0	5.9	100.0	▲	No	0.310

2010 & 2011 N = 17
FOO = Frequency of Occurrence
▲ or ▼ = Change Statistically Valid (Chi-square; α = 0.05)
▲ or ▼ = Change Not Statistically Valid (Chi-square; α = 0.05)

The Eagle River Chain of Lakes was again selected to participate in a residual herbicide monitoring research project being conducted by the WDNR and US Army Corps of Engineers (USACE). Water samples were collected by a lake volunteer from sites located both within each of the four final herbicide application areas on Otter Lake. The water samples were properly fixed and sent to the USACE laboratory for analysis. The preliminary data show that herbicide concentrations were similar between all sites, with levels slightly higher for Otter-C. This was the largest treatment site and likely the furthest from the main flow of the system, even though the calculated target concentration was the lowest (1.75 ppm ae) of the four sites. Otter-A was located near the constriction to Lynx Lake where flows are likely highest. The measured herbicide concentrations from this site were the lowest. Appendix A contains the USACE draft report with more detail regarding the residual sampling study on Otter Lake.

The 2011 treatment on Otter Lake was successful. An area of scattered EWM was located along the southeast shoreline of Otter Lake in 2011 (Map Otter 2). This area, comprising 2.2 acres, is the only area proposed for treatment in 2012, and is recommended to be applied with granular 2,4-D at 2.50 ppm ae. These levels are slightly higher than applied in 2011.

2011 Final EWM Treatment Areas *Granular 2,4-D*						
Site	Proposed Acres	Permit Acres	Ave. Depth (feet)	Volume (ac-ft)	Navigate Dose (lbs/acre)	PPM 2,4-D a.e
Otter-A	1.80	1.80	7	12.60	200	2.00
Otter-B	2.82	2.45	6	14.70	200	2.33
Otter-C	3.65	3.84	8	30.72	200	1.75
Otter-D	-	1.60	7	11.20	200	2.00
Total	8.27	**9.69**		69.22		



575
Feet

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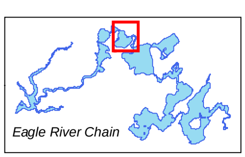
Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Otter1_EWM_2010PB_T2011.mxd*



Extent of large map shown in red.

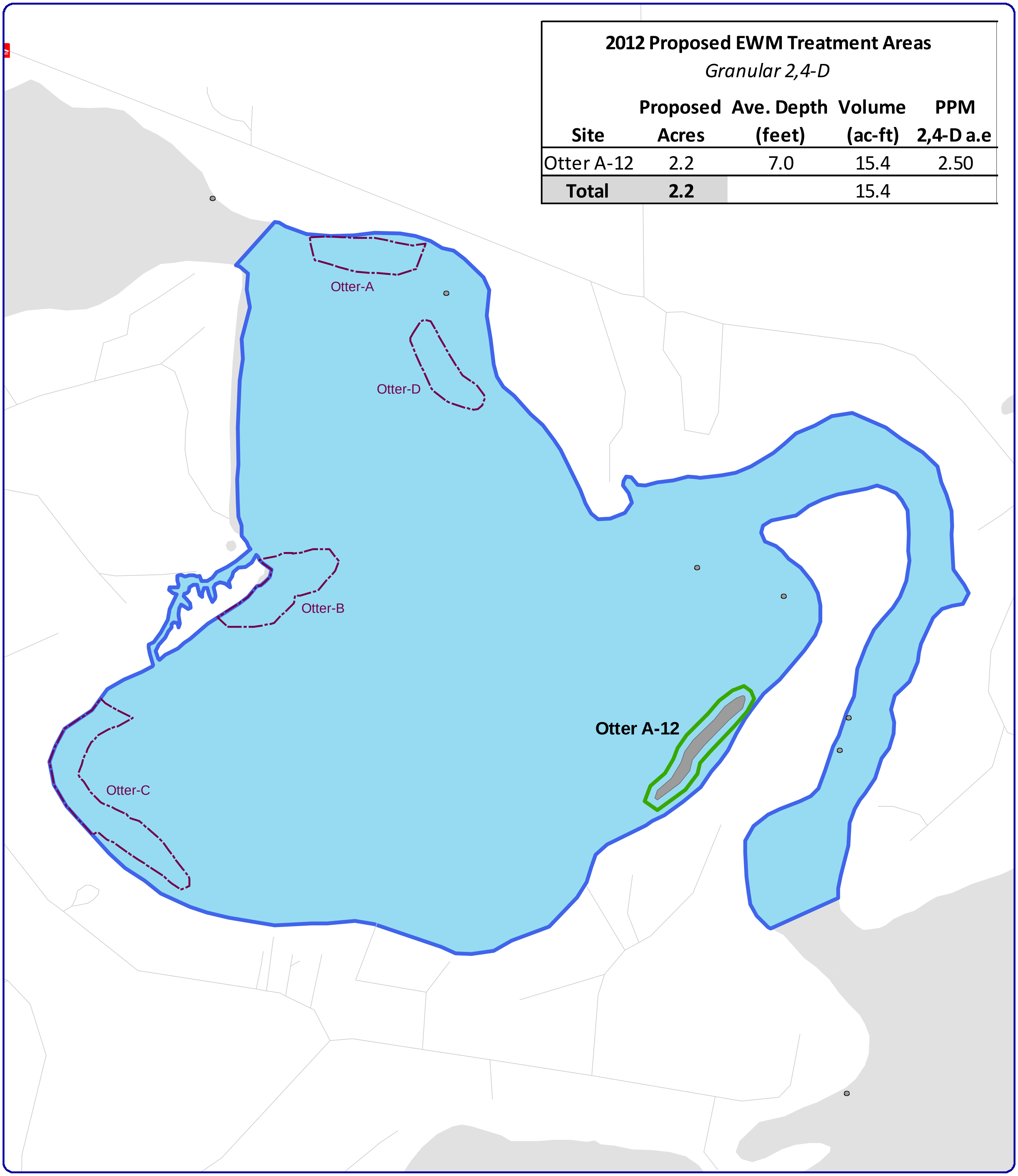
Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Conditional Treatment Area
- 2011 Final Treatment Area

Otter 1

Otter Lake
Vilas County, Wisconsin

2010 EWM Locations & 2011 Treatment Areas



2012 Proposed EWM Treatment Areas *Granular 2,4-D*				
Site	Proposed Acres	Ave. Depth (feet)	Volume (ac-ft)	PPM 2,4-D a.e
Otter A-12	2.2	7.0	15.4	2.50
Total	**2.2**		15.4	

570

Feet

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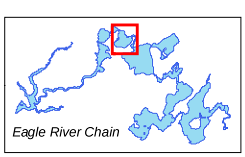
Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Otter2_EWM_T2012_Cond1.mxd*



Extent of large map shown in red.

Legend

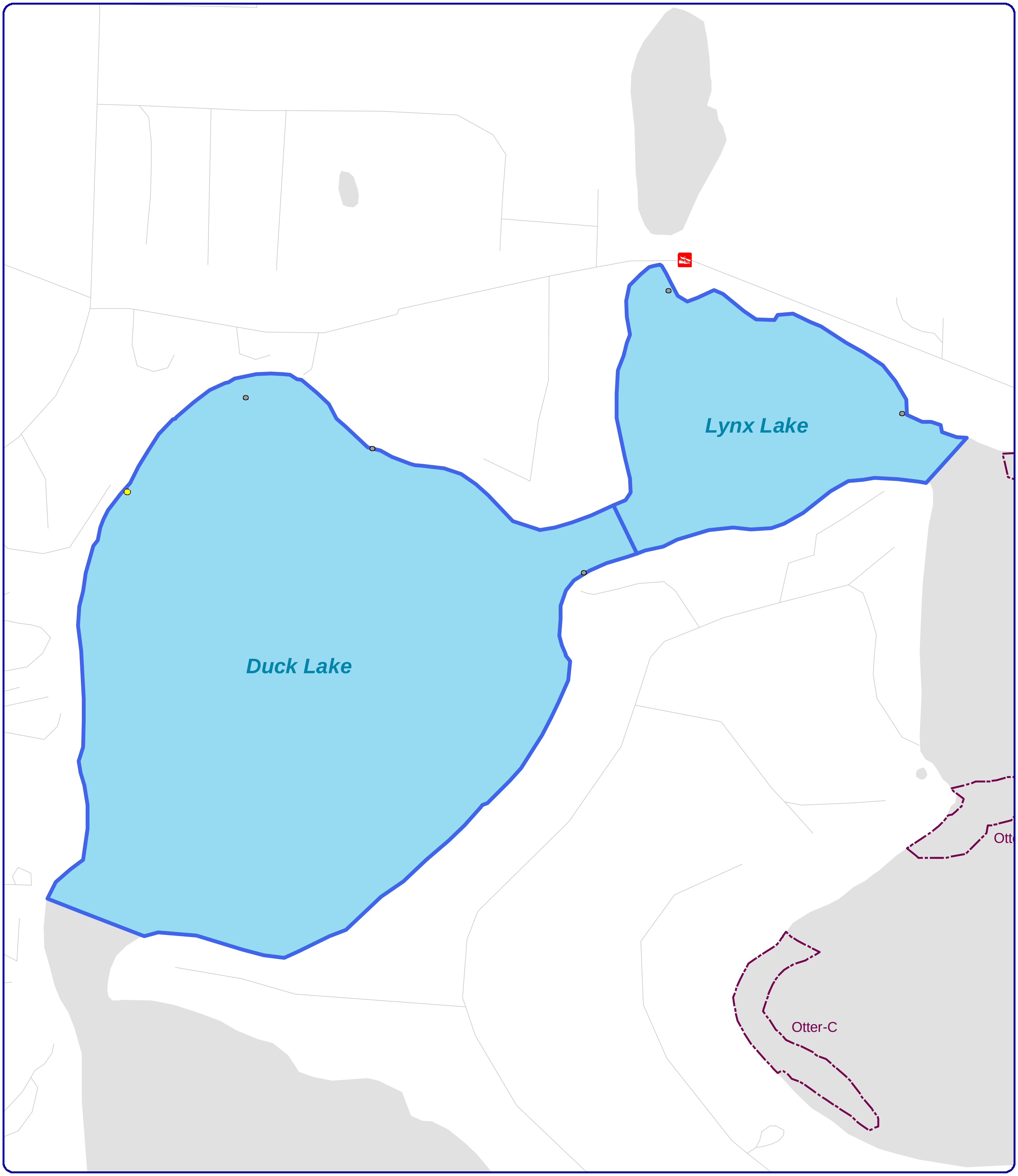
- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Final Treatment Area
- 2012 Proposed Treatment Area

Otter 2
Otter Lake
Vilas County, Wisconsin

2011 Treatment Areas & 2012 Proposed Treatment Areas v.2

LYNX AND DUCK LAKES SUMMARY AND CONCLUSIONS

Relative to the size of the lakes, large treatments occurred on Lynx and Duck Lake in 2010. These treatments were shown to be effective and no EWM treatments occurred on Lynx and Duck Lakes in 2011. During the 2011 peak-biomass survey, a single EWM plant was located in Lynx Lake, and a few single and clumps of EWM plants were located in Duck Lake (Map Lynx-Duck 1). No treatments are proposed on either of the lakes in 2012, though these areas will be assessed during the 2012 pre-treatment survey to determine if they have expanded and warrant treatment.



550
Feet

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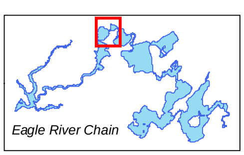
Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Lynx-Duck1_EWM_2011PB.mxd*



Extent of large map shown in red.

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony

Lynx-Duck 1

Lynx & Duck Lakes

Vilas County, Wisconsin

2011 EWM Locations

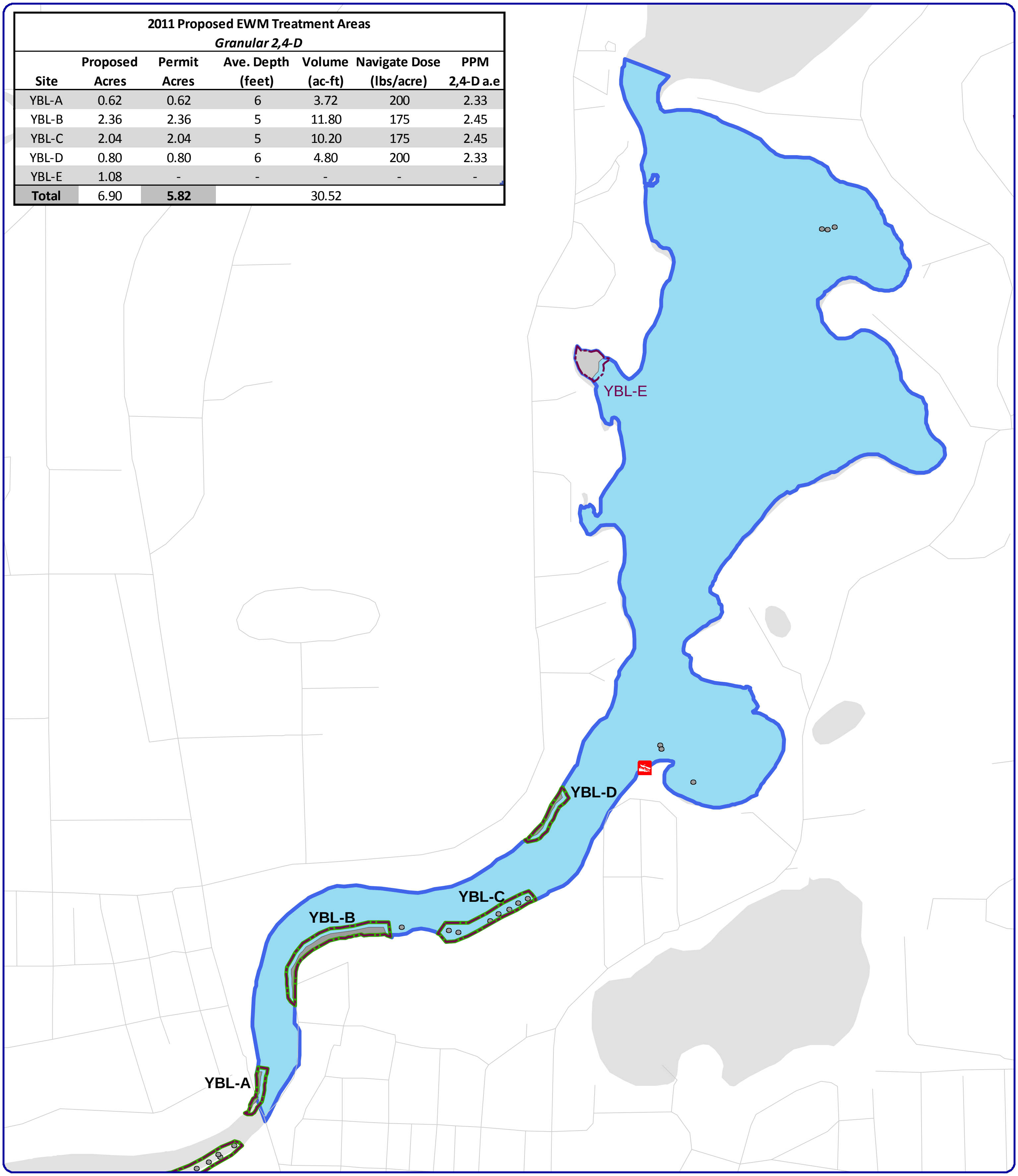
YELLOW BIRCH LAKE SUMMARY AND CONCLUSIONS

Approximately 5.8 acres of EWM acres were treated using granular 2,4-D (Navigate) in Yellow Birch Lake in 2011 at between 2.33 and 2.45 ppm ae (Map YBL 1). In 2010, the majority of the EWM within these treatment areas consisted of scattered EWM. Following the 2011 treatment, all of the 2011 treatment areas were observed to have a reduction in EWM density, exceeding the qualitative success criteria (75% of treatment acreage reduced) (Map YBL 2). Quantitative evaluation of the frequency of occurrence of EWM could not be conducted as this small treatment did not have a sufficient number if point-intercept sampling locations.

The Eagle River Chain of Lakes was again selected to participate in a residual herbicide monitoring research project being conducted by the WDNR and US Army Corps of Engineers (USACE). Water samples were collected by a lake volunteer from sites located both within each of the four final herbicide application areas on Yellow Birch Lake. The water samples were properly fixed and sent to the USACE laboratory for analysis. The preliminary data show that herbicide concentrations were similar between all sites, with levels slightly higher for YBL-B. This was the largest treatment site and on the inside bend of the river where flows are lower. Appendix B contains the USACE draft report with more detail regarding the residual sampling study on Yellow Birch Lake.

The 2011 treatment on Yellow Birch Lake was successful at reducing the density of EWM within the 2011 treatment areas; however most of these sites still contain low levels of EWM. During the 2011 peak-biomass survey, one dominant EWM colony and a few scattered and highly scattered EWM colonies were located and proposed for treatment in 2012 (Map YBL 2). Treatment Site YBL A-12 is located in the northern portion of the lake, while the other five treatment sites are located downstream of the boat landing locally known as the T-Docks. These areas, comprising approximately 5.8 acres, are proposed to be treated in Yellow Birch Lake in 2012 using granular 2,4-D. Consistent with the strategy employed on other lakes of the Eagle River Chain, YBL A-12 is proposed to be treated at 2.5 ppm ae because it is greater than 1 acre. The four other proposed treatment areas are located within the Eagle River and exposed to higher flows. To combat the rapid herbicide dilution that is likely in these areas, a 2,4-D dose of 3.0 ppm ae is proposed for these sites.

2011 Proposed EWM Treatment Areas *Granular 2,4-D*						
Site	Proposed Acres	Permit Acres	Ave. Depth (feet)	Volume (ac-ft)	Navigate Dose (lbs/acre)	PPM 2,4-D a.e
YBL-A	0.62	0.62	6	3.72	200	2.33
YBL-B	2.36	2.36	5	11.80	175	2.45
YBL-C	2.04	2.04	5	10.20	175	2.45
YBL-D	0.80	0.80	6	4.80	200	2.33
YBL-E	1.08	-	-	-	-	-
Total	6.90	**5.82**		30.52		



970
Feet

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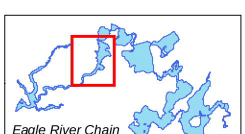
Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *YBL1_EWM_2010PB_T2011.mxd*



Extent of large map shown in red.

Legend

Highly Scattered
Scattered
Dominant
Highly Dominant
Surface Matting
Single or Few Plants
Clumps of Plants
Small Plant Colony
2011 Conditional Treatment Area
2011 Final Treatment Area

YBL 1

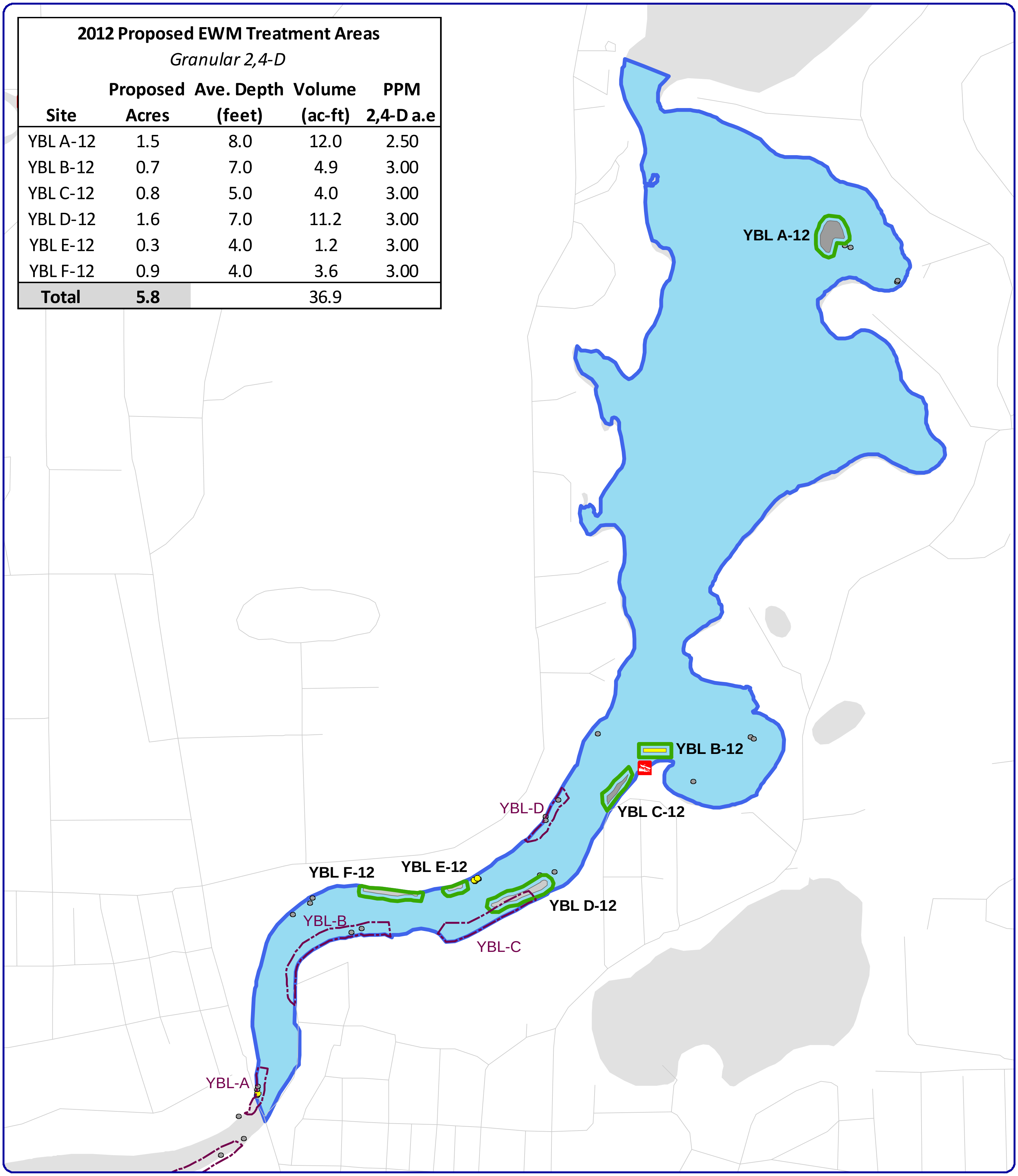
Yellow Birch Lake
Vilas County, Wisconsin

2010 EWM Locations & 2011 Treatment Areas

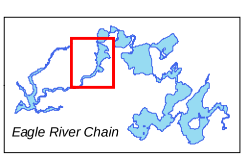
2012 Proposed EWM Treatment Areas

Granular 2,4-D

Site	Proposed Acres	Ave. Depth (feet)	Volume (ac-ft)	PPM 2,4-D a.e
YBL A-12	1.5	8.0	12.0	2.50
YBL B-12	0.7	7.0	4.9	3.00
YBL C-12	0.8	5.0	4.0	3.00
YBL D-12	1.6	7.0	11.2	3.00
YBL E-12	0.3	4.0	1.2	3.00
YBL F-12	0.9	4.0	3.6	3.00
Total	**5.8**		36.9	



970
Feet



Extent of large map shown in red.

Legend

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

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Sources:
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Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *YBL2_EWM_T2012_Cond1.mxd*

YBL 2
Yellow Birch Lake
Vilas County, Wisconsin

2011 EWM Locations & 2012 Proposed Treatment Areas v.2

WATERSMEET SUMMARY AND CONCLUSIONS

Based upon the 2010 EWM peak-biomass survey, approximately 52.6 acres were originally proposed for treatment (Map 1). Site Wat-A_1 is known to contains low levels of northern wild rice (*Zizania palustris*) which has been shown to be susceptible to 2,4-D during early spring applications. Conversations with the WDNR and Great Lakes Indian Fish and Wildlife Commission (GLIFWC) indicate that a strategy for re-seeding this area would need to be in place in case this population experiences negative impacts following the treatment. Because of this uncertainty, this site was elected not to be treated in 2011.

Approximately 32.7 acres of EWM acres were treated using granular 2,4-D (Navigate) in Watersmeet Lake in 2011 at between 2.0 and 2.62 ppm ae (Map Wat 1). In 2010, the majority of the EWM within these treatment areas consisted of scattered, highly scattered, and some small dominant areas of EWM. Following the 2011 treatment, all of the treatment areas were observed to have a reduction in EWM density, exceeding the qualitative success criteria (75% of treatment acreage reduced) (Map Wat 2). In both the summers of 2010 and 2011, 3.5% of the 57 point-intercept locations within the 2011 treatment areas contained EWM. While these data indicate no change in EWM occurrence (Table 8), it also reveals the difficulty of using quantitative methodologies to evaluate treatments of sparse EWM.

Data concerning native aquatic plant species within the 2011 treatment areas indicate that no native aquatic plant species saw statistically valid changes in occurrence following the treatment (Table 8). Comparing the upcoming 2012 whole-lake point-intercept survey with the 2006 survey will allow an understanding of how the aquatic plant community changed over this time period.

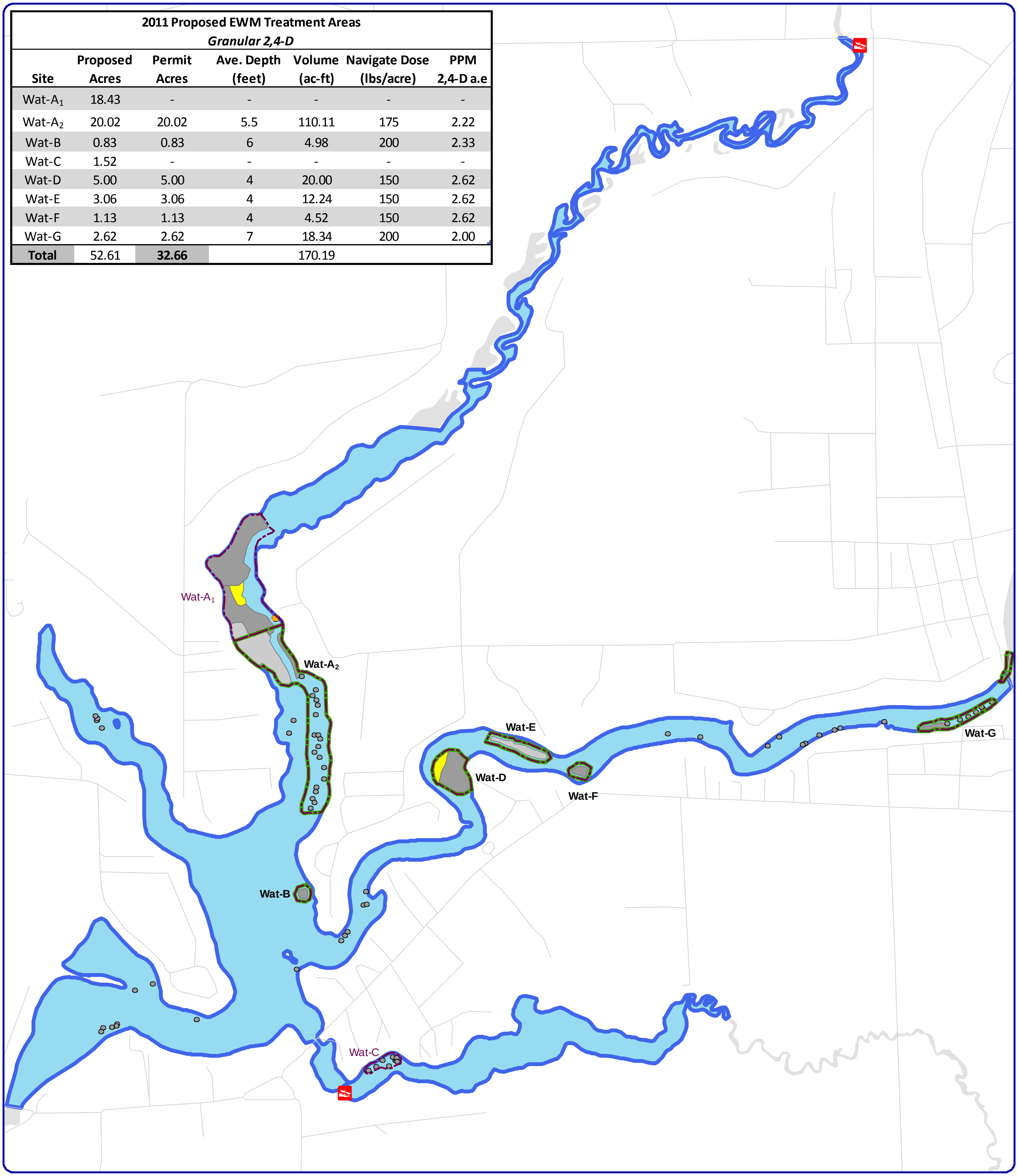
Table 8. Statistical comparison of aquatic plant frequency data within 2011 treatment areas on Watersmeet from 2010 pre- and 2011 post-treatment surveys. Only species with greater than 5.0% frequency of occurrence in at least one of the two surveys are applicable for analysis.

	Scientific Name	Common Name	2010 FOO	2011 FOO	Percent Change	Direction	Chi-square Analysis	
							Statistically Valid	p-value
D	*Myriophyllum spicatum*	Eurasian water milfoil	3.5	3.5	0.0	-	No	1.000
D	*Ceratophyllum demersum*	Coontail	29.8	17.5	-41.2	▼	No	0.123
Non-dicots	*Potamogeton robbinsii*	Fern pondweed	36.8	21.1	-42.9	▼	No	0.063
Non-dicots	*Vallisneria americana*	Wild celery	17.5	29.8	70.0	▲	No	0.123
Non-dicots	*Elodea canadensis*	Common waterweed	15.8	5.3	-66.7	▼	No	0.067
Non-dicots	*Nitella spp.*	Stoneworts	5.3	3.5	-33.3	▼	No	0.647
Non-dicots	*Potamogeton zosteriformis*	Flat-stem pondweed	5.3	5.3	0.0	-	No	1.000

2010 & 2011 N = 57
FOO = Frequency of Occurrence; D = Dicots
▲ or ▼ = Change Statistically Valid (Chi-square; α = 0.05)
▲ or ▼ = Change Not Statistically Valid (Chi-square; α = 0.05)

The 2011 treatment on Watersmeet was successful in reducing the density of EWM. The proposed 2012 EWM control strategy for Watersmeet Lake includes 13.9 acres of herbicide treatment with granular 2,4-D at 2.5 ppm ae. Almost two-thirds of the proposed treatment acreage (9 acres) is within areas of sparse wild rice (Map 2, Sites Wat B-12 and Wat C-12). These areas contain the largest and densest colonies of EWM from the entire Eagle River Chain of Lakes and represent the largest threat to the overall success of the long-term EWM management of the system. This message has been relayed to the WDNR and GLIFWC. In the upcoming weeks, these two entities have plans to meet and discuss the precise steps that would need to occur if this site is to be targeted for EWM control. With this information in hand, the ULERCLC will determine if control strategies should be implemented on Sites Wat B-12 and Wat C-12.

2011 Proposed EWM Treatment Areas						
Granular 2,4-D						
Site	Proposed Acres	Permit Acres	Ave. Depth (feet)	Volume (ac-ft)	Navigate Dose (lbs/acre)	PPM 2,4-D a.e
Wat-A_1	18.43	-	-	-	-	-
Wat-A_2	20.02	20.02	5.5	110.11	175	2.22
Wat-B	0.83	0.83	6	4.98	200	2.33
Wat-C	1.52	-	-	-	-	-
Wat-D	5.00	5.00	4	20.00	150	2.62
Wat-E	3.06	3.06	4	12.24	150	2.62
Wat-F	1.13	1.13	4	4.52	150	2.62
Wat-G	2.62	2.62	7	18.34	200	2.00
Total	52.61	**32.66**		170.19		



1,500

Feet

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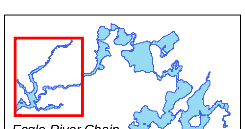
Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra 2010-2011
Map Date: January 30, 2012
Filename: *Wat1_EWM_2010PB_T2011.mxd*



Extent of large map shown in red.

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Conditional Treatment Area
- 2011 Final Treatment Area

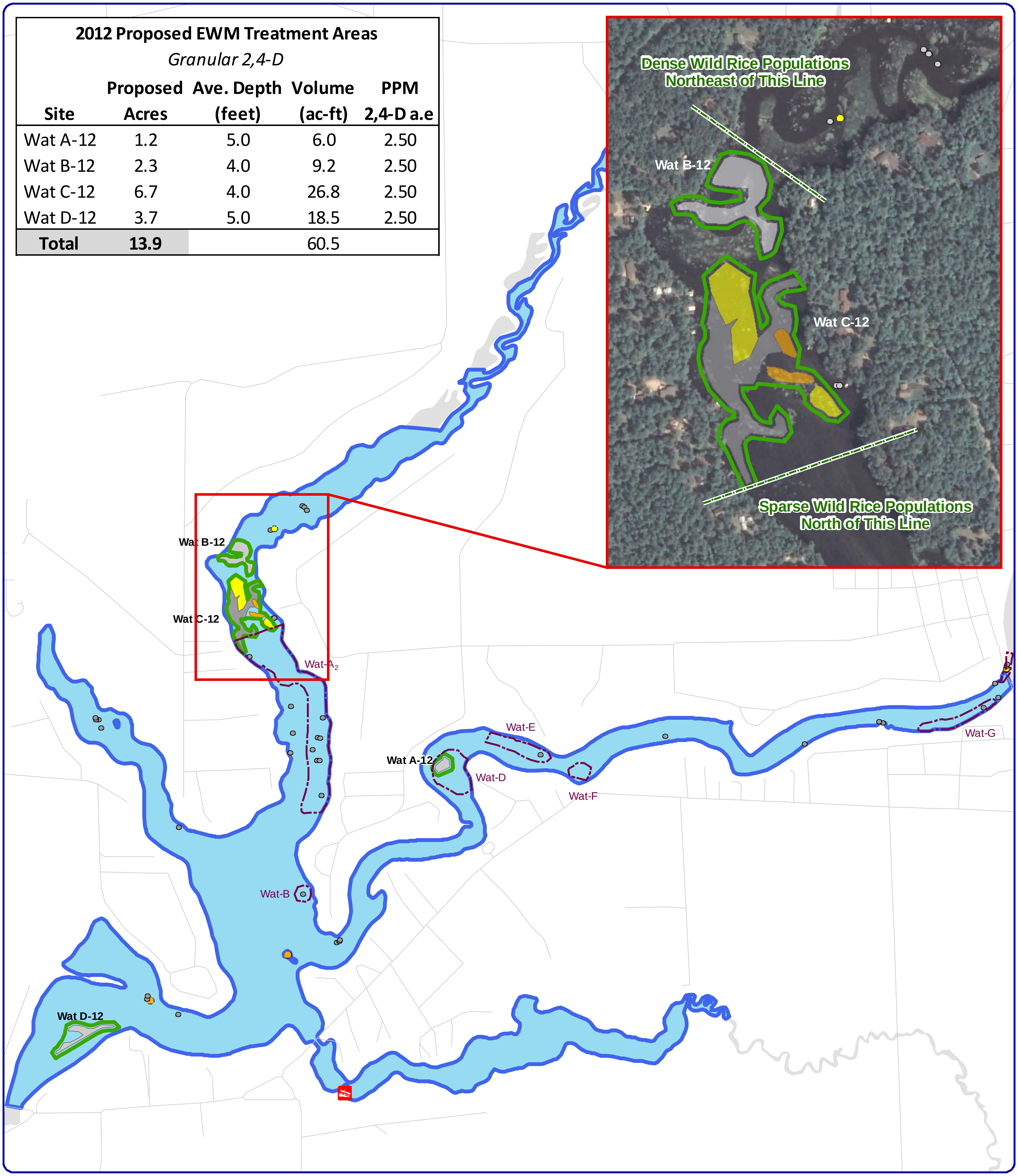
Wat 1
Watersmeet Lake &
Eagle River Channel
Vilas County, Wisconsin

2010 EWM Locations & 2011 Treatment Areas

2012 Proposed EWM Treatment Areas

Granular 2,4-D

Site	Proposed Acres	Ave. Depth (feet)	Volume (ac-ft)	PPM 2,4-D a.e
Wat A-12	1.2	5.0	6.0	2.50
Wat B-12	2.3	4.0	9.2	2.50
Wat C-12	6.7	4.0	26.8	2.50
Wat D-12	3.7	5.0	18.5	2.50
Total	**13.9**		60.5	



1,500

Feet

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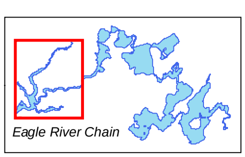

Extent of large map shown in red.

Legend

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2011 Final Treatment Area
- 2012 Proposed Treatment Area

Wat 2

Watersmeet Lake & Eagle River Channel

Vilas County, Wisconsin

2011 EWM Locations & 2012 Proposed Treatment Areas v.2