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LAKE REDSTONE, SAUK COUNTY

2016 AQUATIC PLANT MANAGEMENT SUMMARY REPORT
WDNR WBIC: 1280400

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Revised January 23, 2018

LAKE REDSTONE PROTECTION DISTRICT
LA VALLE, WI 53941

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PREPARED FOR THE LAKE REDSTONE PROTECTION DISTRICT

INTRODUCTION

This report discusses aquatic plant management activities completed by the Lake Redstone Protection District (LRPD) and Lake Education and Planning Services (LEAPS) during the 2016 season and provides additional information about the 2016 EWM treatment completed on Lake Redstone. The following list of education and management actions were completed in 2016.

- Spring 2016 EWM Management Planning
- 2016 Early Season EWM Treatment Details
- 2016 Chemical Concentration Testing
- 2016 Summer Point-Intercept (PI) Surveys of Lake Redstone Bays
- 2016 CLP and Purple Loosestrife
- 2016 Summer Nuisance and Navigation Management
- 2016 Manual Removal Efforts
- 2016 Clean Boats Clean Waters
- 2016 Lake Education
- 2017 EWM Management Planning
- 2017 Summer Point Intercept Surveys
- December 2015 AIS and SPL Grant Summaries
- 2016 and 2017 LEAPS Contracts

Each of these actions will be summarized in the following sections of this report.

Based on a fall EWM survey completed on October 9, 2015 by Cason and Associates, summer point-intercept surveys completed by Aquatic Plant Habitat Services (APHS), and discussions with the Lake Redstone Protection District (LRPD) and Lake Education and Planning Services (LEAPS), a proposal was made by the LRPD and a permit application submitted to the Wisconsin Department of Natural Resources (WDNR) to treat three bays on Lake Redstone totaling 11.8 acres (Table 1, Figure 1). The proposals for these three bays include the application of a liquid formulation of the active ingredient 2, 4-D (DMA 4) at 2.0 ppm on two of them; and diquat (Reward) at the maximum label rate on the third one.

All three of these bays were surveyed in the summer of 2015, were surveyed again in 2016 post-treatment, and will be surveyed again in 2017.

Table 1 - 2016 Early Season EWM Treatment Proposal

2016 Lake Redstone-Cardinal Bay EWM Treatment Proposal - Diquat (4/18/2016)

Treatment Area Characteristics					Eurasian Watermilfoil — Diquat (Reward)					
Treatment Location	Site Name	Acreage	Mean Depth (feet)	Volume (acre-feet)	Max Label Treatment Rate (2 gal/acre)	Application rate (gal/ac-ft)	Max allowed diquat ion (2lbs/gallon)	Total diquat ion (mg) (Col.M x 453594)	Treatment a.i. ppm (Col.L/12334 81.84)	Exceeds label or DNR rate
Cardinal Bay	Bed2-16	1.30	6.0	7.80	2.60	0.333	0.667	302394.667	0.245	no
Total		*1.30*		*7.80*	*2.60*					
EWM Treatment (1.3 acres); early spring application-Diquat										

2016 Lake Redstone Spring EWM Chemical Treatment Proposal (Rev: 4/18/2016)

Treatment Area Characteristics					Eurasian Watermilfoil — 2,4-D (DMA 4)		
Treatment Site	Site Name	Acreage	Mean Depth (feet)	Volume (acre-feet)	Treatment a.i. ppm	Treatment application (gal)	Application rate (gal/ac-ft)
Bed1-16ChiS	Chickadee Bay South	3.30	4.5	14.85	2.0	21.1	1.42
Bed4-16Orio	Oriole Bay	7.20	7.0	50.40	2.0	71.6	1.42
Total		*10.50*		*65.25*		*92.7*	
					EWM Treatment (10.5 acres); early spring application		

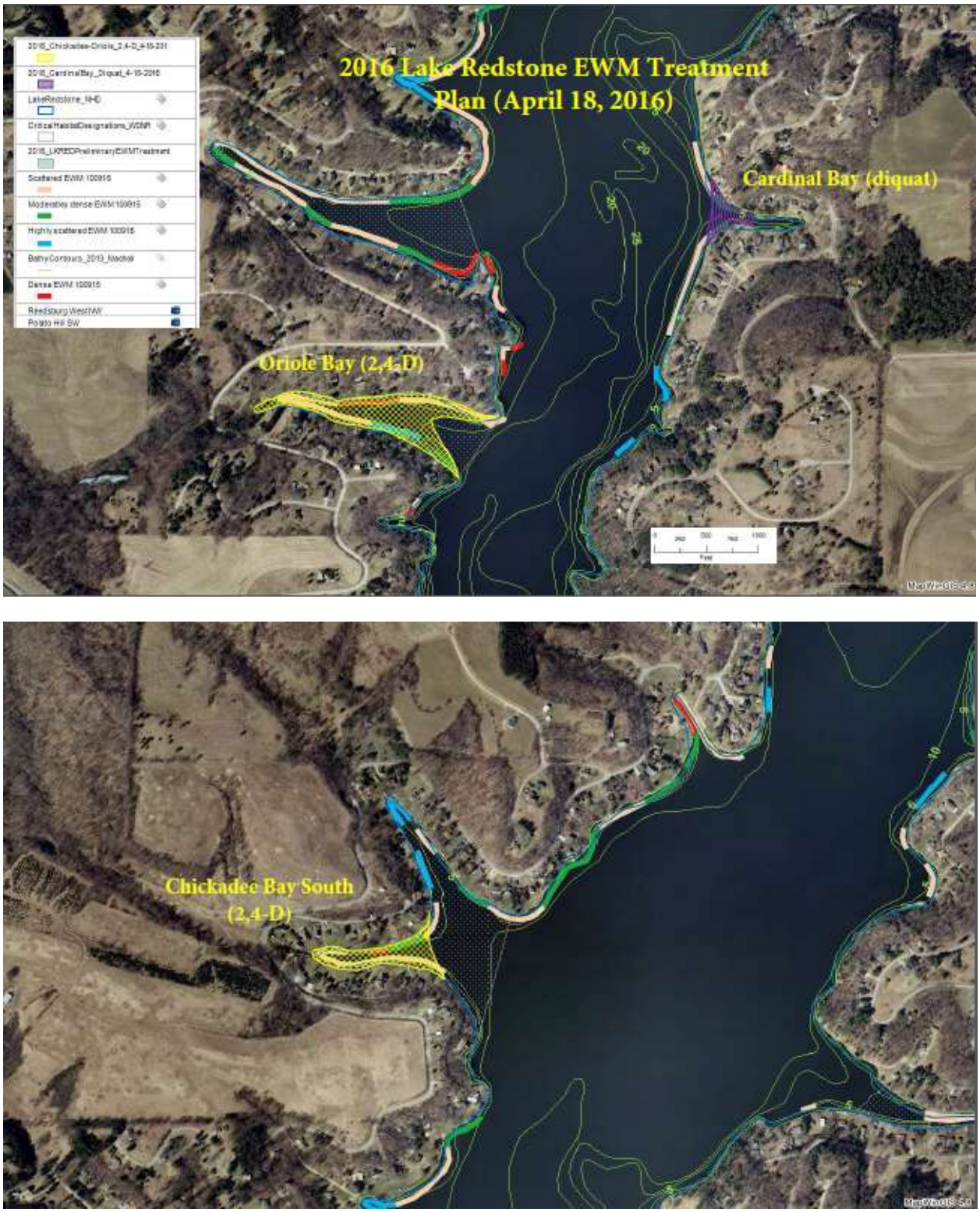

Figure 1 - 2016 Proposed EWM treatment in three bays

2016 EARLY SEASON EWM TREATMENT DETAILS

On April 29, 2016 Cason and Associates, the applicator retained by the LRPD completed the application of DMA 4 to 10.3 acres in Oriole and Chickadee Bay South. Diquat was applied to 1.3 acres of Cardinal Bay.

2016 CHEMICAL CONCENTRATION TESTING

Following the 2016 early season herbicide application in Oriole and Chickadee Bay South, volunteers from the LRPD collected chemical concentration data from six sites in and near the treatment areas and at the outlet of the lake (Figure 2). Each site was sampled at seven different times after treatment: 3 HAT, 6 HAT, 9 HAT, 24 HAT, 36 HAT, 48 HAT and 72 HAT (HAT stands for "**H**ours **A**fter **T**reatment". Chemical concentration testing is used to determine the concentration reached in the treated areas and how long the herbicide remains in contact with the target plant. In the 2016 early season treatment, the target concentration in the two treated bays was 2.0 ppm.

Only one site in Chickadee Bay, the one furthest into the bay, got close to the target concentration within the first six hours (Figure 3, Table 2). Within the first 24 hours, two sites in Oriole Bay, the middle site and the one furthest in got close to or reached the target concentration. The monitoring sites at the mouths of both treated bays remained low, with the mouth of Chickadee Bay south barely registering the applied herbicide. After 48 hours herbicide concentrations were well below the expected concentrations. Herbicide was not detected (ND) at the outlet until 72 hours later when a concentration of only 0.0042 ppm was documented.

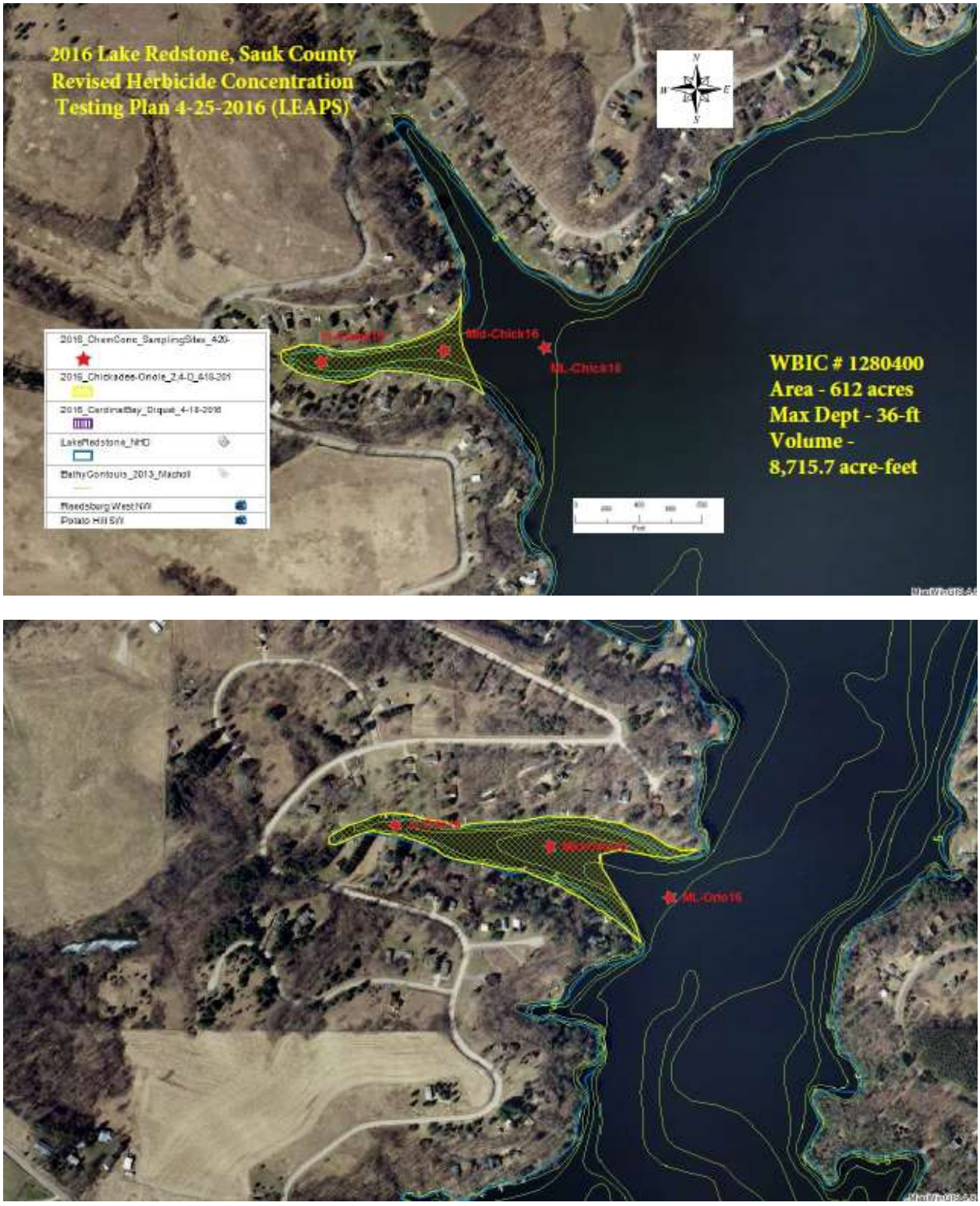

Figure 2 - Chemical Concentration Testing Sites in Chickadee Bay South (top) and Oriole Bay (bottom)

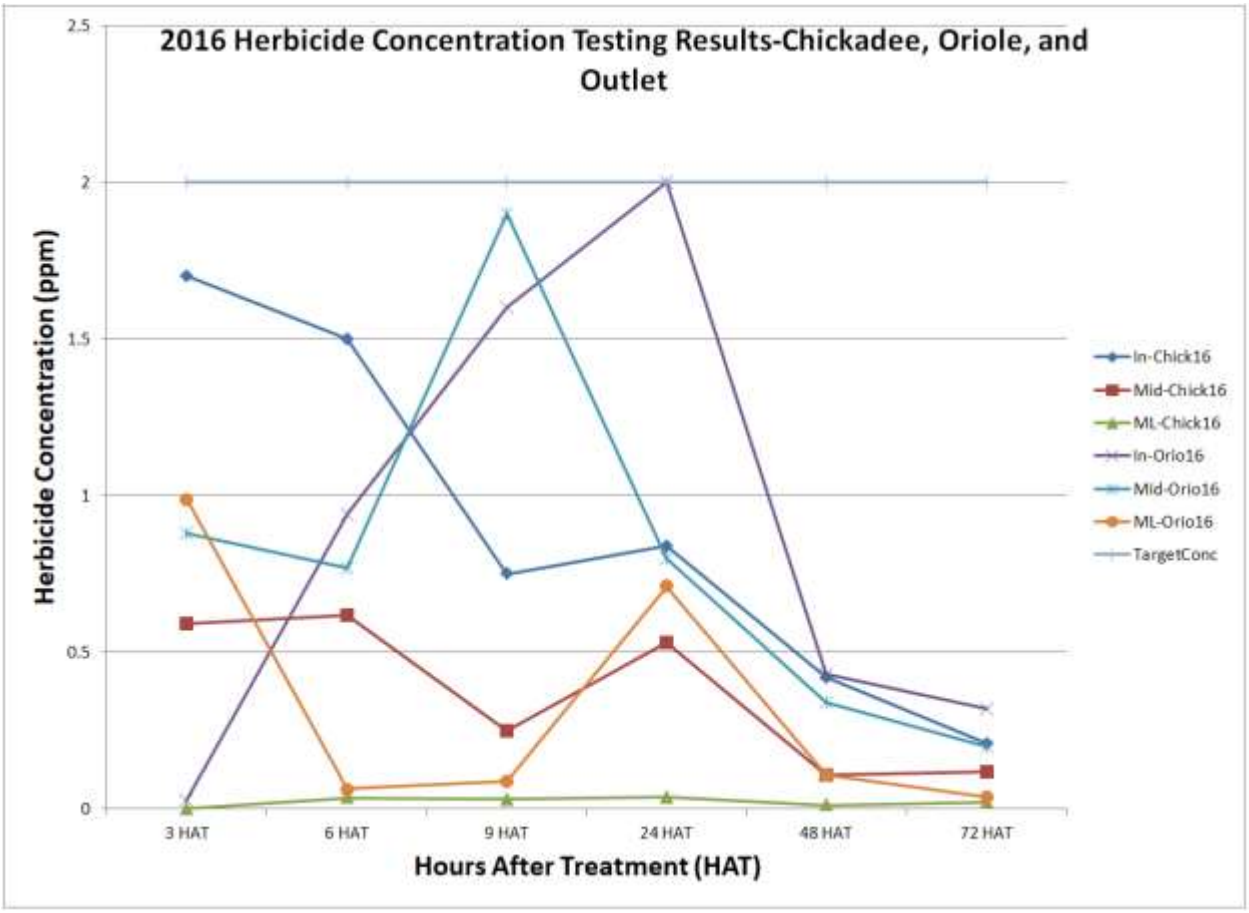

Figure 3 - 2016 Lake Redstone Concentration Testing Results

Table 2 - 2016 Concentration Testing Results

2016 Lake Redstone Chemical Concentration Monitoring Results (ppm) 7-8-2016 (LEAPS)										
Location	**SITE_NAME**	**Lat**	**Long**	**3 HAT**	**6 HAT**	**9 HAT**	**24 HAT**	**48 HAT**	**72 HAT**	**Ave ppm**
Chickadee Bay South	In-Chick16	43.609	-90.102	1.7	1.5	0.75	0.84	0.42	0.21	**0.90**
Chickadee Bay South	Mid-Chick16	43.609	-90.1	0.59	0.62	0.25	0.53	0.11	0.12	**0.37**
Chickadee Bay South	ML-Chick16	43.609	-90.098	0.0018	0.036	0.032	0.037	0.013	0.023	**0.02**
Oriole Bay	In-Orio16	43.598	-90.104	0.029	0.94	1.6	2	0.43	0.32	**0.89**
Oriole Bay	Mid-Orio16	43.597	-90.101	0.88	0.77	1.9	0.8	0.34	0.2	**0.82**
Oriole Bay	ML-Orio16	43.597	-90.099	0.99	0.064	0.09	0.71	0.11	0.04	**0.33**
Oulet/Spillway	Outlet16	43.587	-90.087	ND	ND	ND	ND	ND	0.0042	
	TargetConc			2.00	2.00	2.00	2.00	2.00	2.00	
	In - Bay Tip									
	Mid - Bay Middle									
	ML - Main Lake Mouth									
	ND - No Detect									
	ppm - parts per million (mg/L)									
	nearTarConc									

The LRPD partnered with APHS to complete an aquatic plant survey of nine bays on Lake Redstone during the summer of 2016 (Table 3). Mourning Dove, Goldfinch, Hummingbird, and Woodpecker Bays were surveyed for the first time in preparation for possible treatment in 2017. Chickadee Bay South, Cardinal, and Oriole Bays were surveyed for the second time in the year they were treated (2016). Martin-Meadowlark and Swallow Bays were surveyed for the third time in the year following treatment.

Table 3 - 2016 Summer PI Surveys on Lake Redstone

2016 Lake Redstone Summer PI Surveys (Rev. 12/22/2015)			
Treatment Site		**Acreage**	**NOTES**
Bed1-15MM	Martin-Meadowlark	3.40	3rd Time-PostPI
Bed2-15	Swallow	4.40	3rd Time-PostPI
Bed1-16ChiS	Chickadee Bay South	3.30	2nd time-DurtreatPI
Bed2-16Card	Cardinal Bay	1.30	2nd time-DurtreatPI
Bed4-16Orio	Oriole Bay	7.20	2nd time-DurtreatPI
Bed1-16PI-MD	Mourning Dove	12.90	1st time - PrePI
Bed2-16PI-GF	Goldfinch	1.50	1st time - PrePI
Bed3-16PI-HB	Hummingbird	1.60	1st time - PrePI
Bed4-16PI-WP	Woodpecker	4.60	1st time - PrePI
Total		*40.20*	

Field methods followed the standardized protocol developed by the Wisconsin Department of Natural Resources (WDNR) in Hauxwell et. al (2010) and the surveys were completed on August 17&18, 2016. The WDNR generated a point-intercept map for all nine of the bays and APHS recorded individual plant survey data at each point within each bay (Table 4).

Table 4 - Summary PI Statistics for All 9 Bays Surveyed in 2016 (APHS, 2016)

Bay & Year		1	2	3	4	5	6				7		8
							Average # of species per site				Species Richness		
		Total # sites visited	Total # sites w/ vegetation	Max. depth of plants	Total # sites shallower than max. depth of plants	Frequency of occurrence at sites shallower than max. depth of plants	a) Shallower than max. depth	b) Vegetated sites only	c) Native shallower than max. depth	d) Native at veg. sites only	a) Total # species on rake at all sites	b) Including visuals	Simpson's Diversity Index
Martin-Meadowlark	2014	52	45	4	52	86.54	2.25	2.6	1.81	2.41	7	9	0.8
	2015	54	30	3	50	60.00	1.12	1.87	1.12	1.87	7	8	0.75
	2016	54	50	4	54	92.59	2.63	2.84	2.41	2.83	8	9	0.83
Swallow	2014	70	43	4	64	67.19	1.36	2.02	0.83	1.56	7	7	0.69
	2015	71	37	5	71	52.10	0.72	1.38	0.69	1.32	8	10	0.66
	2016	72	44	4	65	67.69	1.23	1.82	1.09	1.65	7	7	0.70
Cardinal	2015	67	33	7	46	71.74	1.15	1.61	0.85	1.39	7	8	0.74
	2016	65	39	6	45	86.67	1.73	2.00	1.42	1.83	9	11	0.83
Chickadee (South Arm)	2015	55	7	3	11	63.64	1.00	1.57	0.45	1.25	4	5	0.61
	2016	56	7	5	28	25.00	0.46	1.86	0.36	1.43	6	7	0.71
Oriole	2015	68	26	9	48	54.17	0.90	1.65	0.63	1.36	5	5	0.70
	2016	62	28	7	44	63.64	0.91	1.43	0.77	1.26	6	6	0.69
Goldfinch		57	26	5	57	45.61	0.79	1.73	0.61	1.67	7	8	0.72
Hummingbird		59	34	6	59	57.63	0.93	1.62	0.58	1.21	7	9	0.66
Mourning Dove		122	59	7.5	89	66.29	1.04	1.58	0.88	1.39	9	10	0.68
Woodpecker		83	22	4.5	77	28.57	0.77	2.68	0.68	2.36	7	8	0.82

Survey results are summarized from the 2016 Aquatic Plant Survey Report – Lake Redstone Bays.

MARTIN-MEADOWLARK BAY 2016 POST TREATMENT SUMMER PI RESULTS

The first PI survey in 2014 revealed EWM at 22 sites. Herbicide treatment was conducted in spring of 2015 and a survey that same summer yielded promising results with no EWM found in the bay. No herbicide treatment was done in spring of 2016. The 2016 survey revealed EWM at 12 sites (Figure 4), which is a statistically significant increase from 2015 according to the chi square analysis. There were also 7 sites where EWM was visually observed but not found on the rake sample. The majority of the EWM was found in the eastern half near the mouth of the bay. Even though the increase in EWM was significant, it was not among the most common plant species found in the bay with a low relative frequency of 8.45%. This is not surprising when considering the fact that vegetation was found at 93% of all survey sites. In other words, there was a high abundance of vegetation and relatively high species richness for the small survey area and thus other plant species competing for the same space as EWM.

Figure 4 - 2016 EWM in Martin-Meadowlark (APHS, 2016)

SWALLOW BAY 2016 SUMMER PI RESULTS

The first EWM survey in 2014 revealed EWM at 33 sites. Herbicide treatment was conducted in spring of 2015 and a survey that same summer yielded promising results with EWM at only 1 site with another 4 visual observations. No herbicide treatment was done in spring of 2016. The 2016 survey revealed EWM at 6 sites (Figure 5), which is ***not*** a statistically significant increase from 2015 according to the chi-squared test. However, if visual observations are included in the analysis, we see an increase from 5 sites in 2015 to 16 sites in 2016, which ***is*** a statistically significant increase. The EWM was found scattered throughout the bay and not concentrated in any particular area. Even though there was an increase in EWM, it was not among the most common plant species found in the bay with a low relative frequency of 7.5%.

Figure 5 - 2016 EWM in Swallow Bay (APHS, 2016)

Both Martin-Meadowlark and Swallow bays were chemically treated in 2015. After treatment, the frequency of occurrence of EWM in both bays was down significantly based on chi-square analysis. In 2016, a year after treatment, the frequency of occurrence of EWM in both bays was up, but only about half of where it was 2014. During this same time frame, the Mean Coefficient of Conservatism (C) and the Floristic Quality Index (FQI), two other measures of the health of the aquatic plant community in the lake, increased steadily for Martin-Meadowlark through all three years. In Swallow, these values increased in the year of treatment, but declined again in the year after treatment, but not to the low levels these values were in 2014, before treatment occurred. This reduction in EWM is considered positive for the lake, but not necessarily for the property owners.

Many property owners on Lake Redstone consider other plants to be a nuisance as well. Two native species, white waterlily and coontail, are often complained about by some property owners. The frequency of occurrence and density of coontail was reduced in both bays in the year of treatment (2015), but in the year after treatment (2016), the frequency of occurrence increased to greater levels than it was in the year prior to treatment (2014) in both bays. The density of coontail increased in the year after treatment, but still remained below the density in the year prior to treatment (2014).

The frequency of occurrence and density of white waterlily increased in both bays in the year of treatment. In Martin-Meadowlark, the frequency of occurrence of white waterlily went down, but not to where it was in the year prior to treatment. The density of white waterlily in Martin-Meadowlark went down in the year after treatment, to a point lower than in the year prior to treatment. In Swallow, the frequency of occurrence of white waterlily went up in the year after treatment, but the density was down below levels in the year prior to treatment (2014).

The data suggests that native plants generally increased after treatment of EWM, but probably not enough to be considered at nuisance levels. Fall survey work completed in 2014, 2015, and 2016 by Cason and Associates visually shows a reduction of EWM from 2014 to 2015; and an increase in EWM from 2015 to 2016, but that increase is still less than what was found in the fall of 2014 (Figure 6). Fall survey results are not quantitative and likely reflect other factors that impact the growth of EWM and other vegetation.

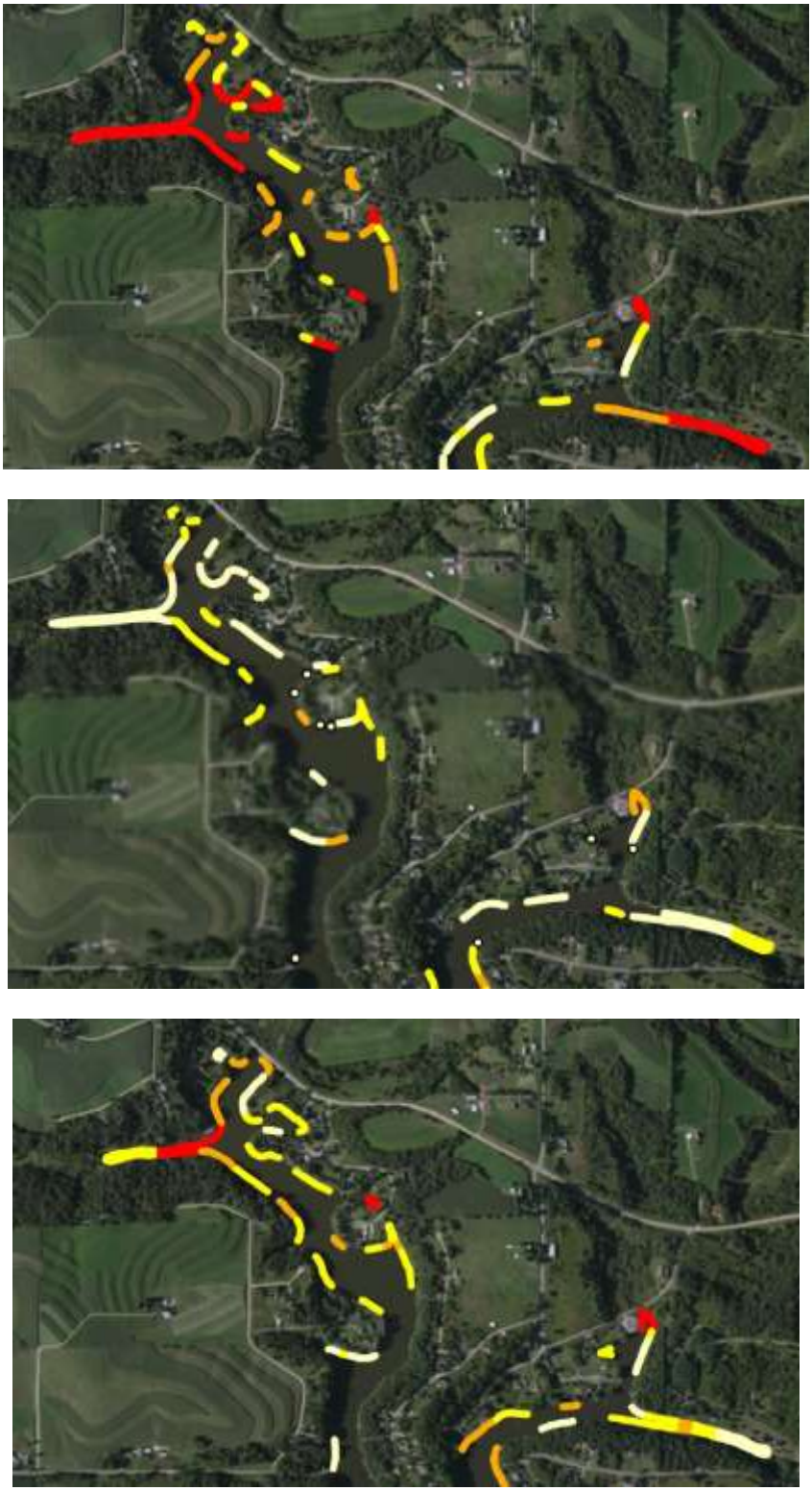

Figure 6 - Fall 2014 (top), Fall 2015 (middle), and Fall 2016 (bottom) EWM Survey Results from Cason and Associates (red represents dense growth, yellow represents scattered growth, orange represents moderate growth, and pale yellow (or white) represents highly scattered growth)

CARDINAL BAY

In 2016, EWM was the second-most common plant with scattered distribution at 14 sites and visual observation at another 5 points (Figure 7). It was also the second-most common plant in 2015 with occurrence at 14 sites and visual observation at another 7 sites (Figure 7). Diquat herbicide was applied in Cardinal Bay in spring of 2016 to address the EWM infestation there. A chi-squared test of EWM presence in 2015 compared to 2016 reveals no significant difference between the years, even when visual observations are included in the analysis. However, the density of EWM was less in 2016 than it was in 2015. In 2015, the 14 sites with EWM on the rake averaged a rake fullness of 1.43 with 7 visuals. In 2016, the fourteen sites with EWM on the rake averaged a rake fullness of 1.0 with only 5 visuals.

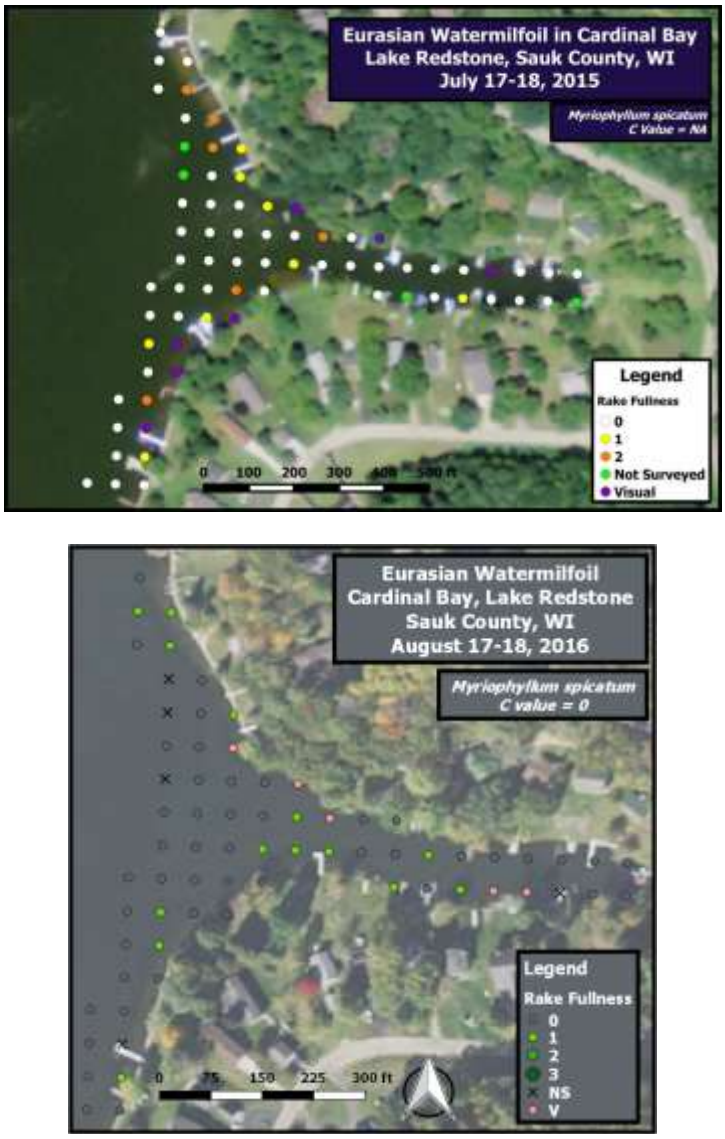

Figure 7 – 2015 Pre-treatment and 2016 Post-treatment Summer PI EWM Survey Results for Cardinal Bay (APHS, 2015&16)

The diquat treatment in 2016 was not applied to the entire bay, only to the mouth of the bay. Furthest into the bay and outside of the 2016 treated area, only two points had EWM in 2015, one on the rake and one with a visual. In 2016, there were five points further into the bay and outside the treated area – 3 points on the rake, and two with a visual. This indicates that even though, statistically speaking, the 2016 treatment did not change things, other data suggests it did, at least in the area that was treated.

Chemical concentration testing was not completed in Cardinal Bay as there was no lab test available at the State Lab of Hygiene for diquat.

The number of native aquatic plant species in Cardinal Bay increased from 7 in 2015 to 9 in 2016, with Large duckweed and Water stargrass the new species. The frequency of occurrence in the littoral zone of coontail increased from 2015 to 2016, however the density or rake fullness rating went down. White waterlily remained at 3 sites in both 2015 and 2016. The number of sites with native aquatic plants went up for all species in 2016.

CHICKADEE BAY

During the 2015 Summer PI Survey, six points in the entire bay were identified with EWM (Figure 8). Herbicides were applied to the southern arm of Chickadee Bay in spring of 2016 to combat EWM, based on Cason 2015 fall survey results which showed much more EWM than the 2015 summer did (Figure 9). Only the southern arm of Chickadee Bay was surveyed in 2016 and overall had a low occurrence of all plants with vegetation present at only 25% of sites at or below maximum rooting depth. EWM was found at 3 sites compared to 3 sites in 2015 in the southern arm (Figure 10). A chi-squared test of EWM presence in 2015 compared to 2016 based on the 2015 and 2016 summer PI survey reveals no significant difference between the years, even when visual observations are included in the analysis. The 2016 fall survey completed by Cason indicates that perhaps the density on EWM in the southern arm of Chickadee Bay is less, but the number of points with EWM during the two PI surveys is limited, and the Cason survey results are not quantifiable.

Based on both summer PI and fall meandering survey results, it appears that at very least, the 2016 treatment kept EWM from expanding in 2016 from 2015 levels, even if it did not reduce the amount of EWM. Concentration testing indicated that the herbicide applied to the bay was close to the target concentration of 2.0 ppm (1.7 and 1.5 ppm at 3 and 6 hours after treatment (HAT)), but did not reach it. And it only got close in the inner portions of the treated area. Based on this, future chemical management in Chickadee Bay may need herbicide applied at a higher concentration on the open end of the bay, but what was done in the interior of the bay may be sufficient at the level it was applied.

The overall littoral frequency of all plants went down from 2015 to 2016. The littoral frequency of EWM was down from 2015 to 2016, however, the rake fullness rating or density was up. The same was true for coontail.

Figure 8 – 2015 APHS EWM Summer Survey Results

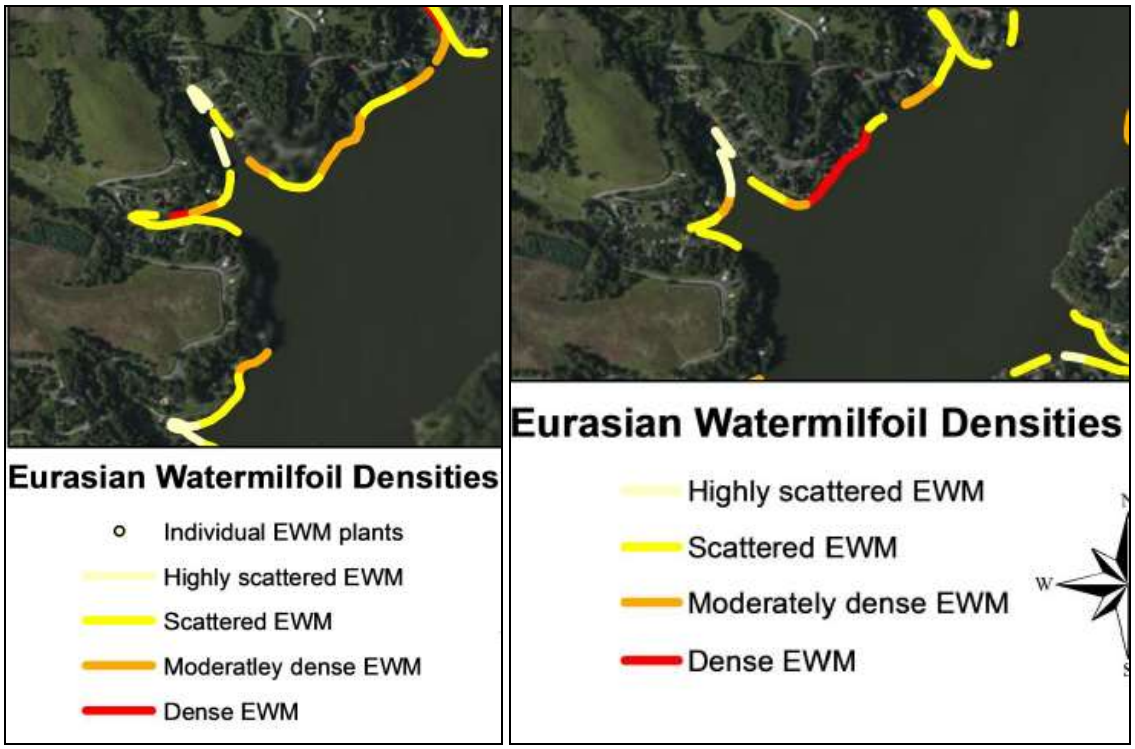

Figure 9 – Cason and Associates 2015 & 2016 Fall EWM Survey Results

Figure 10 - 2016 Summer PI EWM Survey Results for Chickadee Bay, Post-Treatment (APHS, 2016)

ORIOLE BAY

In 2016, EWM was the second-most common plant with occurrence at 6 sites and visual observation at another 7 points and it was concentrated along the northern shore (Figure 11). It was also the second-most common plant in 2015 with occurrence at 13 sites and visual observation at another 5 sites (Figure 11). Herbicide was applied at in spring of 2016 to address the EWM infestation. Although a chi-squared test of EWM presence in 2015 compared to 2016 reveals no significant difference between the years, some differences can be verified. In 2015, 12 of the 13 sites with EWM were along the north shore of the bay, all with rake fullness rating or density of 1.0 out of 3. Four of the five visual points in 2015 were also on the north shore and deep in the most inner reaches of the bay. In 2016, no points with EWM were documented in the inner most reaches of the bay. While the number of points with EWM along the north shore only declined by 1point (12 in 2015 to 11 in 2016), only 5 of the 11 points had a rake fullness rating or density of 1.0, less than half of what was there in 2015. The remaining 6 points were visual only. There remained only 1 point on the south shore with EWM in 2016, and it was just a visual. There were two points in 2015, with one with a 1.0 rake fullness rating and one as a visual.

Concentration testing in Oriole Bay showed that the herbicide applied to the middle and inland most portions of the bay reached levels near the target level of 2.0 at 9.0 HAT (1.9 at middle site, and 1.6 at the inside site), and at 24 HAT, the concentration at the inner most site actually reached 2.0 ppm. Given that the herbicide applied actually reached its target level after 24 hours, the amount of herbicide applied appears to have been enough to reduce the density of EWM in the bay, although, not the distribution of it. A slightly higher concentration in the future, might give better, longer lasting results. Concentrations at the open end of the bay may have to be slightly higher than the concentration applied at the middle and inner most portions of the bay.

Native plants responded well in Oriole Bay. White waterlily was documented at four sites during the 2016 PI survey after the treatment. There was no white waterlily identified in the 2015 survey. There were only four native plants identified in 2015, there were 5 in 2017. The littoral frequency of coontail was up in 2016, buts its rake fullness rating (density) was down. The frequency of the other native plants was split.

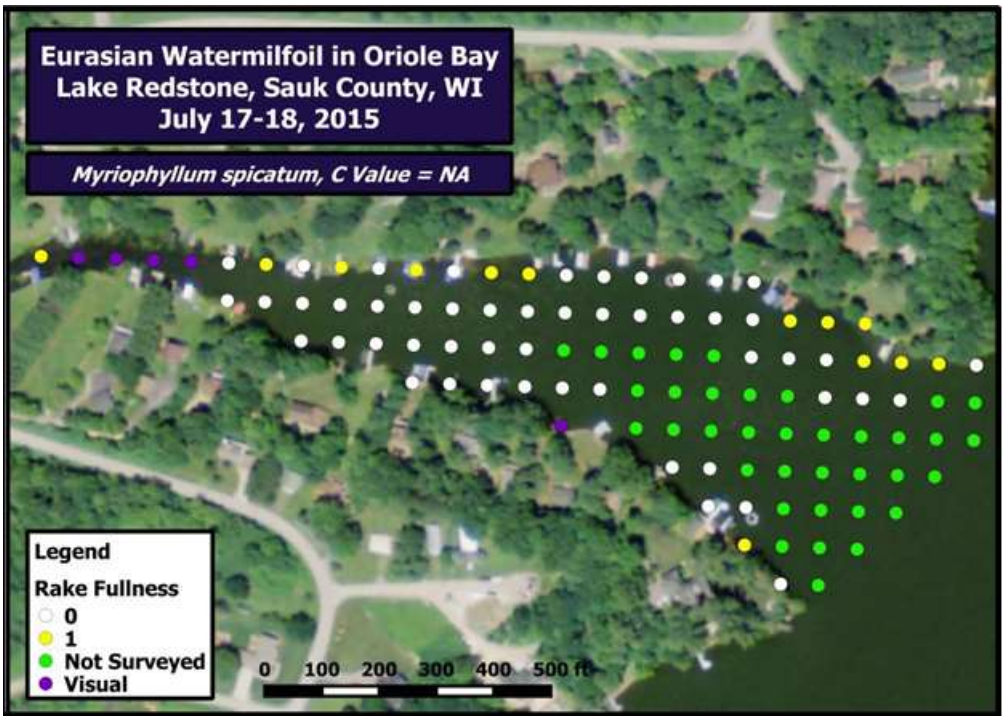

Figure 11 – 2015 Summer PI EWM Survey results in Oriole Bay (APHS, 2015)

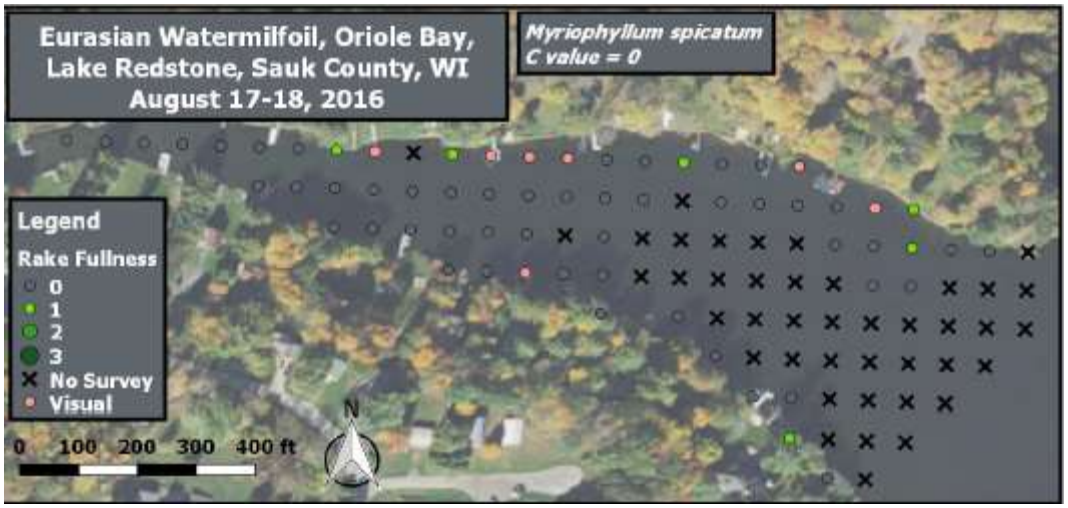

Figure 12 - 2016 Summer PI EWM Survey Results for Oriole Bay, Post-Treatment (APHS, 2016)

FIRST TIME SURVEY BAYS IN 2016

Four additional bays were surveyed in 2016 in order to document the amount of EWM and identify existing native plants in the event that any, all, or none of these bays would be proposed for treatment in 2017. These four bays were chosen based on fall 2015 survey results from Cason and Associates that indicated sufficient amounts of EWM in the bays to consider treatment in 2017.

MOURNING DOVE

During the 2012 summer whole lake, PI survey which included 27 points within Mourning Dove Bay, EWM was identified at 7 of the 27 points (26%), with a rake fullness rating (density) of 1.71 on a1-3 scale. Based on this, a chemical treatment was proposed and completed in 2013, but has not been repeated since. There was concern that after 3 years, EWM was returning to the bay, so it was included in the 2016 summer survey, in the event EWM totals would suggest a possible chemical treatment in 2017.

A total of 89 points in the bay were surveyed in 2016. EWM was found at 15 survey points with another 6 visual observations (23.6%). It had a littoral frequency of 16.85, making it the second most common plant species in Mourning Dove Bay (Figure 13). Coontail was the most common plant, found at 50 points with a littoral frequency of 55.06. EWM was found scattered along the shore throughout the bay. There were 59 survey points with vegetation (66%) out of 89 points that were equal to or shallower than the maximum rooting depth. Nine different native plants were identified in Mourning Dove Bay in 2016.

In 2013, the WDNR completed a post-treatment PI survey or 119 points within Mourning Dove Bay. During that survey, EWM was found at only 2 points, with a littoral frequency of 2.63. Only 6 native plant species were identified in the bay at this time. Slender waterweed, small duckweed, and long-leaf pondweed were new in 2016. Coontail was found at 36 points and had a littoral frequency of 46.05 at that time. White waterlily was found at 12 points in 2013 and had a littoral frequency of 5.58. In 2016, it was found at 22 points with a littoral frequency of 11.24. Seven species were included in the calculation of the FQI. The average C was 5.1 in 2016 and the FQI was 13.6. Only two other bays had higher FQI's (Cardinal – 14.5, Martin-Meadowlark – 14.7).

Figure 13 - 2016 EWM in Mourning Dove Bay (APHS, 2016)

GOLDFINCH

Goldfinch was surveyed for the first time in 2016. Fifty-seven points were surveyed out of a possible 59 because one point was obstructed by piers and the other point was on shore. All survey points were the same depth or shallower than the maximum rooting depth of 5 feet and 26 of those sites

surveyed had vegetation. The average number of species found at vegetated points was 1.73 and the average rake fullness was 1.19. A total of 8 species of aquatic plants were found, one of which was "visual only" (i.e., within 6 feet of the survey point but not found on the rake). Coontail and Eurasian watermilfoil were the most common species found at 35% and 18% of survey points (≤maximum rooting depth) respectively. The Simpson Diversity Index was 0.72 on a scale from 0 to 1. The FQI only factors species raked at survey points and does not include visuals or aquatic invasive species. Therefore, 6 species were included in the calculation, yielding a floristic quality of 12.7 with an average C value of 5.2.

EWM was the second most common plant and was found at 10 sites and visually observed at one site (Figure 14). Overall, plants were found at about half the sites (46%) at or shallower than the maximum rooting depth. Herbicide treatment has not been conducted in Goldfinch Bay.

Figure 14 - 2016 Summer PI EWM Survey Results for Goldfinch Bay (APHS, 2016)

HUMMINGBIRD BAY

Hummingbird Bay was surveyed for the first time in 2016. Fifty-nine points were surveyed out of a possible 65 because three points were obstructed by piers and three points were on shore (Figure 15). All survey points were the same depth or shallower than the maximum rooting depth of 6 feet and 34 of those sites surveyed had vegetation. The average number of species found at vegetated points was 1.62 and the average rake fullness was 1.38. A total of 9 species of aquatic plants were found, two of which were visual only. Filamentous algae is not counted as one of the 9 species. Coontail and EWM were the most common species found at 41% and 36% of survey points (≤maximum rooting depth) respectively. Together they accounted for 82% of the total relative frequency, indicating a very homogeneous plant community. The Simpson Diversity Index was 0.66 on a scale from 0 to 1. The FQI only factors species raked at survey points and does not include visuals or aquatic invasive

species. Therefore, 6 species were included in the calculation, yielding a floristic quality of 13.1 with an average C value of 5.3.

EWM was found at 21 survey points and another 3 visual observations, making it the second most common plant species in Hummingbird Bay. EWM was distributed throughout the bay. Just over half of the survey points (34 points or 58%) that were equal to or shallower than the maximum rooting depth had aquatic plants. No herbicide treatment has been conducted in Hummingbird Bay.

Figure 15 - 2016 Summer PI EWM Survey Results for Hummingbird Bay (APHS, 2016)

WOODPECKER BAY

Woodpecker Bay was surveyed for the first time in 2016. A total of 86 survey waypoints were attempted, 83 of which were surveyed. The maximum rooting depth was 4.5 feet and 77 of the survey points were ≤4.5 feet. Vegetation was present at 22 survey points. An average of 2.68 species was found at vegetated sites and the average rake fullness was 1.27. A total of 8 species of aquatic plants were found, one of which was visual only. Coontail and white water lily were the most common species, and each was found at 17% of survey points (≤ maximum rooting depth). Together they accounted for 44% of the total relative frequency, indicating the plant community is more heterogeneous than most of the other bays. Maps of native plant species can be found in Appendix I. The Simpson Diversity Index was 0.82 on a scale from 0 to 1. The FQI does not include aquatic invasive species or visual observations. Therefore, 6 species were included in the calculation, yielding a floristic quality of 13.1 with an average C value of 5.3.

EWM was found at 7 survey points and one visual observation with the majority of the EWM in the northern section of the bay (Figure 16). EWM was not among the most common species in the bay with a relative frequency of 12%. There were 22 survey points with vegetation (29%) out of 77 points that were equal to or shallower than the maximum rooting depth. Herbicide treatment has not been conducted in the bay.

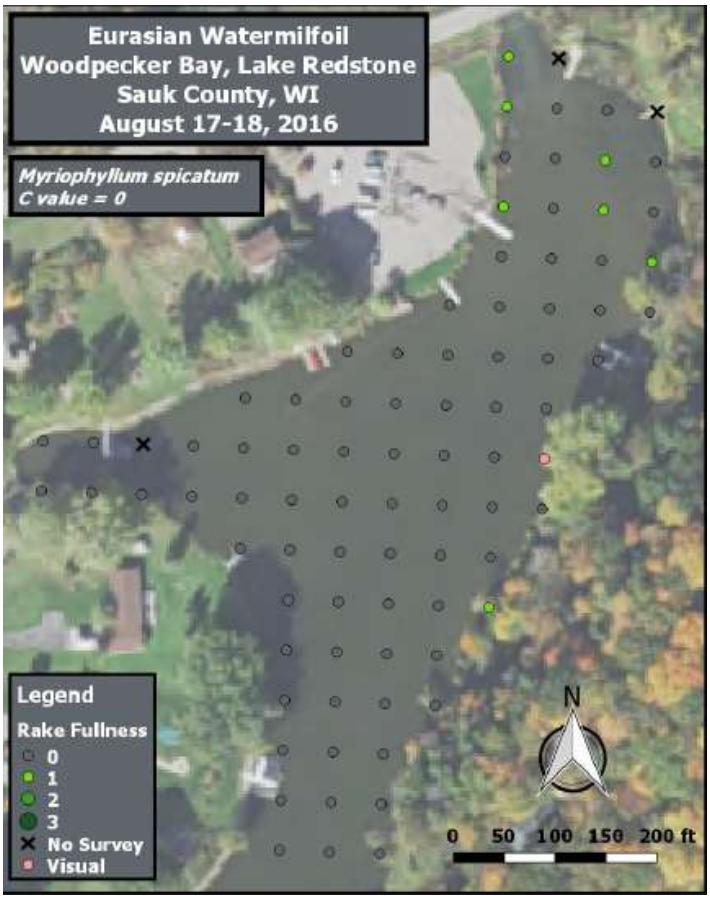

Figure 16 - 2016 Summer PI EWM Survey Results for Woodpecker Bay (APHS, 2016)

2015 AND 2016 CASON AND ASSOCIATES FALL EWM MEANDERING SURVEY

Cason and Associates conducted a fall EWM meandering surveys in October of 2015 and 2016 documenting the density of EWM along the shores and in the bays of Lake Redstone based on a visual survey. During the survey, the density of EWM is categorized in four different levels Dense (red), Moderate (orange), Scattered (yellow), and Highly scattered (white) (Figure 17). Based on a side by side comparison, it appears there is more moderate and dense growth EWM along the shore and in the bays in 2016 than there was in 2015.

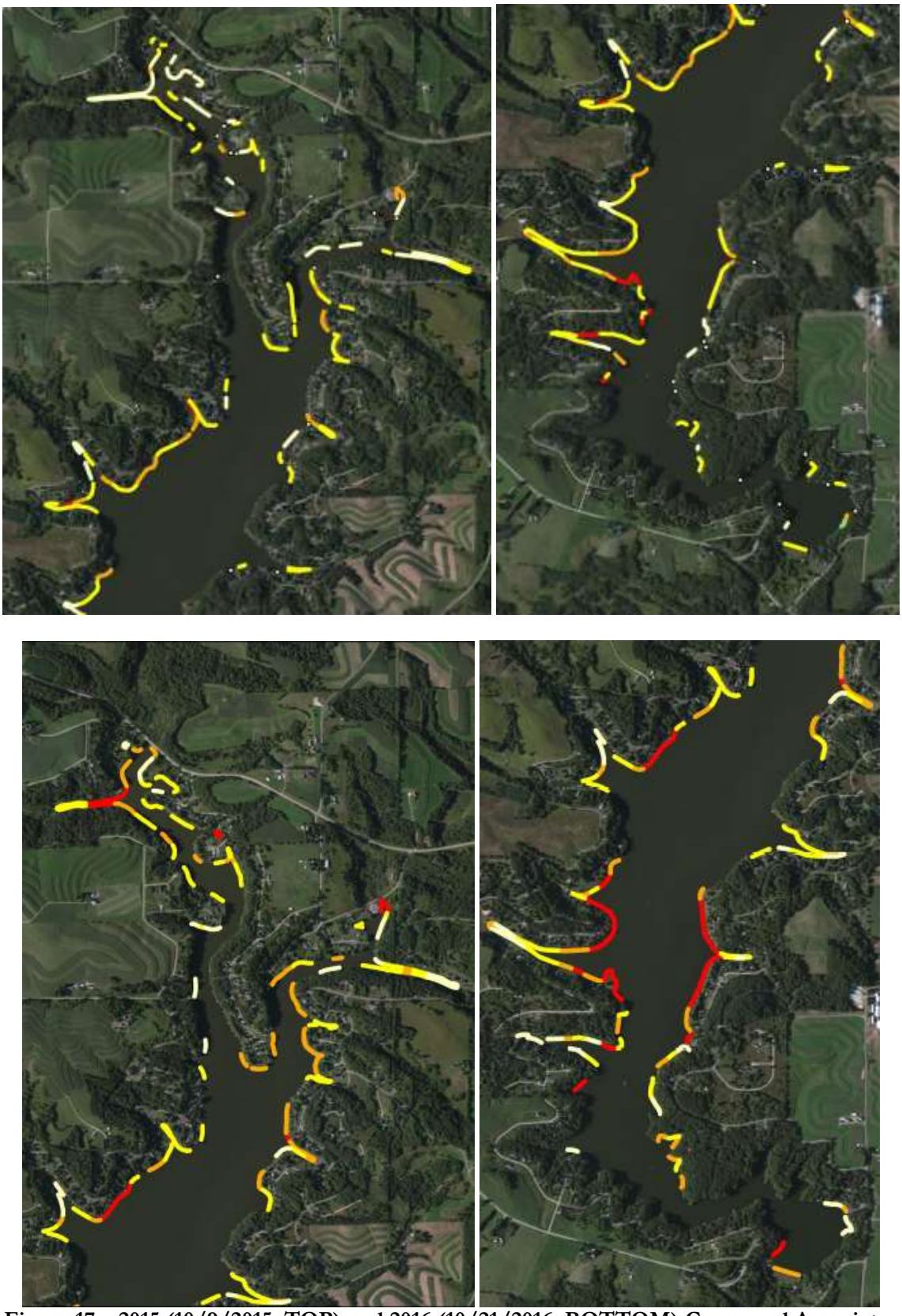

Figure 17 – 2015 (10/9/2015, TOP) and 2016 (10/21/2016, BOTTOM) Cason and Associates Fall EWM Meandering Survey Results

2016 CURLY-LEAF PONDWEED AND PURPLE LOOSESTRIFE

Curly-leaf pondweed (CLP) was found in Swallow Bay in the 2016 summer PI surveys. CLP was identified in several other bays early in 2016 during a volunteer visual survey of the littoral zone by Lake Redstone Protection District volunteers.

Purple loosestrife was not found in any of the surveyed bays.

2016 SUMMER NUISANCE AND NAVIGATION MANGEMENT

No summer nuisance and navigation aquatic plant treatments were completed in 2016. A limited amount of "planned" physical removal was done however, and plans for a better 2017 physical removal program were underway.

2016 MANUAL REMOVAL EFFORTS

Because the WDNR would not permit summer nuisance and navigation treatments during the summer season 2016, the LRPD proposed a new physical removal plan. They proposed to use the funds that otherwise would have been used to pay Cason for summer spot treatments to assist property owners with paying for manual removal of Eurasian Water Milfoil.

According to the proposal, if property owners have nuisance levels of EWM, they can hire an approved vendor to perform manual removal, for them. Once the vendor has been paid, the property owner can submit the receipt to the LRPD for reimbursement for up to 50% of the cost of EWM removal, with a maximum reimbursement of $100 per property owner. The program will operate on a first come-first served basis and the LRPD will spend no more than $3,500 on the manual removal program in the summer of 2016.

If the board approves this plan, the Aquatic Invasive Species Committee will advertise the program with local flyers, postings in the LRPOA weekly electronic newsletter, and by posting information on the LRPD web site. Forms requesting reimbursement will be available on the LRPD web site.

There were six to eight requests in regard to the harvesting reimbursement program in 2016.

2016 CLEAN BOATS CLEAN WATERS

In 2016, 212 hours were completed and 1480 contacts were made. People came from 17/18 lakes and there were 679 boats coming and going. Section 11 was the busiest boat landing. Gary Herritz is willing to return next year. CBCW time in 2016 will be reimbursed through grant money for the program.

2016 LAKE EDUCATION

The LRPD creates a newsletter each year. In late 2016, the board looked to do a new design and template for next year's newsletter and will talk to Krueger about cost of having newsletters done in color. Board members will also look into other designers to complete the newsletter.
Training for physical removal was completed on June 18, 2016, although it was not well attended.

In June, a presentation by Brian Cunningham from Sauk County Zoning and Planning on the proposed changes to the new version of Chapter 8 Shoreline Zoning was presented to the board. The presentation addressed changes that resulted from the passage by the state legislature of Act 55. Previously counties were allowed to create more stringent standards than the state standards. That is no longer allowed and the state standards have now become the maximum standards, thereby influencing regulations related to water and wetland setbacks, height of boathouses, impervious surfaces and other issues that may impact property owners on Lake Redstone.

A handheld GPS and a new computer were purchased in 2016 to support education and management efforts on Lake Redstone.

Several members of the LRPD Board attended the WAL Lake Conference in Steven's Point in April. They showed a slideshow that they presented at the WAL conference. They also gave a brief summary of the seminars and workshops they attended. With a single exception, they attended different workshops. Walters' focus was on Whole Lake Management and shared what he took away from the conference: Importance of water quality and networking, communication, being passionate and inspirational and having flexible programs. Do what is best for the lake. Ecklund's focus was on clean boats/clean waters. He shared manual harvesting slideshow comparing Northern and Eurasian Watermilfoil. Reported that there is information on both the UW and DNR websites about clean boats/clean water programs.

Aaron Pape gave a slideshow presentation demonstrating how the rainfall simulator can be used to illustrate soil erosion to various audiences. The simulator shows how five different soil types retain water after a storm, with the best ones reducing soil erosion and nutrient runoff. Reducing soil erosion in the Lake Redstone watershed will improve water quality in Lake Redstone. Sauk County is looking to purchase a rainfall simulator and is seeking funds of $2,100 from supporters to buy additional components beyond their budget. Keegstra made a motion to allocate $1,597 to buy the Field Day Unit ($998) and Infiltration Demo ($599) components for the stimulator, second by Walters. Motion carried.

Based on the results of the 2016 summer surveys in Hummingbird, Goldfinch, Woodpecker, and Mourning Dove bays and the 2016 Fall EWM survey by Cason and Associates, an early-season, whole bay EWM treatment proposal was made in 2017 that included two of the four bays. Mourning Dove and Goldfinch were left out due to a feeling that treatment could be put off for another year (Table 6, Figure 18). Two of the three treatment areas were in Woodpecker Bay on either side of the channel coming in from the north. These are very small beds and would be treated with diquat. The third was larger and in Hummingbird Bay and would be treated with DMA 4 at 2.0ppm. Concentration testing would be completed post-treatment. Aquatic plant survey work to support 2017 EWM management began with the summer surveys in 2016 and will continue with a repeat of the summer 2016 survey in 2017 and again in 2018. Changes in EWM and other aquatic vegetation will be compared when these surveys are completed. These three areas may not be treated again until 2019 in accordance with the recommendations in the APM Plan.

Table 5 - 2017 Preliminary EWM Herbicide Management Proposal

2017 Lake Redstone Modified Spring EWM Chemical Treatment Proposal (4/4/2017)													
Treatment Area Characteristics					Eurasian Watermilfoil — 2,4-D (DMA 4)			Eurasian Watermilfoil — Diquat (Reward)					
Treatment Site	Site Name	Acreage	Mean Depth (feet)	Volume (acre-feet)	Treatment a.i. ppm	Treatment application (gal)	Application rate (gal/ac-ft)	Treatment Rate (1.5 gal/acre)	Application rate (gal/ac-ft)	Max allowed diquat ion (2lbs/gallon)	Total diquat ion (mg) (Col.M x 453594)	Treatment a.i. ppm (Col.L/1233481.84)	Exceeds suggested DNR rate (0.37 ppm a.i.)
WP-17-1	Woodpecker Bay	0.11	3.00	0.33				0.17	0.50	1.00	453592.00	0.37	no
WP-17-2	Woodpecker Bay	0.20	3.00	0.60				0.30	0.50	1.00	453592.00	0.37	no
HB-17	Hummingbird Bay	1.45	3.22	4.67	2.0	6.6	1.42						
Total		*1.76*		*5.60*		*6.6*		*0.47*					
					EWM Treatment (1.45 acres); early spring application			EWM Treatment (0.31 acres); early spring application					

Figure 18 - 2017 Proposed Chemical Treatment Areas

A WDNR permit request for herbicide application was prepared by the LRPD and Cason and Associates, and approved by the WDNR. Treatment of these three areas occurred on May 9, 2017. Herbicide concentration testing was completed following the treatment according to a plan prepared for the LRPD by LEAPS and the WDNR. The results of the 2017 treatments and concentration testing will be presented in a Summary Report for the 2017 season.

Summer nuisance treatments were not expected in Lake Redstone in 2017. Instead a local father/son team built a modified suction harvest machine to aid in physical removal of aquatic vegetation. A WDNR permit for this activity was applied for and awarded. The existing Lake Redstone Aquatic Plant Management Plan was modified to accommodate for harvesting using a modified DASH (diver aided suction harvest) machine. Unfortunately, it took a while for this program to get up and running, and the lead worker was injured, slowing the work down.

Based on the results of October shoreline surveys completed by Cason and Associates, Lake District member comments, and observations made by the LRPD planning consultant, fourteen bays are planned for 2017 summer point intercept surveys for aquatic plants (Table 7). Martine-Meadowlark and Swallow will be surveyed starting a new three year management process. Cardinal, Chickadee, and Oriole will be surveyed for a third year in a row (following treatment); and Mourning Dove, Hummingbird, and Woodpecker will be surveyed for the second time, with the expectation that these bays may will be treated in 2017.

Including Swallow and Martin-Meadowlark, eight bays are newly proposed for summer surveys. These small bays are possible candidates for chemical treatment in 2018.

Dredging of several bays around Lake Redstone has been discussed and plans to do so are moving forward. However, it is not expected that any dredging will occur in 2017. Additional discussion of the dredging plans of the LRPD and how they pertain to future management of EWM will be discussed in more detail in the 2017 Summary Report.

Table 6 - 2017 Plan for Summer PI Surveys

2017 Lake Redstone Proposed Summer PI Surveys, North to South (02/01/2017)					
Treatment Site	Name of Bay	Acreage	# of PI Points	Last Treated	NOTES
KD-SS-17	Killdeer	3.00	TBE	NT	PrePI
MM-SS-17	Martin-Meadowlark	3.00	54	2015	PrePI
WB-SS-17	Warbler	1.60	TBE	NT	PrePI
MB-SS-17	Mockingbird	0.50	TBE	NT	PrePI
WP-SS-17	Woodpecker	4.60	83	2017	ActivePI
SW-SS-17	Swallow	3.80	72	2015	PrePI
GF-SS-17	Goldfinch	1.50	59	2017	ActivePI
HB-SS-17	Hummingbird	1.70	59	2017	ActivePI
CHS-SS-17	Chickadee South	4.10	56	2016	PostPI
EG-SS-17	Eagle	9.70	TBE	NT	PrePI
QL-SS-17	Quail	3.50	TBE	NT	PrePI
MD-SS-17	Mourning Dove	12.90	122	2013	PrePI
CD-SS-17	Cardinal	2.10	67	2016	PostPI
OR-SS-17	Oriole	8.90	68	2016	PostPI
TOTAL		*60.90*			

Included in 2017 Spring Treatment Proposal

PrePI - PI survey to set up possible spring treatment in the following year
ActivePI - PI survey of bays treated in this current year
PostPI - PI survey of bays treated in the previous year
NT - Never has been treated
TBE - To be established

APHS will again be contracted with in 2017 to complete all the aquatic plant survey work.

DECEMBER 2015 AQUATIC INVASIVE SPECIES AND LAKE MANAGEMENT PLANNING GRANT APPLICATIONS

With the new APM Plan completed and approved, the LRPD applied for AIS grant funding to support the expected implementation of the plan in 2016. An AIS Education Prevention and Planning grant was submitted on December 10, 2015 and awarded in February 2016. This project is on-going with an end date of June 30, 2018.

An AIS Education grant can be used to support any management implementation activities except actual management. By submitting an AIS Education grant, on-going discussion related to future dredging can take place without compromising grant funding used to reduce the EWM in Lake Redstone.

In addition to the AIS Education Grant, a small-scale lake management planning grant was submitted on December 10, 2015 to support initial steps toward developing a Comprehensive Lake Management Plan for Lake Redstone. This grant was also awarded. This project was completed in early 2017, with a final report submitted to the LRPD and WDNR in June 2017.

2016 AND 2017 LEAPS CONTRACTS

With the completion of this report, all contract obligations stated in the 2016 Professional Services Agreement and Schedule D between the LRPD and LEAPS have been fulfilled. A new Professional Services Agreement between the LRPD and LEAPS has been signed for services being provided in 2017.

Original 2016 Summary Report revised on January 23, 2018 based on comments from Susan Graham, WDNR Regional Lake Management Coordinator.