Exhibit G

2016 EWM Treatment and Monitoring Results

Memorandum

To: Beaver Dam Lake Management District (Board of Commissioners)
From: Barr Engineering Co. (Meg Rattei)
Subject: 2016 EWM Treatment Results
Date: December 13, 2016
Project: 49030011.17
c: Kevin Kretsch (Lake Restoration, Inc.), Alex Smith (WDNR), Mark Sundeen (WDNR), and John Skogerboe (Research Scientist)

The purpose of this memorandum is to present the results of the Beaver Dam Lake 2016 EWM management program. Memorandum contents include:

- Discussion of herbicide treatment and manual removal of EWM during 2016.
- Overview of EWM in Beaver Dam Lake.
- Discussion of EWM in each of the eight management areas, including results of herbicide treatment and manual removal of EWM.

In this memorandum:

- EWM frequency of occurrence in the littoral zone is the percent of sample points up to the 25-foot depth that contained EWM.
- EWM extent is the acres of EWM.
- Percent of littoral zone with EWM is the acres of EWM divided by the total acres of the littoral zone, which is the area up to the 25-foot depth, and then multiplied by 100 to convert to percent.

Two whole lake point-intercept plant surveys were completed in 2016 to assess the results of EWM management efforts. A survey of all plants was completed July 19 through 24. A survey of invasive species (EWM and curly-leaf pondweed) was completed October 8, 9, 22, and 23. Sample locations are shown on

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maps found in Appendix E of the *Beaver Dam Lake Aquatic Plant Management Plan*.[1] The 2016 EWM data, together with historical data, are summarized in Tables 1 through 3.

In addition to the plant surveys, EWM presence in Beaver Dam Lake was assessed in August to identify areas suitable for manual EWM removal.

In 2016, herbicide treatment area was much reduced from previous years and manual removal area was much increased. The 2016 changes resulted from the success of the 2015 EWM management efforts which reduced EWM to 8.5 percent of the littoral area. In the fall of 2015, the majority of the EWM was found in two areas not treated with herbicide in 2015—Cemetery Bay and Library Lake. City Bay was the only area treated with herbicide in 2015 that had sufficient EWM to warrant herbicide treatment in 2016. EWM was not observed in East Lake and Williams Bay in fall of 2015 and was only observed in 1 to 2 percent of the littoral area in Norwegian Bay, Rabbit Island Bay, and West Lake. Hence, these five areas did not warrant herbicide treatment in 2016. The 2016 EWM management plan for Beaver Dam Lake was spring herbicide treatment in three areas—Cemetery Bay, Library Lake, and City Bay—and manual removal of EWM in areas not treated with herbicide as well as any EWM observed in treated areas during the summer period.

[1] Barr Engineering Company. 2015. *Beaver Dam Lake Aquatic Plant Management Plan*, Prepared for Beaver Dam Lake Management District. http://www.beaverdamlake.org/apmp

Table 1 2006-2016 Beaver Dam Lake EWM Frequency of Occurrence in Beaver Dam Lake

Location	% of sample points up to 25 foot depth with Eurasian watermilfoil, including visuals																				
	Fall 2006	Fall 2007	Fall 2008	July 2009	Fall 2009	July 2010	Fall 2010	July 2011	Fall 2011	June 2012	July 2012	Fall 2012	May 2013	June 2013	July 2013	Fall 2013	July 2014	Fall 2014	July 2015	Fall 2015	July 2016	October 2016
Norwegian Bay	28.57	16.39	52.46	39.71	80.00	33.82	28.36	11.76	51.52	13.24	54.41	72.13	39.71	0.00	7.35	58.82	4.41	44.12	1.47	1.47	8.82	22.06
East Lake	5.13	0.00	13.38	14.00	27.86	22.70	27.54	28.78	33.79	N/A*	17.57	27.86	N/A*	N/A*	2.88	19.73	0.73	2.10	0.00	0.00	0.00	1.36
City Bay	59.12	7.74	72.84	32.78	62.13	21.67	55.93	54.40	70.39	8.89	48.07	58.90	46.93	0.00	21.67	46.11	1.67	9.44	0.00	7.78	0.00	1.67
Cemetery Bay	41.10	0.00	40.00	0.00	6.82	0.00	10.23	3.37	47.73	N/A*	0.00	18.39	N/A*	3.37	0.00	2.25	0.00	1.14	4.49	44.94	5.62	26.97
West Lake	18.77	11.07	21.19	14.84	13.33	10.59	13.61	7.35	10.18	N/A*	8.64	14.15	N/A*	N/A**	6.69	17.31	5.50	11.52	0.00	1.21	4.28	8.36
Williams Bay	13.33	28.05	23.81	16.98	11.01	3.85	12.15	9.80	10.19	N/A*	3.85	15.96	N/A*	N/A**	0.96	6.36	0.00	9.43	0.00	0.00	1.87	8.33
Rabbit Island Bay	39.39	28.72	30.10	18.49	20.54	12.82	26.79	10.17	17.86	0.00	1.67	11.43	N/A**	N/A**	0.85	3.33	1.68	5.00	0.00	1.67	4.20	10.00
Library Lake	73.33	61.97	47.30	5.04	2.60	0.72	7.41	0.00	0.00	N/A*	2.88	1.79	N/A*	N/A*	0.00	0.72	0.00	1.44	5.76	12.23	0	0.00
East Lake Basins	**12.74**	**24.17**	**26.45**	**13.84**	**12.90**	**7.93**	**14.26**	**7.02**	**10.71**	**N/A***	**5.53**	**12.54**	**N/A*****	**N/A*****	**3.48**	**10.95**	**2.88**	**8.06**	**1.17**	**3.31**	**2.30**	**9.09**
West Lake Basins	**16.79**	**5.52**	**44.89**	**21.97**	**43.72**	**19.67**	**34.89**	**31.38**	**54.31**	**N/A***	**30.86**	**43.24**	**N/A*****	**N/A*****	**10.08**	**33.12**	**1.46**	**10.65**	**1.05**	**11.46**	**3.03**	**6.98**
Beaver Dam Lake—All Basins	**14.42**	**15.77**	**34.46**	**17.17**	**25.96**	**12.77**	**22.64**	**17.43**	**29.51**	**N/A*****	**16.03**	**26.16**	**N/A*****	**N/A*****	**6.17**	**20.29**	**2.30**	**9.11**	**1.12**	**6.64**	**2.73**	**7.84**

N/A* Frequency of occurrence not available because the area was not surveyed

N/A** Frequency of occurrence not available because limited areas were surveyed - not the whole lake/bay area. Rabbit Island Bay channels surveyed and small area near the Eagle Point Boat Launch.

N/A*** Frequency of occurrence not available because some areas were not surveyed and/or only limited areas were surveyed in West Lake (area near Eagle Point boat landing) and Rabbit Island Bay (only the channels)

Table 2 2006-2016 EWM Extent in Beaver Dam Lake

	Acreage of EWM (based on plant surveys)																					
Location	**Fall 2006**	**Fall 2007**	**Fall 2008**	**July 2009**	**Fall 2009**	**July 2010**	**Fall 2010**	**July 2011**	**Fall 2011**	**June 2012**	**July 2012**	**Fall 2012**	**May 2013**	**June 2013**	**July 2013**	**Fall 2013**	**July 2014**	**Fall 2014**	**July 2015**	**Fall 2015**	**July 2016**	**October 2016**
Norwegian Bay	3.64	4.75	18.12	8.65	28.23	12.09	9.61	1.99	19.67	3.36	21.21	26.91	15.16	0.00	2.19	23.37	1.10	17.89	0.45	0.81	2.48	6.94
East Lake	0.00	0.00	9.34	8.14	19.37	14.13	17.48	17.18	23.93	N/A*	11.33	19.98	N/A*	N/A*	1.18	15.72	0.33	0.90	0.00	0.00	0.00	1.97
City Bay	60.25	3.94	68.06	27.89	61.62	20.11	54.01	47.97	73.66	7.65	48.76	55.75	50.85	0.00	20.70	49.01	0.79	7.26	0.00	6.87	0.00	1.50
Cemetery Bay	10.90	0.00	17.80	0.00	1.81	0.00	3.97	0.86	21.32	N/A*	0.00	7.17	N/A*	0.75	0.00	0.51	0.00	0.26	1.54	31.56	1.70	13.76
West Lake	25.27	11.36	33.19	24.59	19.67	15.80	25.15	8.65	14.78	N/A*	15.31	23.11	N/A*	3.15**	10.05	29.13	7.23	29.94	0.00	1.72	6.83	20.64
Williams Bay	3.63	10.23	12.64	9.48	4.80	1.15	6.68	4.57	4.65	N/A*	1.68	6.92	N/A*	0.26**	0.33	2.46	0.00	7.45	0.00	0.00	0.92	5.78
Rabbit Island Bay	5.80	12.36	13.21	10.57	8.51	6.26	11.47	4.22	8.01	0.00	0.51	5.64	0.00**	N/A**	0.38	1.45	0.61	3.11	0.00	1.37	1.41	9.51
Library Lake	0.66	0.59	3.62	0.40	0.09	0.04	0.72	0.00	0.00	N/A*	0.20	0.04	N/A*	N/A*	0.00	0.06	0.00	0.14	0.70	1.90	0.02	0.00
East Lake Basins	**74.79**	**8.69**	**113.32**	**44.68**	**111.03**	**46.33**	**85.07**	**67.99**	**138.58**	**N/A*** **	**81.30**	**109.81**	**N/A*** **	**N/A*** **	**24.07**	**88.60**	**2.22**	**26.31**	**1.99**	**39.24**	**4.18**	**24.16**
West Lake Basins	**35.36**	**34.54**	**62.66**	**45.04**	**33.07**	**23.25**	**44.02**	**17.44**	**27.44**	**N/A*** **	**17.70**	**35.70**	**N/A*** **	**N/A*** **	**10.76**	**33.10**	**7.84**	**40.64**	**0.70**	**4.99**	**9.18**	**35.93**
Beaver Dam Lake—All Basins	**110.15**	**43.23**	**175.98**	**89.72**	**144.10**	**69.58**	**129.09**	**85.43**	**166.02**	**N/A*** **	**99.00**	**145.51**	**N/A*** **	**N/A*** **	**35.88**	**121.70**	**10.06**	**66.96**	**2.68**	**44.23**	**13.36**	**60.10**

N/A* EWM extent not available because the area was not surveyed

** EWM extent is based on survey of limited areas—not the whole lake/bay area. Rabbit Island Bay channels surveyed and small area near the Eagle Point Boat Launch.

N/A*** Frequency of occurrence not available because some areas were not surveyed and only limited areas were surveyed in West Lake (area near Eagle Point boat landing) and Rabbit Island Bay (only the channels)

Table 3 2006-2016 % of Littoral Zone with EWM in Beaver Dam Lake

Location	% of Littoral Zone with EWM (based on plant surveys)																		
	Fall 2006	Fall 2007	Fall 2008	July 2009	Fall 2009	July 2010	Fall 2010	July 2011	Fall 2011	July 2012	Fall 2012	July 2013	Fall 2013	July 2014	Fall 2014	July 2015	Fall 2015	July 2016	Fall 2016
Norwegian Bay	9.52	12.42	47.38	22.62	73.82	31.62	25.13	0.05	51.44	55.47	70.38	5.72	61.11	2.88	46.79	1.18	2.12	6.49	18.15
East Lake	0.00	0.00	14.83	12.92	30.75	22.43	27.75	27.27	37.98	17.98	31.71	1.87	24.95	0.53	1.43	0.00	0.00	0.00	3.13
City Bay	59.45	3.89	67.15	27.52	60.80	31.92	53.29	47.33	72.68	48.11	55.01	20.42	48.36	0.78	7.17	0.00	6.78	0.00	1.48
Cemetery Bay	20.21	0.00	33.00	0.00	3.36	0.00	7.36	1.59	39.53	0.00	13.29	0.00	0.94	0.00	0.48	2.86	58.51	3.15	25.51
West Lake	17.60	7.91`	23.12	17.13	13.70	11.01	17.52	6.03	10.30	10.67	16.10	7.00	20.29	5.04	20.86	0.00	1.20	4.76	14.86
Williams Bay	7.95	22.41	27.70	20.77	10.52	2.52	0.15	10.01	10.19	3.68	15.15	0.72	5.39	0.00	12.29	0.00	0.00	2.02	11.74
Rabbit Island Bay	9.56	20.38	21.78	17.43	14.03	10.32	18.91	6.96	13.21	0.84	9.30	0.63	2.39	1.01	5.13	0.00	2.26	2.33	15.72
Library Lake	4.81	4.30	26.40	2.92	0.66	0.29	5.25	0.00	0.00	1.46	0.27	0.00	0.45	0.00	0.99	5.11	13.86	0.15	0.00
East Lake Total:	**29.15**	**3.39**	**44.17**	**17.42**	**43.28**	**18.06**	**33.16**	**26.51**	**54.02**	**31.69**	**42.81**	**9.38**	**34.54**	**0.87**	**10.26**	**1.99**	**15.30**	**1.63**	**9.42**
West Lake Total:	**13.42**	**13.11**	**23.78**	**17.09**	**12.55**	**8.82**	**16.70**	**6.62**	**10.41**	**6.72**	**13.55**	**4.08**	**12.56**	**2.98**	**15.42**	**0.70**	**1.89**	**3.48**	**13.69**
Beaver Dam Lake Total	**21.18**	**8.31**	**33.84**	**17.25**	**27.71**	**13.38**	**24.82**	**16.43**	**31.92**	**19.04**	**27.98**	**6.90**	**23.40**	**1.93**	**12.87**	**2.68**	**8.50**	**2.57**	**11.58**

1.0 Herbicide Treatment of EWM

In 2016, the Beaver Dam Lake Management District treated 166 acres of Beaver Dam Lake with 2,4-D to attain the District goal of reducing Eurasian watermilfoil (EWM) to no more than 7 percent of the littoral zone area while minimizing harm to native aquatic plants (Table 4 and Figures 1 and 2). Three areas of the lake were treated—Library Lake, Cemetery Bay, and City Bay.

Table 4 2016 EWM Herbicide Treatment Plan

Treatment Area	Acres Treated	Treatment Date	2,4-D Concentration Applied to Treatment Area (ppm)	Expected Whole Lake/Bay Concentration of 2,4-D (ppm)
West Lake Basins				
Library Lake	10.99	4/22/2016	0.31	0.3
East Lake Basins				
City Bay	102.17	5/2/2016	0.8	0.8
Cemetery Bay	53.17	5/2/2016	0.3	0.3

Herbicide residue samples were collected from sites within treatment areas (Figures 1 and 2) at intervals of approximately:

- 0.04, 0.16, 1, 2, 3, 5, 7, 12, 19, and 26 days after treatment (DAT).

Samples at each site were collected at mid-depth (above the thermocline) and preserved with 3 drops of muriatic acid to fix the 2,4-D and prevent degradation. Samples were stored in a refrigerator until shipped to the Wisconsin Department of Hygiene Laboratory in Madison, Wisconsin for analysis of 2,4-D.

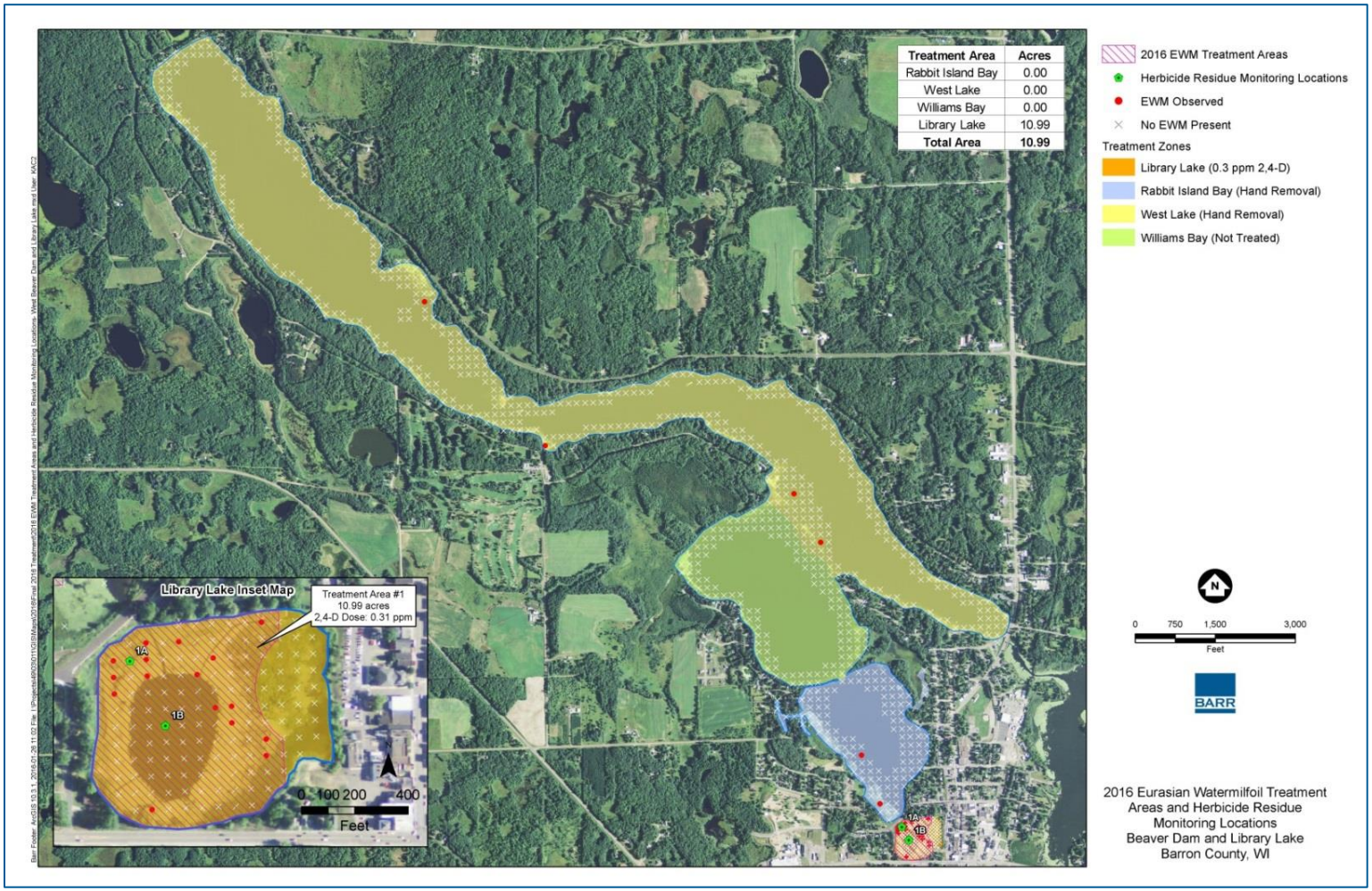

Figure 1: 2016 Beaver Dam Lake Eurasian Watermilfoil Treatment Areas and Herbicide Residue Monitoring Locations: West Lake

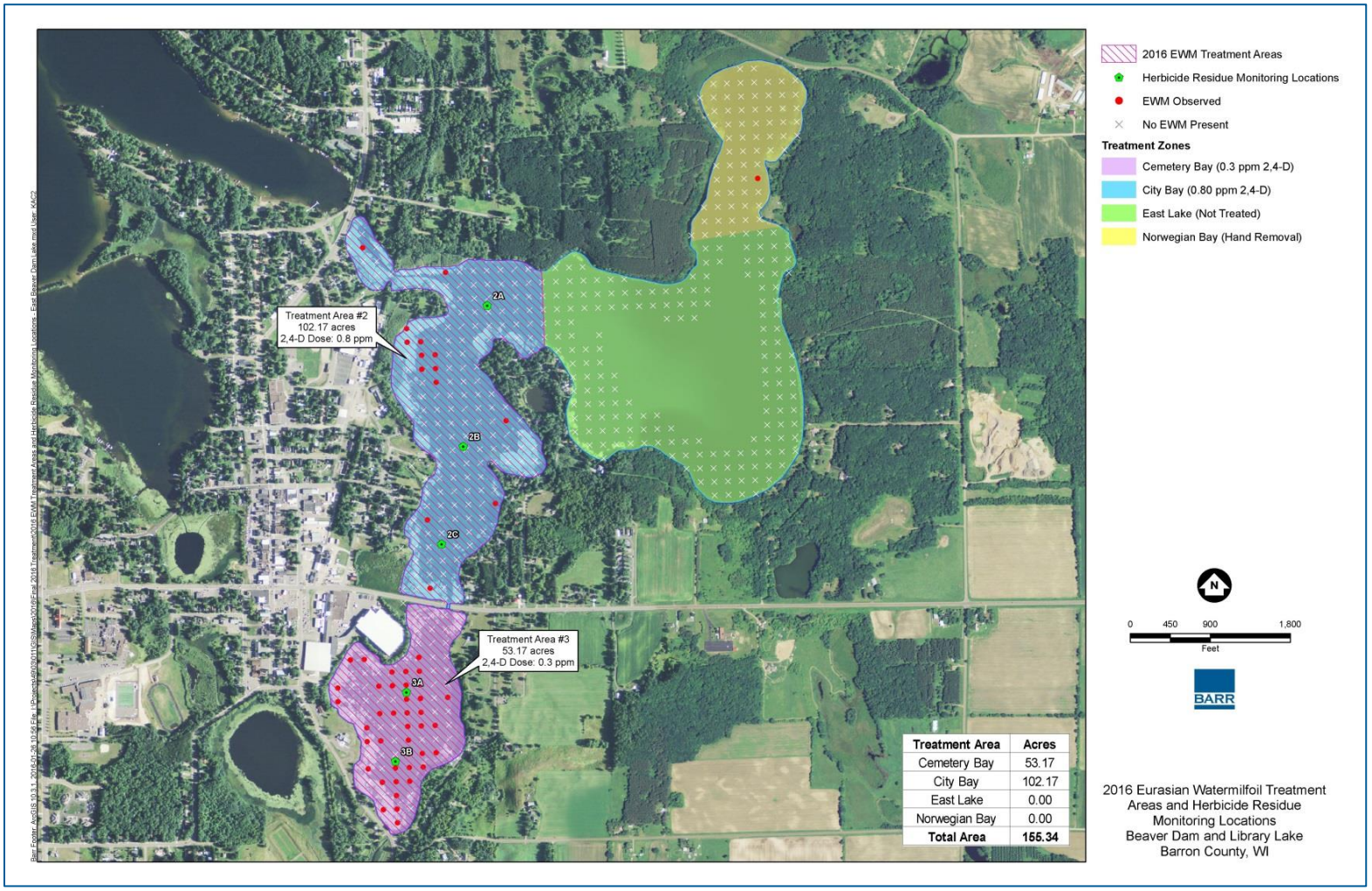

Figure 2: 2016 Beaver Dam Lake Eurasian Watermilfoil Treatment Areas and Herbicide Residue Monitoring Locations: East Lake

2.0 Manual EWM Removal

In 2016, manual removal of EWM was intended for areas not treated with herbicide and also to remove any EWM observed in treated areas during the summer period. The Beaver Dam Lake Management District had hoped to use Diver Assisted Suction Harvesting (DASH) for manual EWM removal. However, unforeseen circumstances prevented the DASH equipment from being available in 2016. Nonetheless, manual EWM removal was completed from five areas during August 15 through 19 using a rake.

- Rabbit Island Bay
- Channel between Rabbit Island Bay and Library Lake
- Cemetery Bay
- City Bay
- Norwegian Bay

The following information was recorded at each manual EWM removal location:

- Latitude and longitude,
- Estimated number of EWM plants removed, and
- Notes about the EWM and/or removal effort.

Details about the manual EWM removal in each area are discussed in Section 4.0, Individual EWM Management Areas.

3.0 Lake-Wide EWM

The lake-wide EWM in 2016 shows the results of the EWM management efforts—herbicide treatment of three areas and manual removal of EWM in five areas.

Spring herbicide treatment:

- Reduced EWM frequency by more than half—from 7 percent in fall of 2015 to 3 percent in July of 2016 (Figure 3),
- Reduced EWM extent by 70 percent—from 44 acres in fall of 2015 to 13 acres in July of 2016 (Figure 4),
- Reduced percent of littoral zone with EWM by two thirds—from 9 percent in fall of 2015 to 3 percent in July of 2016 (Figure 5).

However, despite August manual EWM removal efforts, rapid expansion of EWM between July and October:

- More than doubled EWM frequency—from 3 percent in July of 2016 to 8 percent in October of 2016 (Figure 3),
- More than quadrupled EWM extent—from 13 acres in July of 2016 to 60 acres in October of 2016 (Figure 4),
- Quadrupled percent of littoral zone with EWM—from 3 percent in July of 2016 to 12 percent in October of 2016 (Figure 5).

Because EWM extent was 12 percent of the littoral zone in October of 2016 the District goal of reducing EWM to no more than seven percent of the littoral zone has not yet been attained.

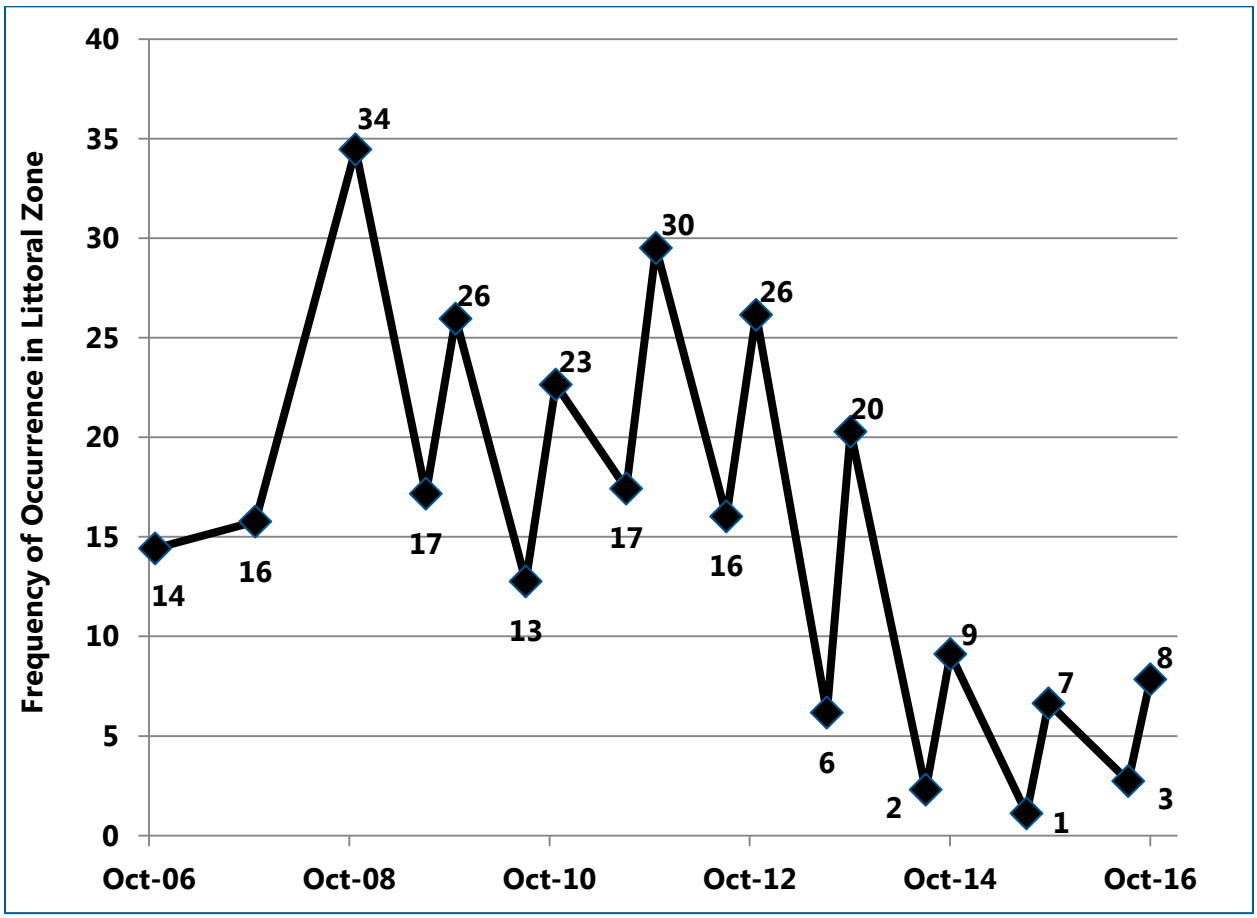

Figure 3: 2006-2016 Beaver Dam Lake Frequency of Occurrence in the Littoral Zone

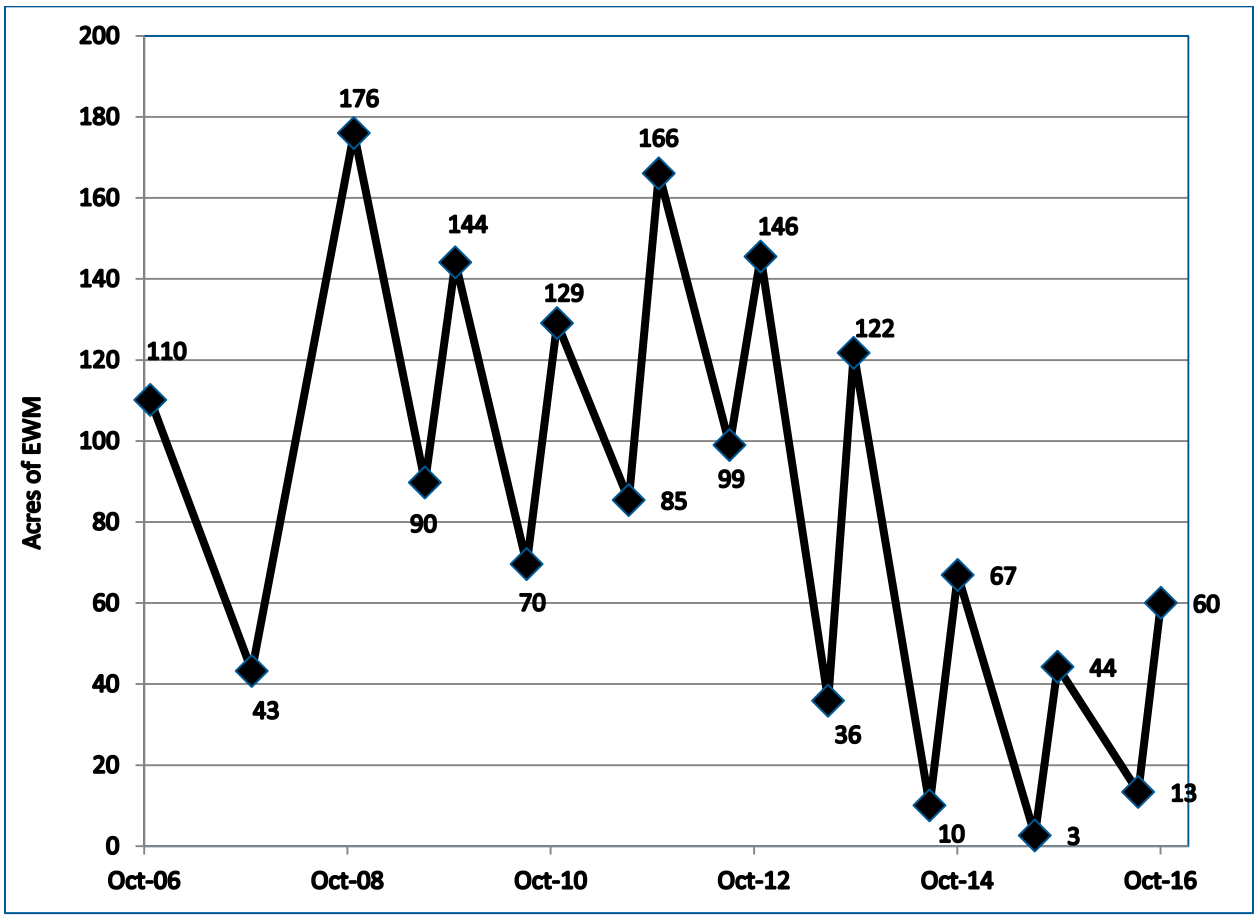

Figure 4: 2006-2016 Beaver Dam Lake EWM Extent

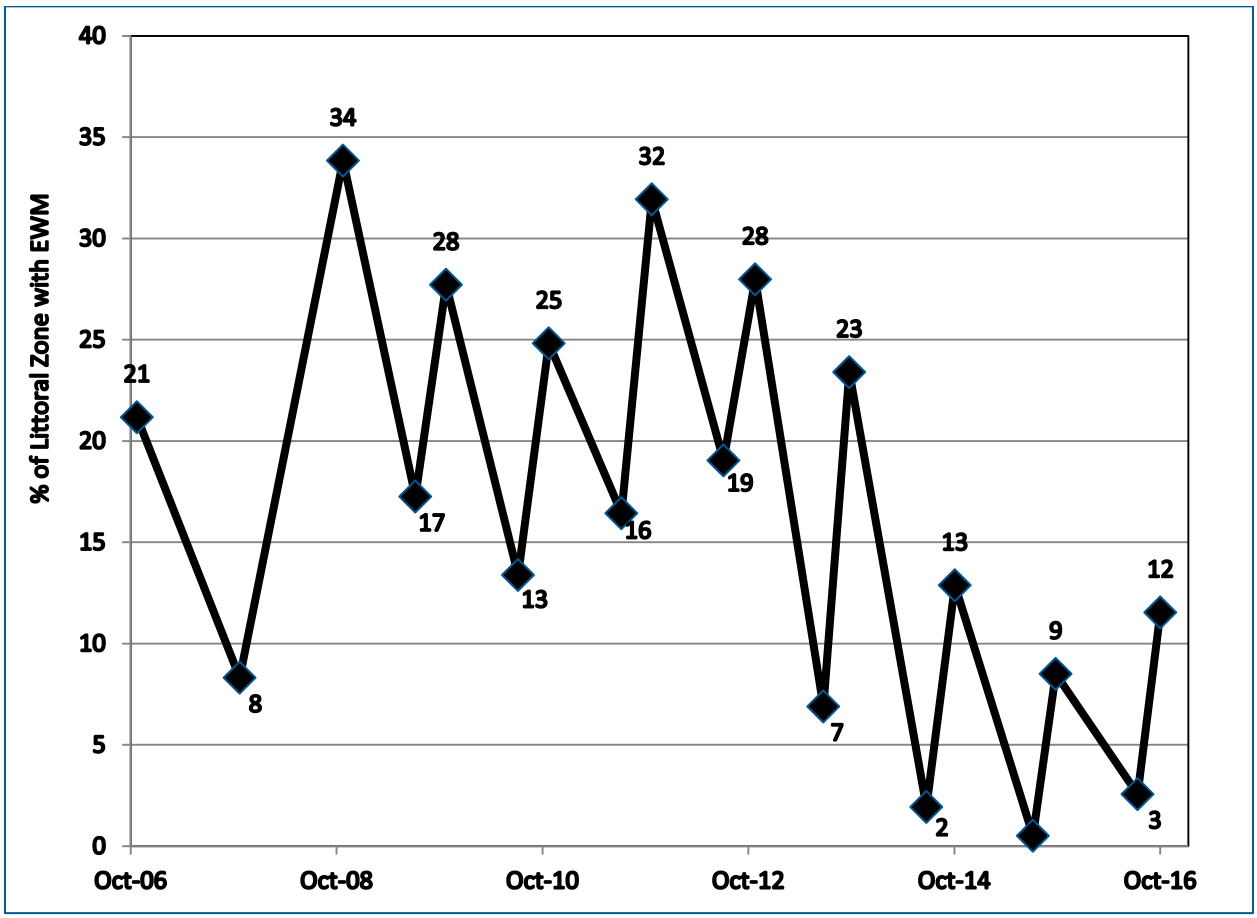

Figure 5: 2006-2016 Beaver Dam Lake Percent of Littoral Zone with EWM

4.0 Individual EWM Management Areas

4.1 West Lake

Although manual removal of EWM in West Lake was intended, the July plant survey indicated manual removal of EWM in West Lake was not feasible due to the magnitude of the EWM infestation. EWM was expanding throughout West Lake with many former deep beds partially or completely reestablished. Hence, EWM was not managed in West Lake during 2016.

Pictured above, dense EWM bed in West Lake during July 2016.

In the absence of management, rapid expansion of EWM occurred in West Lake throughout the 2016 growing season. In October of 2015, EWM frequency of occurrence was 1 percent and EWM extent was 2 acres, which was 1 percent of the littoral zone. In July of 2016, EWM frequency of occurrence had increased to 4 percent and EWM extent to 7 acres, which was 5 percent of the littoral zone. In October of 2016, EWM had increased to a frequency of 8 percent and an extent of 21 acres, which was 14 percent of the littoral zone (Figures 6 through 8). Hence, EWM increased by an order of magnitude between October of 2015 and October of 2016.

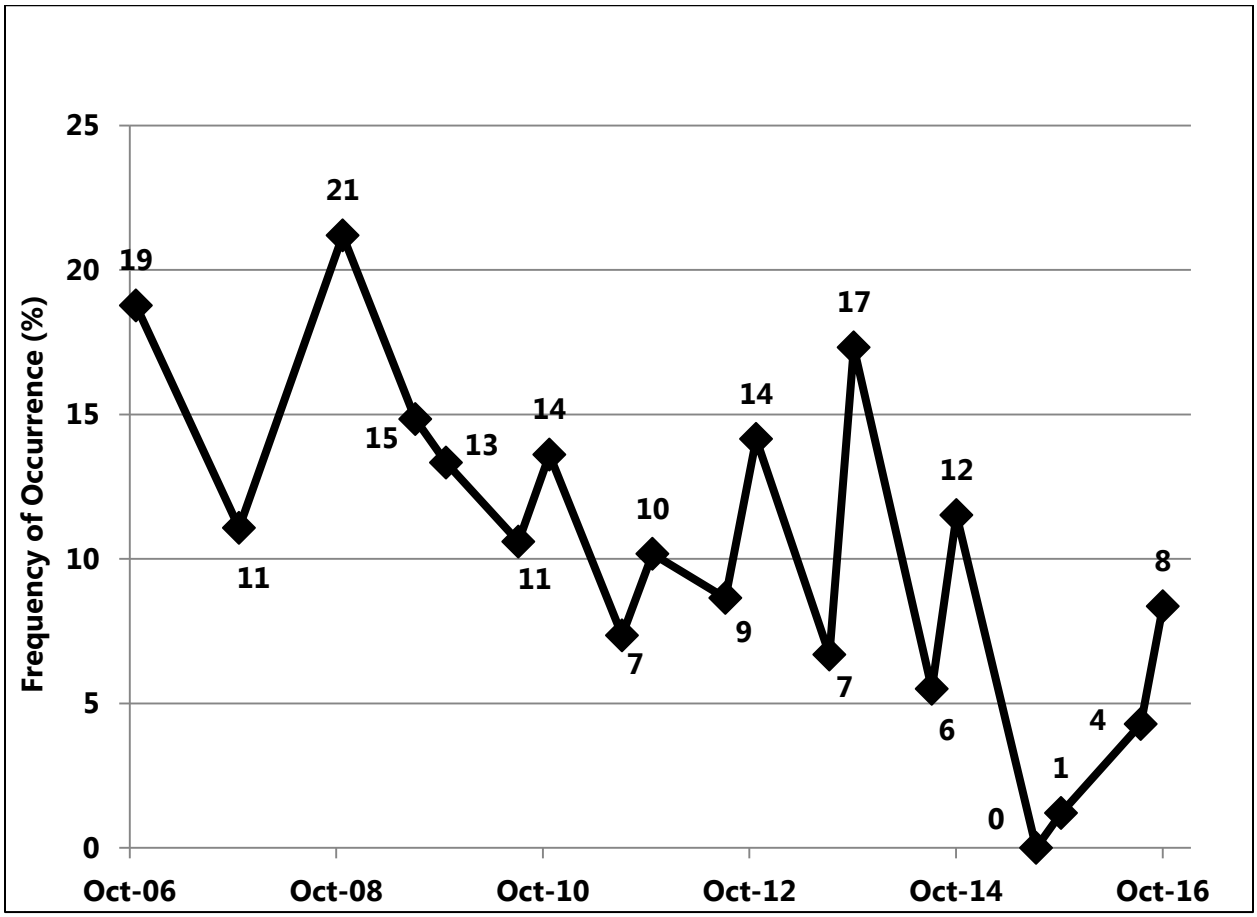

Figure 6: 2006-2016 Beaver Dam Lake Frequency of Occurrence in Littoral Zone: West Lake

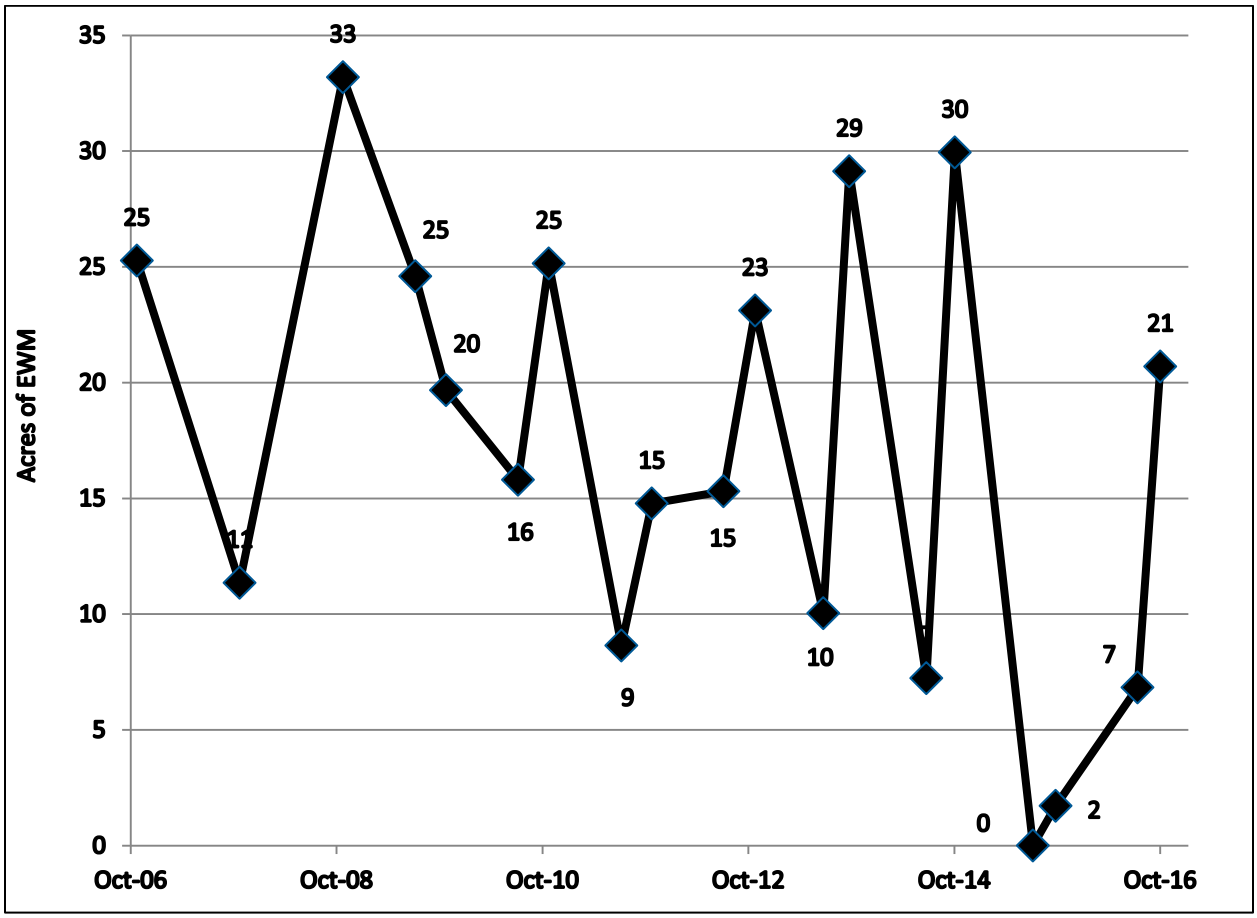

Figure 7: 2006-2016 Beaver Dam Lake EWM Acreage: West Lake

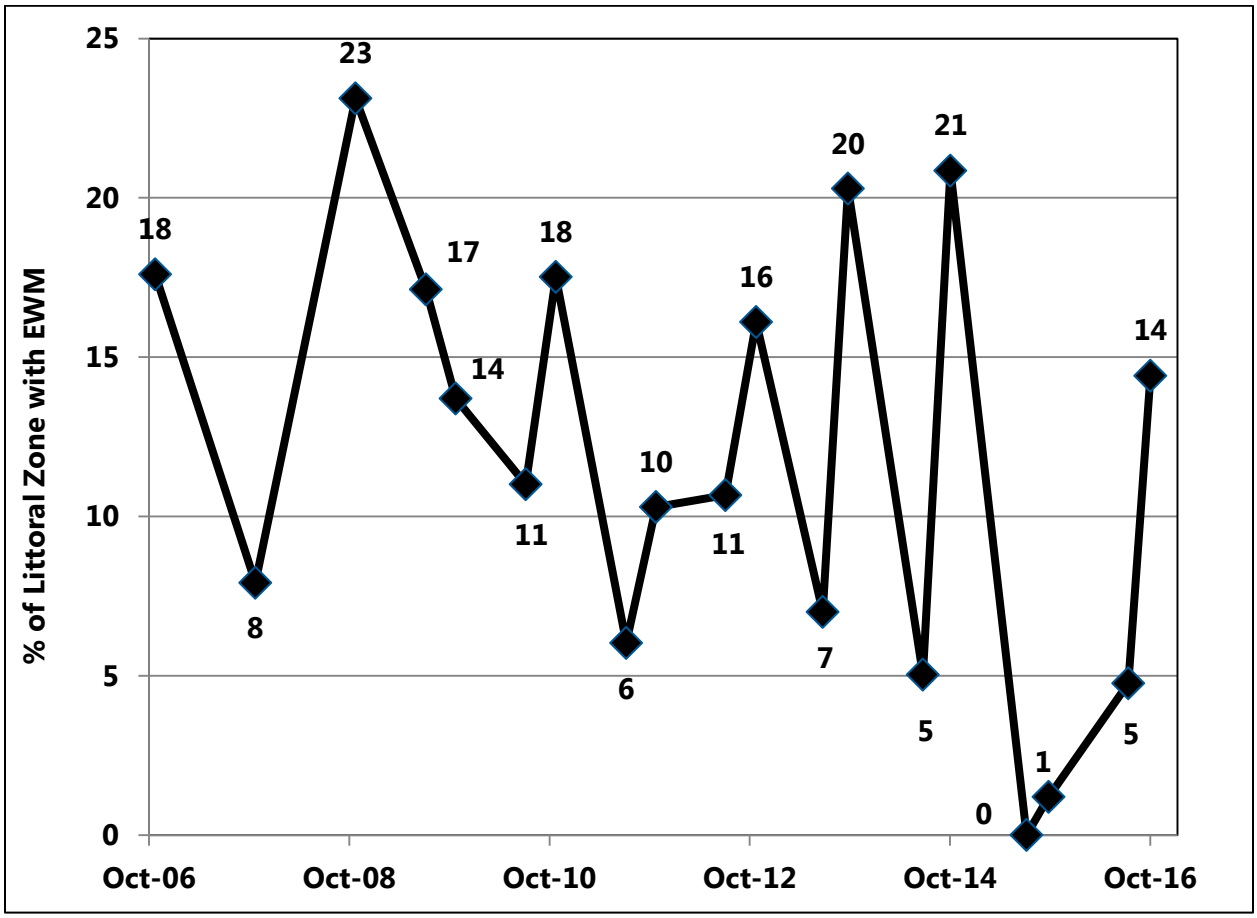

Figure 8: 2006-2016 Percent of Littoral Zone with EWM: West Lake

4.2 Williams Bay

Although manual removal of EWM in Williams Bay during 2016 was intended, DASH was not available and it was determined that removal by rake was not feasible due to its hard compact bottom. In addition, the tendency for EWM to grow in the 7- to 12-foot bathymetric ring makes rake removal challenging (i.e., rake removal is harder in deeper depths). As shown in Figure 9, a large EWM bed was observed in the southeastern corner of Williams Bay in August. The plants in the bed were too deep and too dense to remove by rake and EWM was mixed with natives making it almost impossible to get them out without fracturing the stems and causing fragments to scatter. Hence, EWM was not managed in Williams Bay in 2016.

Although EWM was not managed in 2016, it should be noted that DASH typically works well on EWM beds such as the EWM bed shown in Figure 9. Hence, using DASH in Williams Bay is definitely a potential in the future. However, because EWM plants were so widespread in 2016, herbicide treatment to reduce EWM will be necessary prior to using DASH to manage EWM in Williams Bay.

In October of 2015, EWM was not observed in Williams Bay. However, by July of 2016, EWM frequency of occurrence had increased to 2 percent and EWM extent to 1 acre, which was 2 percent of the littoral zone. In October of 2016, EWM had increased to a frequency of 8 percent and an extent of 6 acres, which was 12 percent of the littoral zone (Figures 10 through 12).

Figure 9: August 17 EWM Bed in Williams Bay

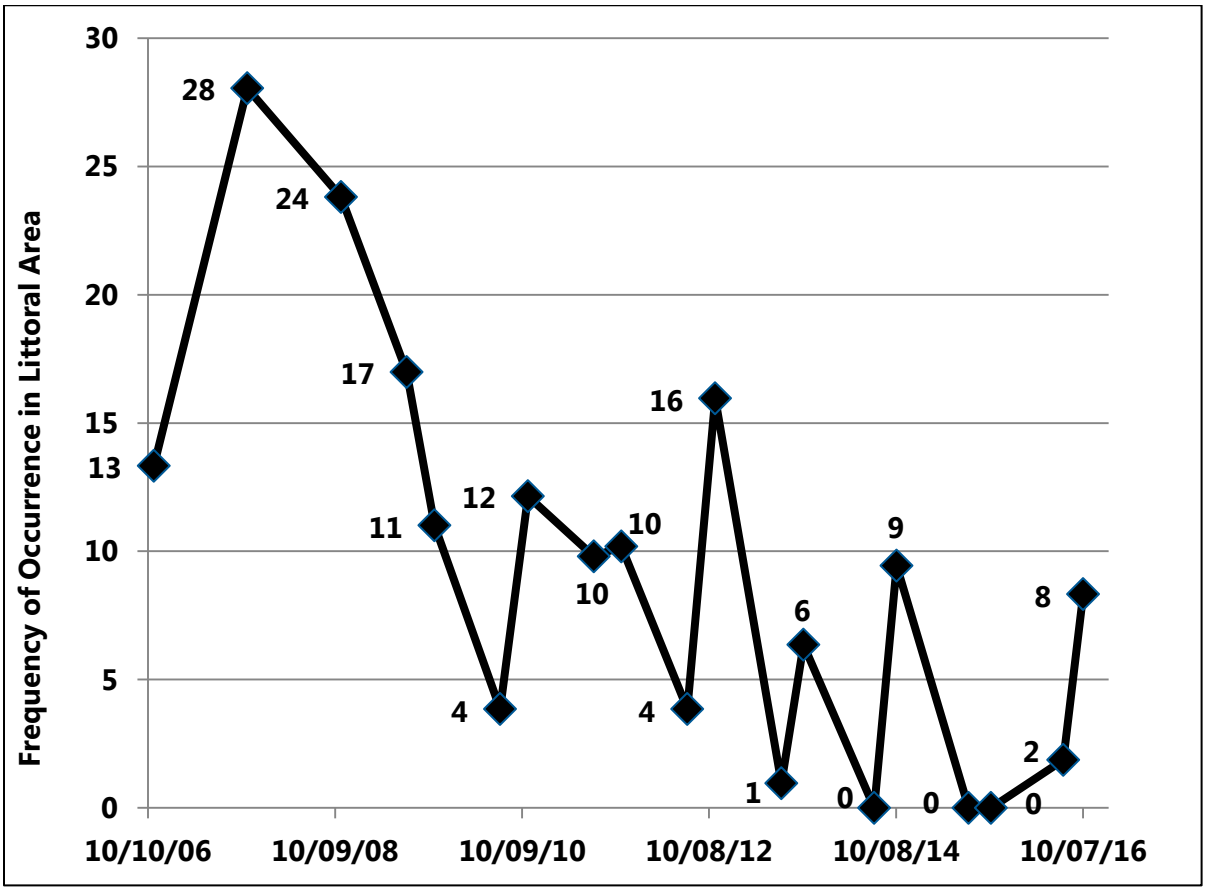

Figure 10: 2006-2016 Beaver Dam Lake Frequency of Occurrence in Littoral Zone: Williams Bay

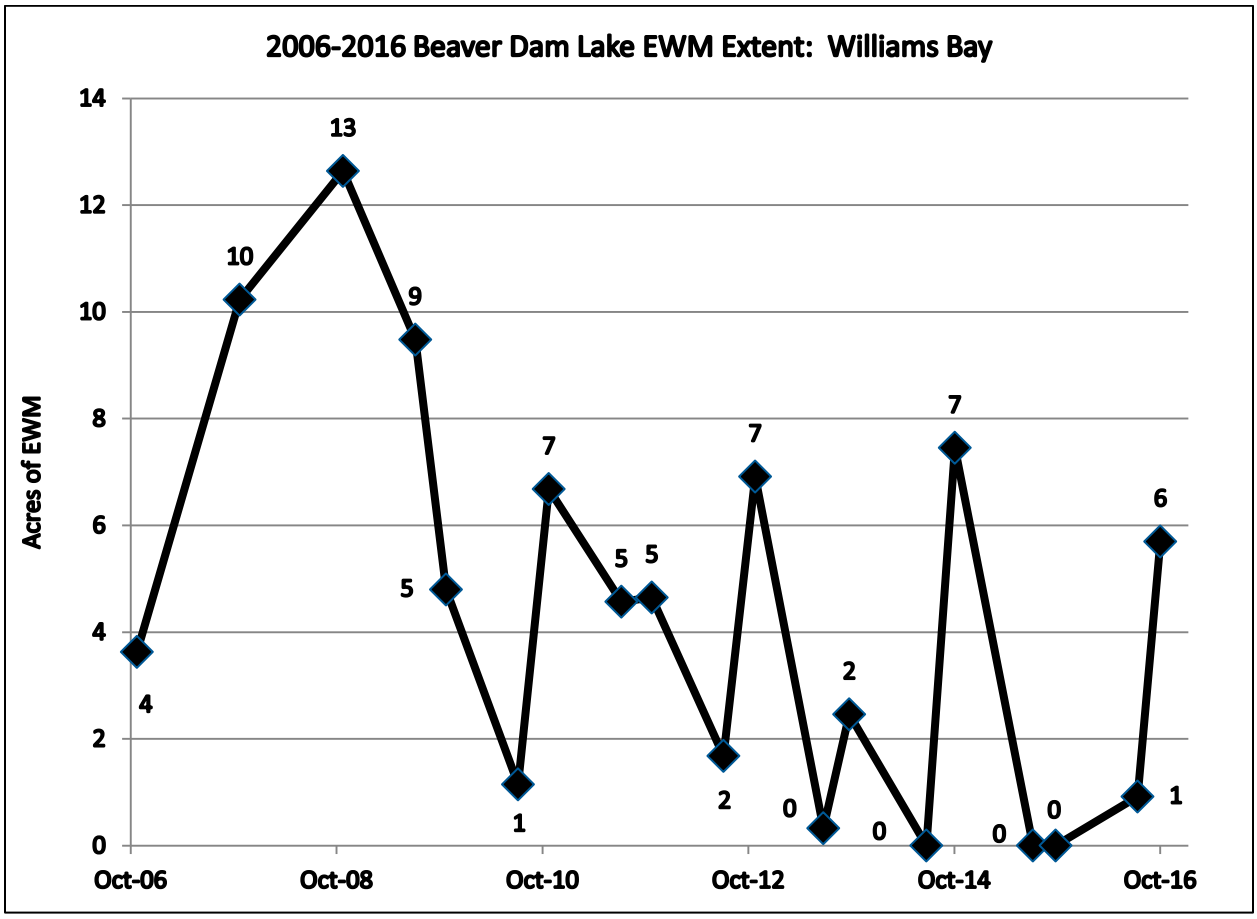

Figure 11: 2006-2016 Beaver Dam Lake EWM Acreage: Williams Bay

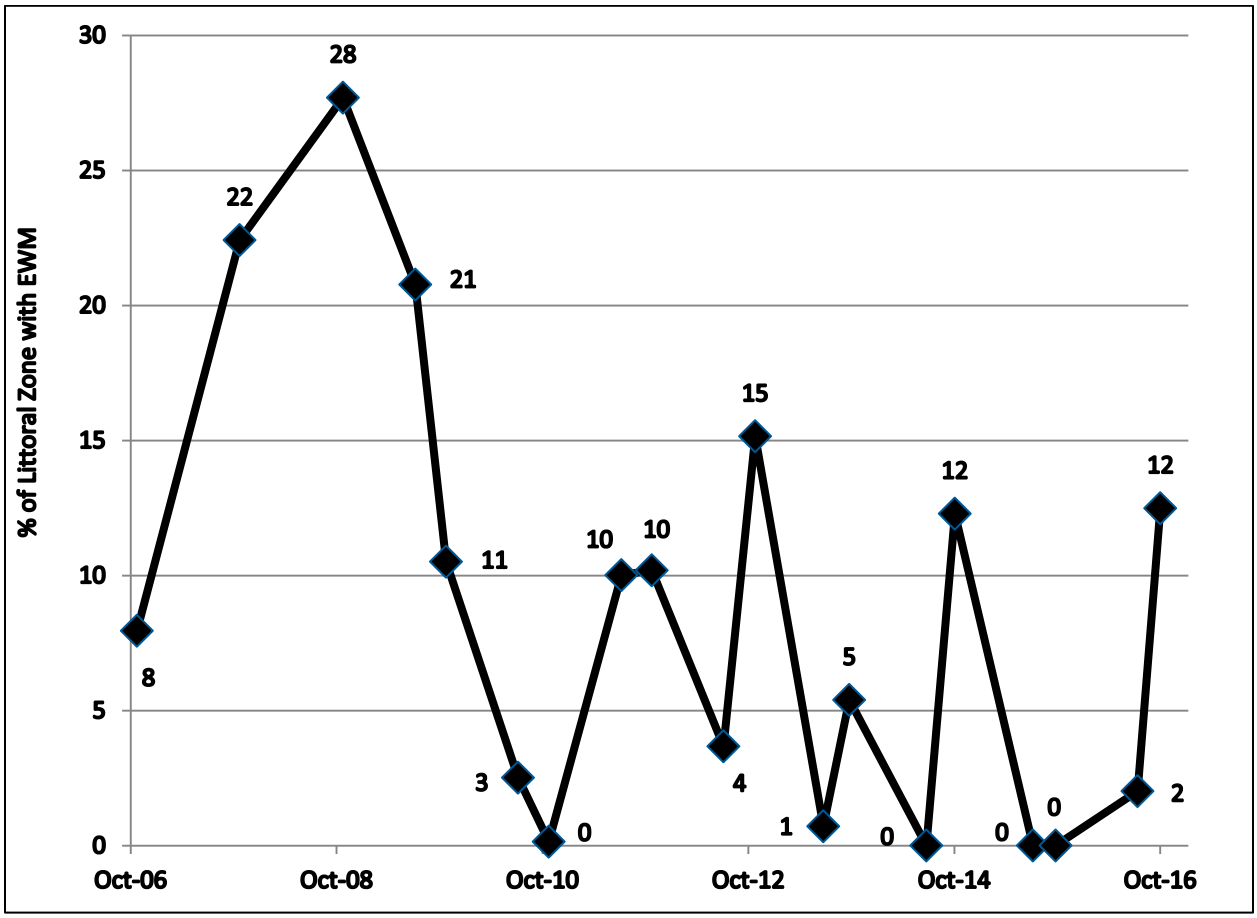

Figure 12: 2006-2016 Percent of Littoral Zone with EWM: Williams Bay

4.3 Rabbit Island Bay

In 2016, EWM management in Rabbit Island Bay consisted of manual removal of EWM from 41 locations on August 17 (Figure 13). The number of plants removed per location ranged from 1 to more than 100, including lots of small EWM sprouts observed near the boat landing that were easily cleaned up with the rake.

It is difficult to manually remove EWM from Rabbit Island Bay by rake as the bottom is hard and compacted making it difficult to remove the EWM roots (i.e., plants break off and the roots remain). There are also significant amounts of native vegetation that tend to get entangled with EWM as many of the EWM plants are growing in deeper water which makes manual removal more difficult. Despite the difficulties, manual removal of EWM occurred at 41 locations. However, when the EWM beds on the west shore were discovered, manual removal was discontinued due to the futility of the endeavor:

- Too many EWM plants/too deep (greater than 10 feet),
- Roots were impacted into the bottom, and
- EWM was mixed in with lots of natives making rake removal essentially impossible.

There is now so much deep water EWM throughout the bay that a herbicide "reset" will be necessary before shifting to DASH for EWM management in Rabbit Island Bay.

In October of 2015, EWM frequency of occurrence in Rabbit Island Bay was 2 percent and EWM extent was 1.4 acres, which was 2 percent of the littoral zone. By July of 2016, EWM frequency of occurrence had increased to 4 percent, but EWM extent remained unchanged at 1.4 acres, which was 2 percent of the littoral zone. Rapid expansion of EWM between July and October of 2016 increased EWM frequency five-fold to 10 percent and EWM extent more than six-fold to 9.5 acres, which was 16 percent of the littoral zone (Figures 14 through 16).

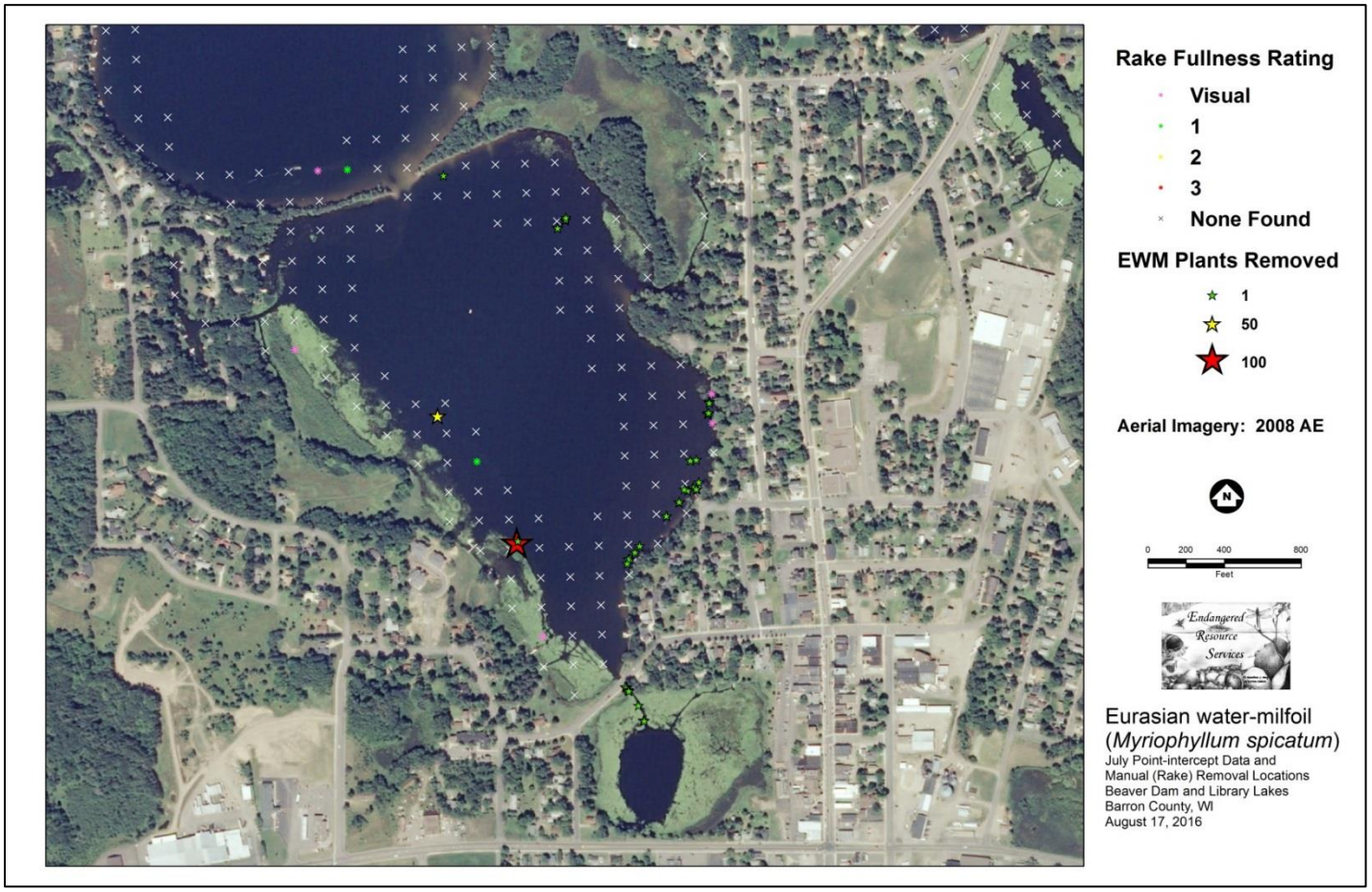

Figure 13: August 2016 Manual Removal of EWM in Rabbit Island Bay and the Channel Between Rabbit Island Bay and Library Lake

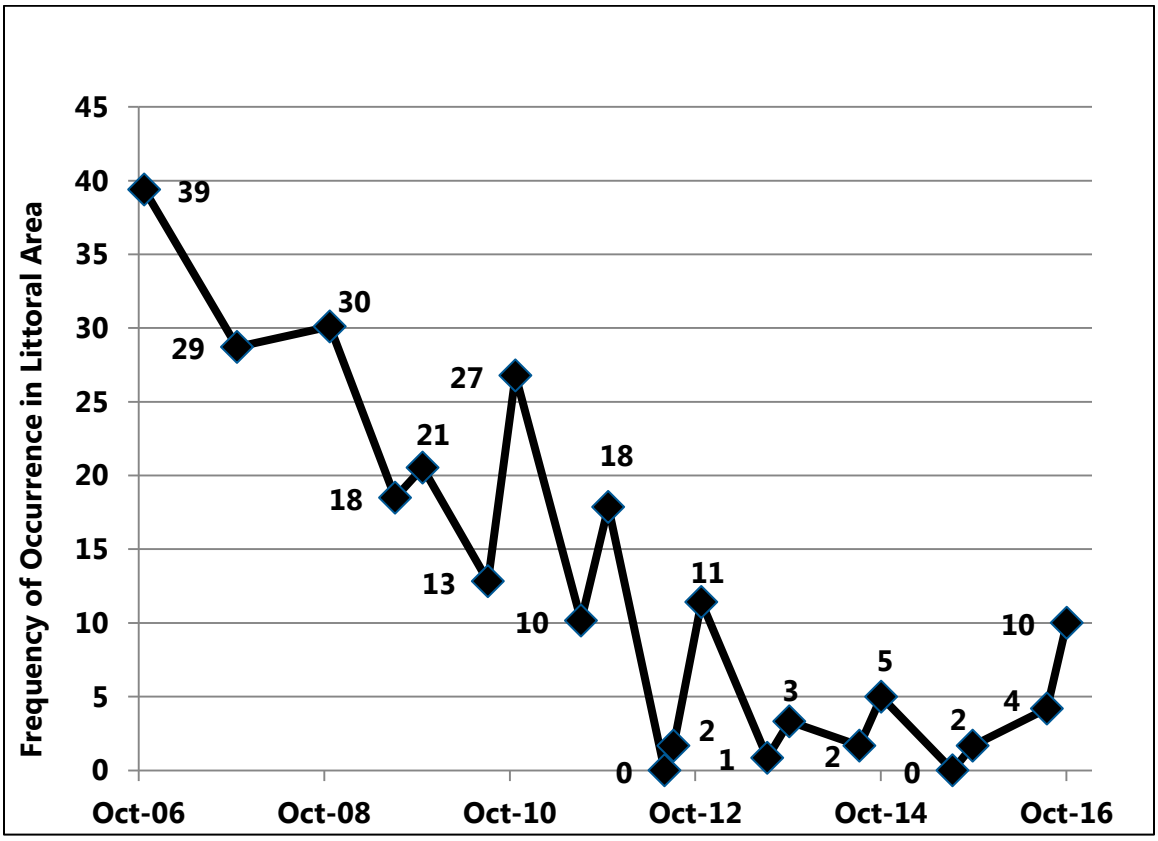

Figure 14: 2006-2016 Beaver Dam Lake Frequency of Occurrence in Littoral Zone: Rabbit Island Bay

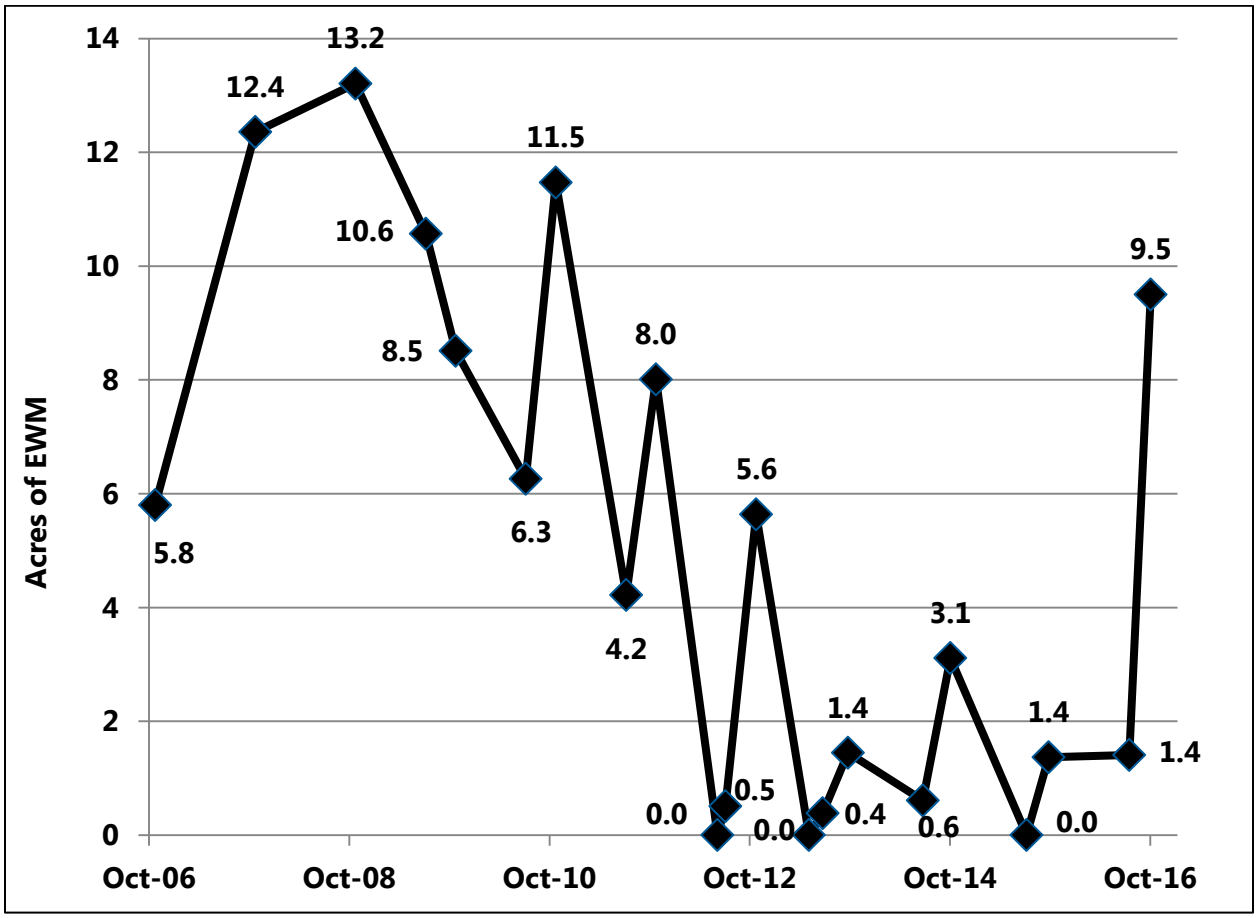

Figure 15: 2006-2016 Beaver Dam Lake EWM Acreage: Rabbit Island Bay

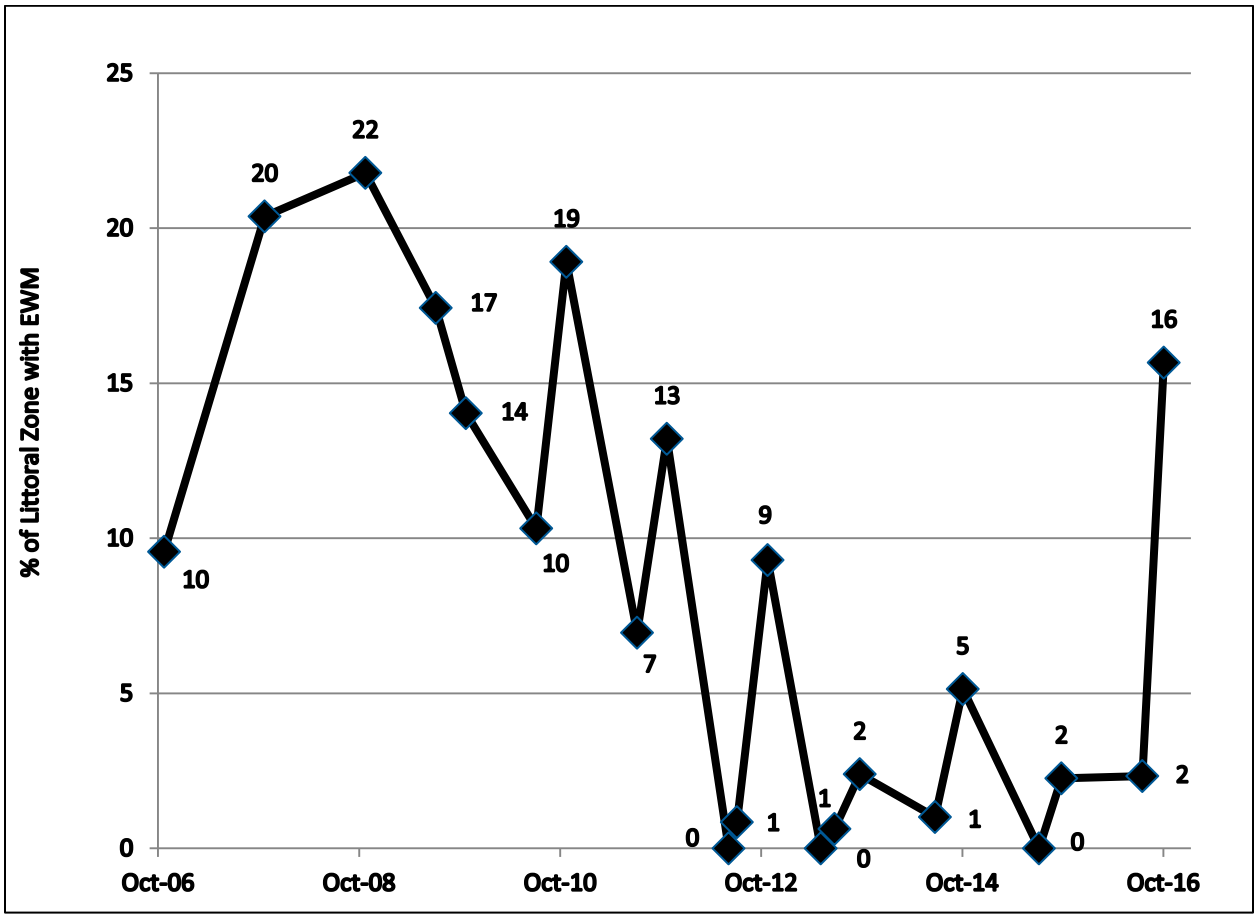

Figure 16: 2006-2016 Percent of Littoral Zone with EWM: Rabbit Island Bay

4.4 Library Lake

In 2016, EWM management in Library Lake consisted of a spring herbicide treatment, manual removal of the two EWM plants observed at the lake entrance in July, and manual removal of EWM from the channel between Rabbit Island Bay and Library Lake in August.

On April 22, a total of 10.99 acres were treated with 0.31 ppm 2,4-D (Figure 1). The expected whole lake 2,4-D concentration after treatment was 0.3 ppm. 2,4-D samples were collected from two locations within the treatment area (Figure 1). As shown in Figure 17, a 2,4-D concentration of 0.3 ppm sustained for at least 4 days is lethal to EWM. Figure 18 shows the observed 2,4-D concentrations in Library Lake from 1 hour after treatment until 26 days after treatment. 2,4-D concentrations from the two monitoring locations were relatively similar throughout the monitoring period. As shown in Figure 18, the 2,4-D concentrations in Library Lake were at least 0.3 ppm ae[2] (300 µg/L ae[2]) for at least 5 or 6 days after treatment. The seven-day average 2,4-D concentration in Library Lake was 0.453 ppm ae[2] (453 µg/L ae[2]). Hence, Library Lake attained and sustained a 2,4-D concentration that was lethal to EWM.

As expected, the 2,4-D concentration in Library Lake at 26 days after treatment was very low, ranging from 28 to 32 µg/L ae[2] (Figure 18).

The spring herbicide treatment was effective. In October of 2015, EWM frequency of occurrence in Library Lake was 12 percent and EWM extent was 1.9 acres, which was 14 percent of the littoral zone (Figures 19 through 21). During the post-treatment survey in July, the only EWM observed in Library Lake were 2 plants at the lake's entrance which were manually removed. In August, EWM plants were observed at 10 locations in the channel between Library Lake and Rabbit Island Bay. The single EWM plant at each of the 10 locations was manually removed on August 17 (Figure 13). EWM was not observed in Library Lake during the fall survey (Figures 19 through 21).

Although EWM management in 2017 is not needed, manual removal of EWM is recommended for small future infestations. Library Lake is ideal for manual removal of EWM with a rake as the bottom is super soft making it easy to get the entire plant and minimizing the chances of losing fragments.

[2] ae is acid equivalent which is the concentration of the active ingredient in 2,4-D (i.e., the ingredient that kills EWM)

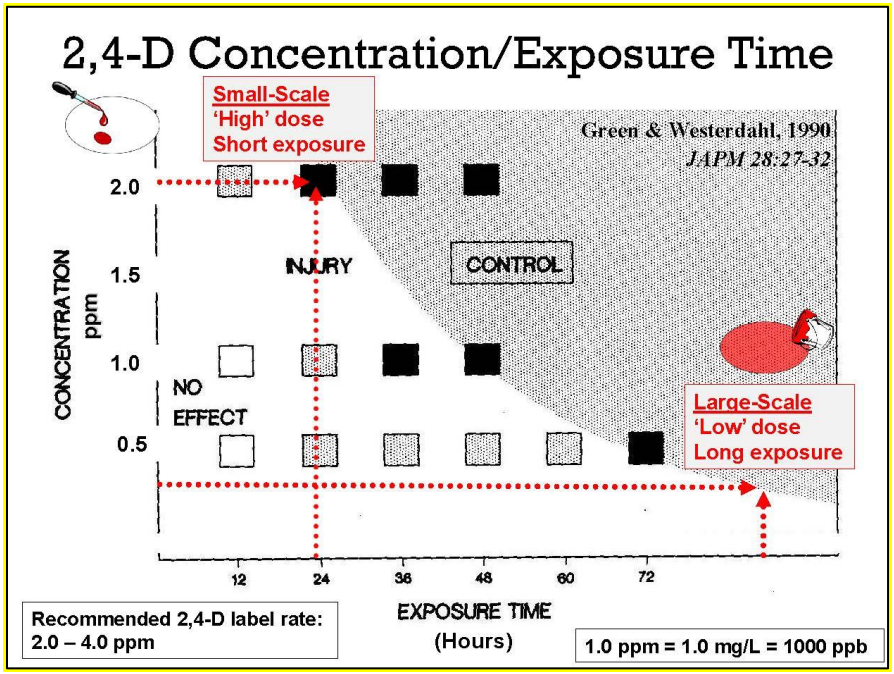

Figure 17: 2,4-D Concentrations/Exposure Times Lethal to Eurasian Watermilfoil
(Figure Credit: Nault, Michelle and John Skogerboe. 2014. *Scientific Evaluation of Efficacy and Selectivity of Herbicide Treatments in Wisconsin Lakes*. Presentation at UMISC—October 22, 2014 in Duluth, Minnesota)

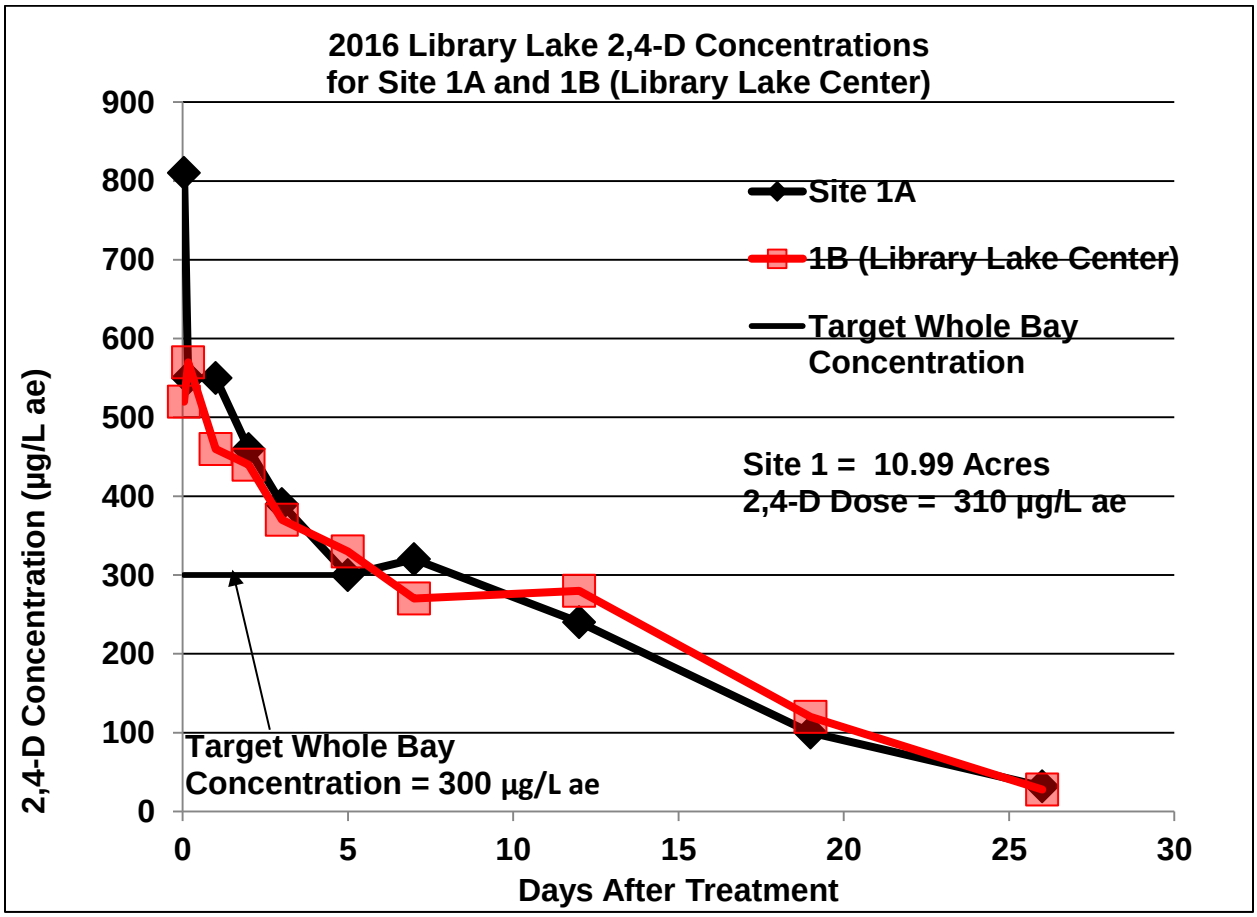

Figure 18: 2016 Library Lake 2,4-D Concentrations

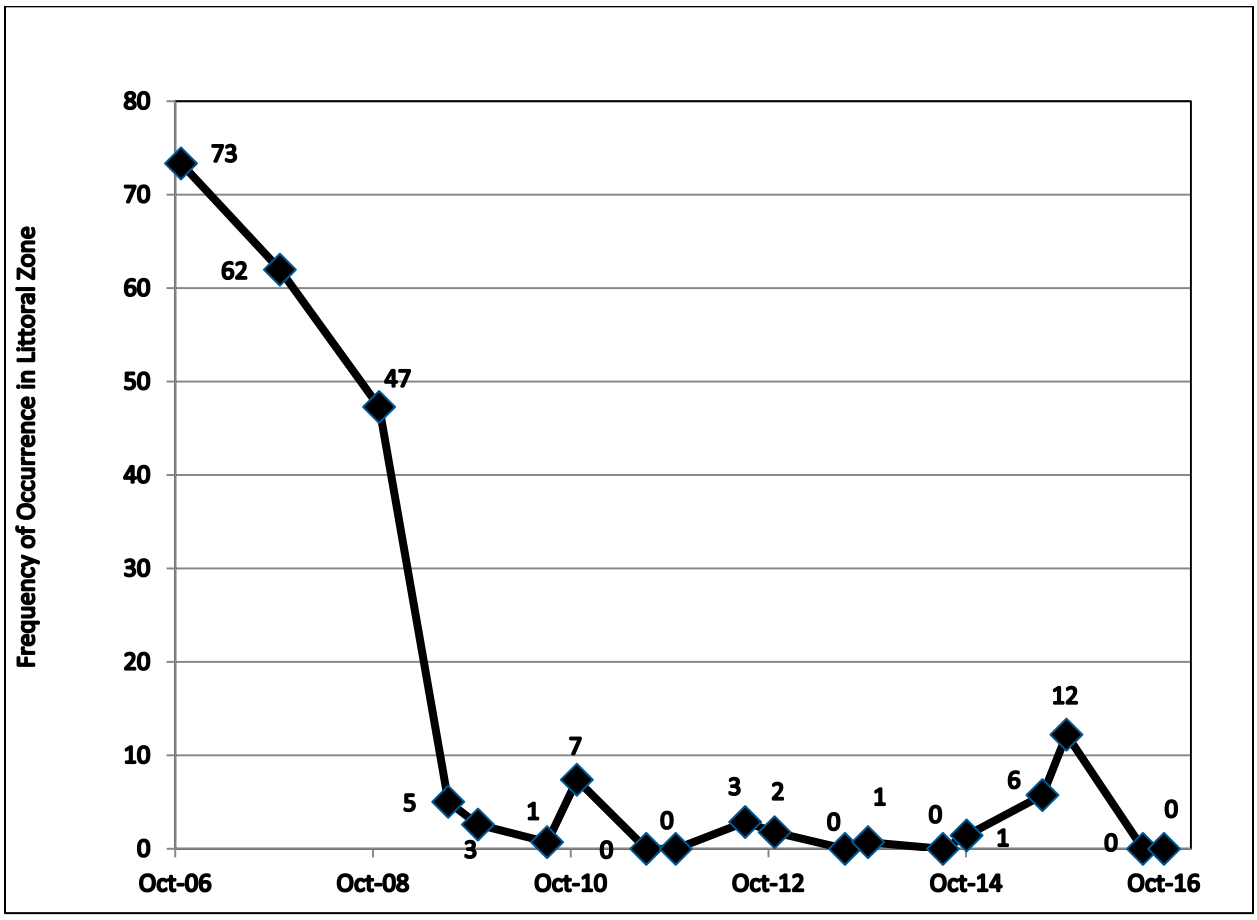

Figure 19: 2006-2016 Beaver Dam Lake Frequency of Occurrence in Littoral Zone: Library Lake

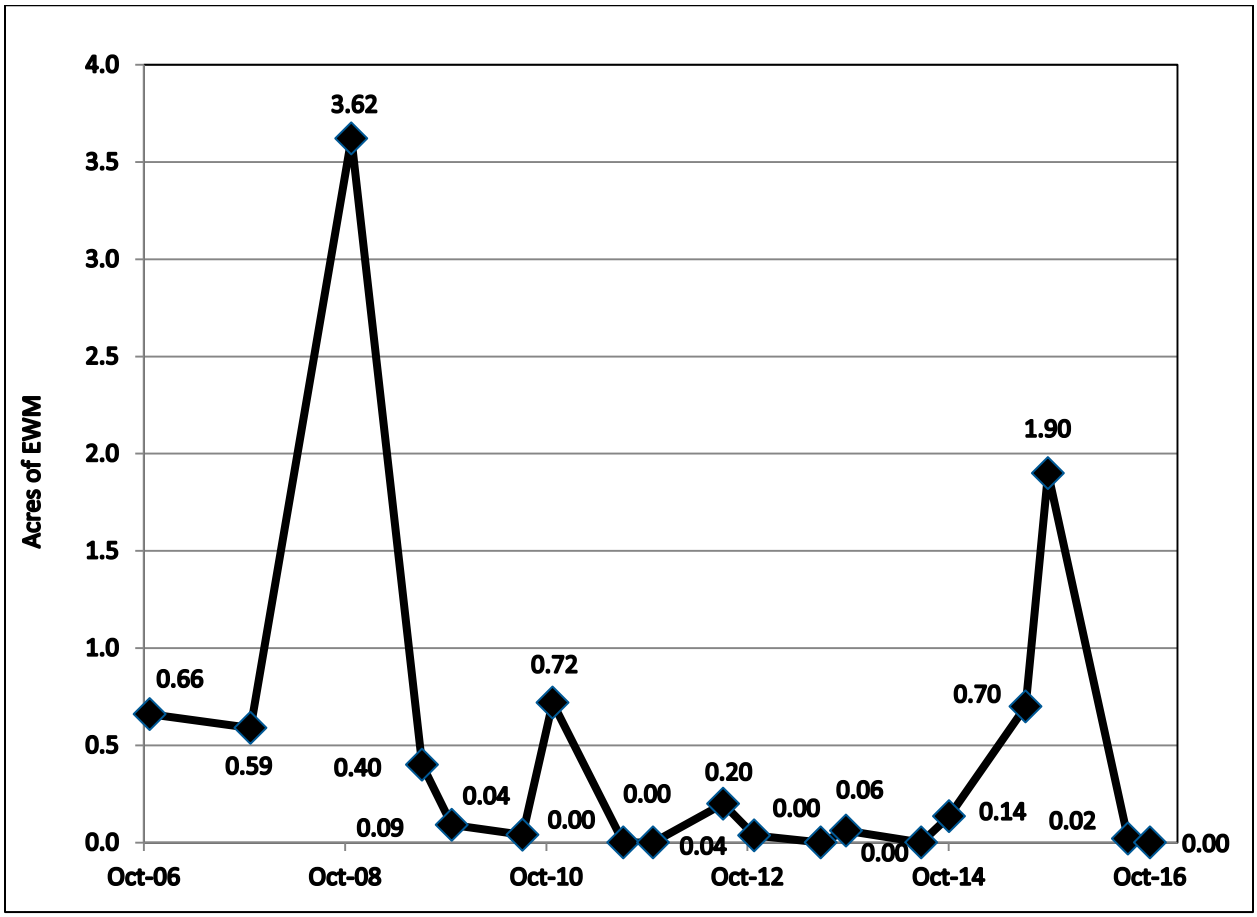

Figure 20: 2006-2016 Beaver Dam Lake EWM Acreage: Library Lake

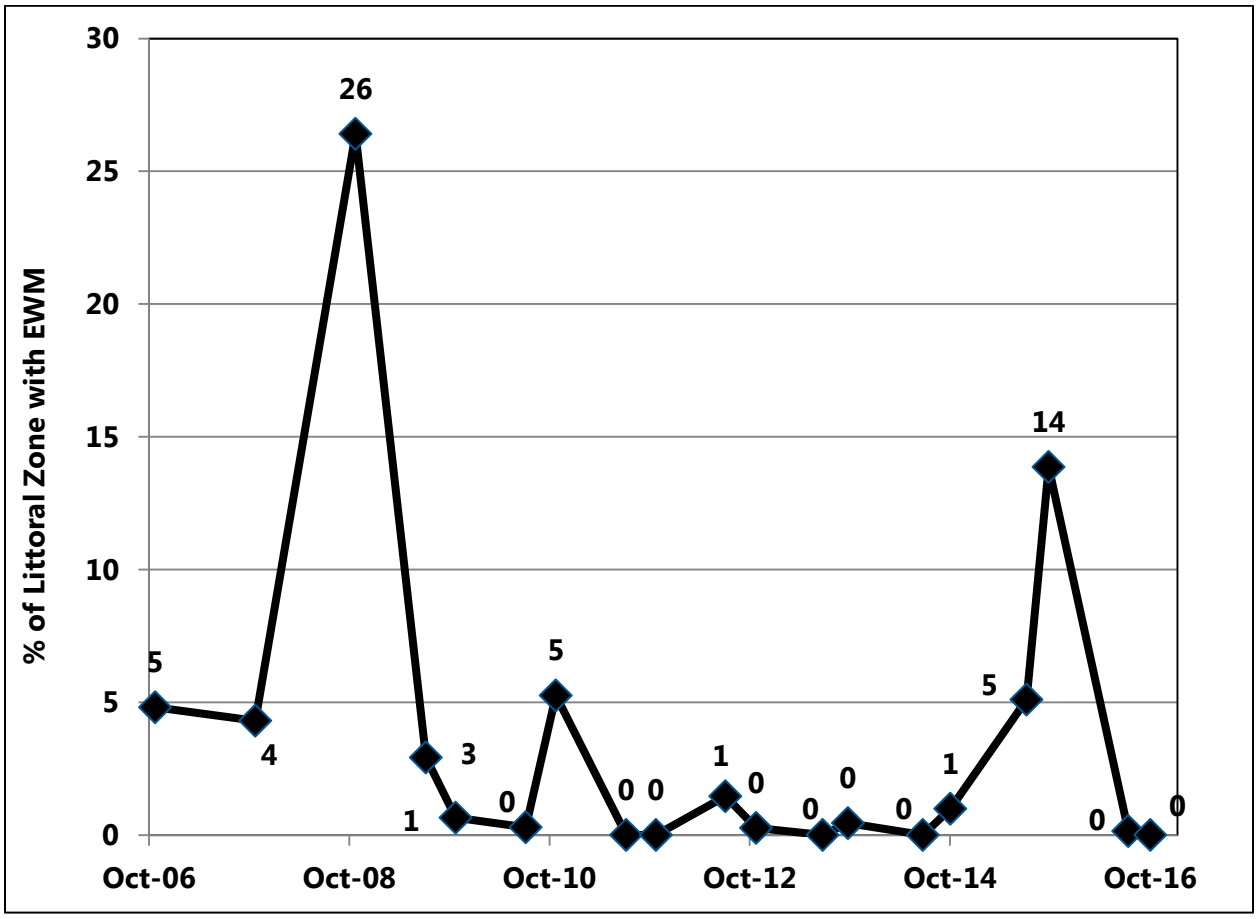

Figure 21: 2006-2016 Percent of Littoral Zone with EWM: Library Lake

4.5 Cemetery Bay

In 2016, Cemetery Bay EWM management consisted of a spring herbicide treatment and manual removal of EWM in August.

On May 2, Cemetery Bay received a whole lake herbicide treatment (Figure 2). The 2,4-D dose was 0.3 ppm. 2,4-D samples were collected from two locations (Figure 2) from 1 hour after treatment to 26 days after treatment. As shown in Figure 17, sustaining a 2,4-D concentration of at least 0.3 ppm for at least 4 days is lethal to EWM. The 2,4-D concentrations in Cemetery Bay were not lethal to EWM (Figure 22). 2,4-D concentrations from Site 3A were greater than 0.3 ppm at 1 hour, 1 day, and 3 days after treatment, but all other 2,4-D concentrations from Site 3A and all 2,4-D concentrations from Site 3B were less than 0.3 ppm (300 µg/L). The seven day average 2,4-D concentration in Cemetery Bay was 0.239 ppm ae^2 (239 µg/L ae^2). Because Cemetery Bay did not attain and sustain a 2,4-D concentration that was lethal to EWM, the EWM in Cemetery Bay was knocked back, but not killed by the herbicide treatment. Hence, EWM was expected to rebound during the growing season.

As expected, concentrations of 2,4-D at 26 days after treatment were very low, ranging from 0.91 to 20 µg/L ae^2 (Figure 22).

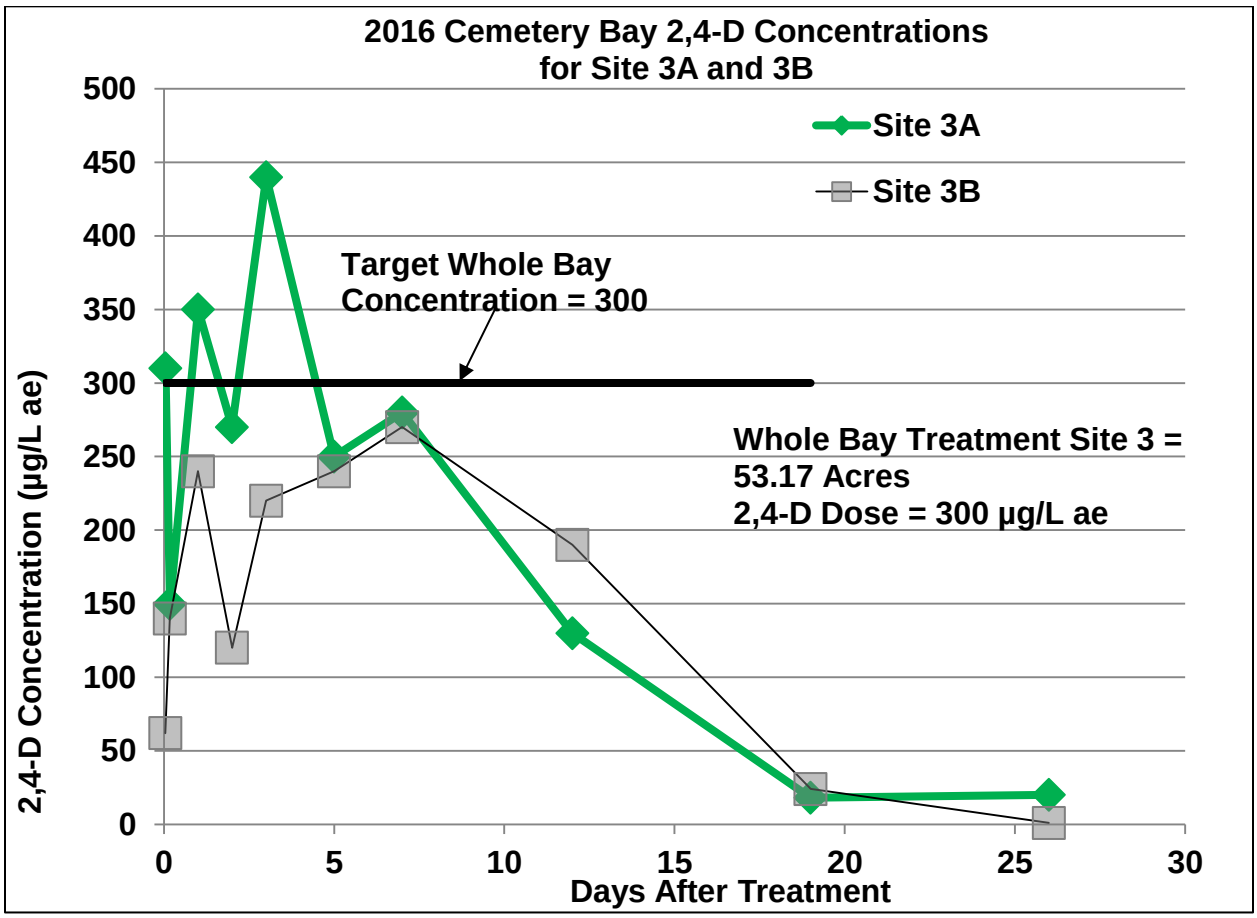

Figure 22: 2016 Cemetery Bay 2,4-D Concentrations

As expected, EWM rebounded and by July, EWM extent in Cemetery Bay was 1.7 acres. EWM continued to expand and by August, several beds of EWM were established. EWM was manually removed from 136 locations in Cemetery Bay during August 15 through 18 (Figure 23). The number of plants removed per location ranged from 1 to 22 and it is estimated that at least 760 EWM plants were removed. In a couple of significant patches of EWM, not all of the EWM plants were removed. It is believed that the manual removal of EWM thwarted its expansion in Cemetery Bay, even though expansion occurred between July and October despite the August removal.

Pictured above, EWM removed by rake from Cemetery Bay.

Rake removal of EWM works well in Cemetery Bay. In 2016, the bay had several EWM beds established when manual EWM removal by raking began. It was easy to remove the EWM by raking—roots and all—as the bay has super soft sediment making rake removal ideal. Although rake removal of EWM is ideal in Cemetery Bay, the super soft sediment would likely make DASH difficult due to stirring up sediment.

In the future, the biggest consideration for Cemetery Bay (as everywhere else) when EWM is managed by manual removal is that EWM assessment and manual removal should start as soon as possible following a chemical treatment. EWM spreads explosively in these shallow muck environments and a handful of plants becomes hundreds of plants in just a few months. In order to manage EWM by manual removal (DASH or rake removal), regular EWM checks—perhaps every month at a minimum—is going to be required. Regular manual removal of the EWM observed by the regular checks is essential for the success of manual removal of EWM.

In October of 2015, EWM frequency of occurrence in Cemetery Bay was 45 percent and EWM extent was 31.6 acres, which was 59 percent of the littoral zone. The spring herbicide treatment knocked back the EWM and in July EWM frequency was 6 percent and extent was 1.7 acres, which was 3 percent of the littoral area. EWM rebounded and manual removal was necessary in August. Despite the manual EWM removal in August, EWM expanded rapidly between July and October. In October 2016, EWM frequency was 27 percent and extent was 13.8 acres which was 26 percent of the littoral zone (Figures 24 through 26).

There is now so much EWM throughout the bay that a herbicide "reset" will be necessary before shifting to manual removal for EWM management in Cemetery Bay.

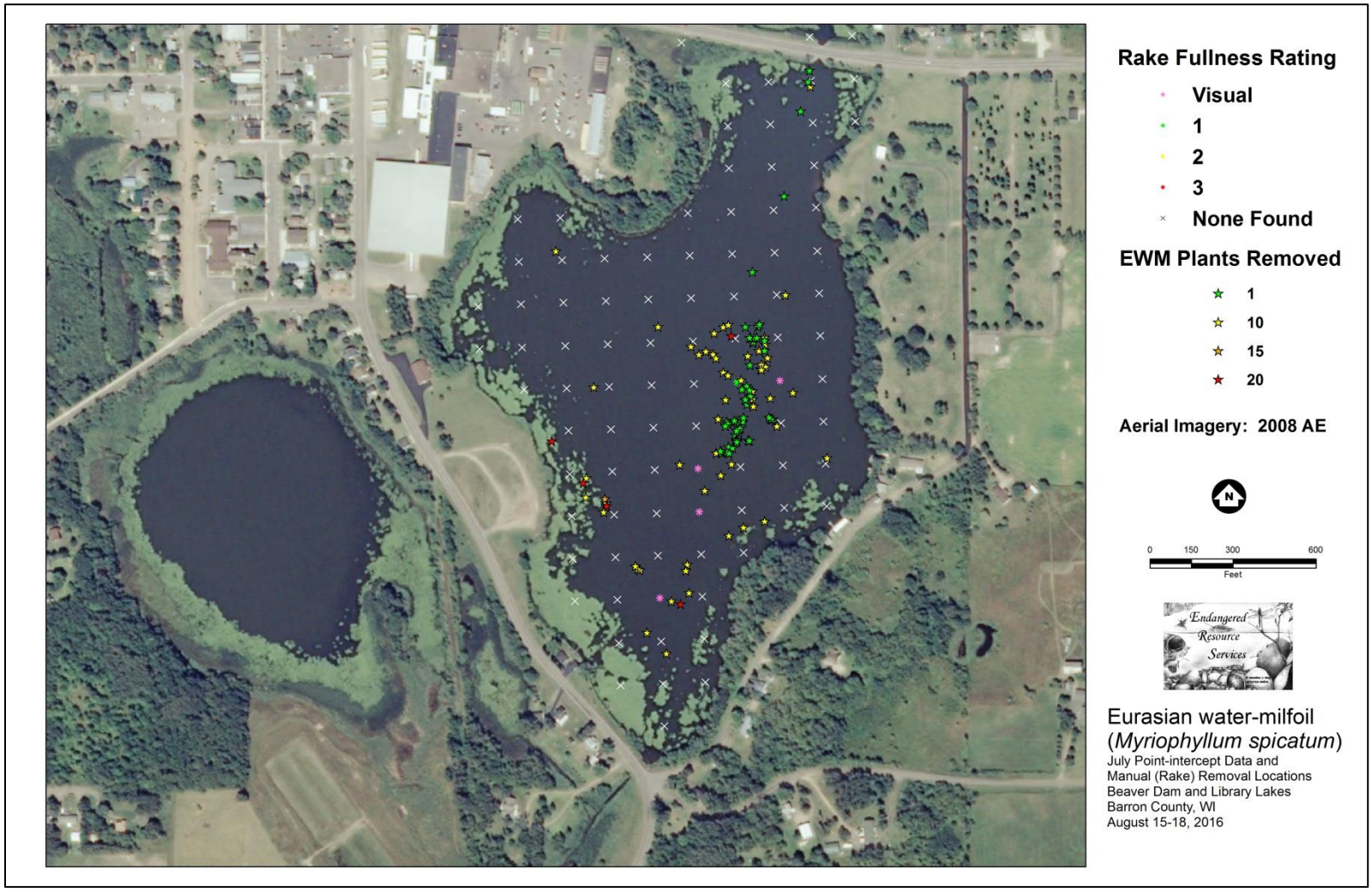

Figure 23: August 2016 Manual Removal of EWM in Cemetery Bay

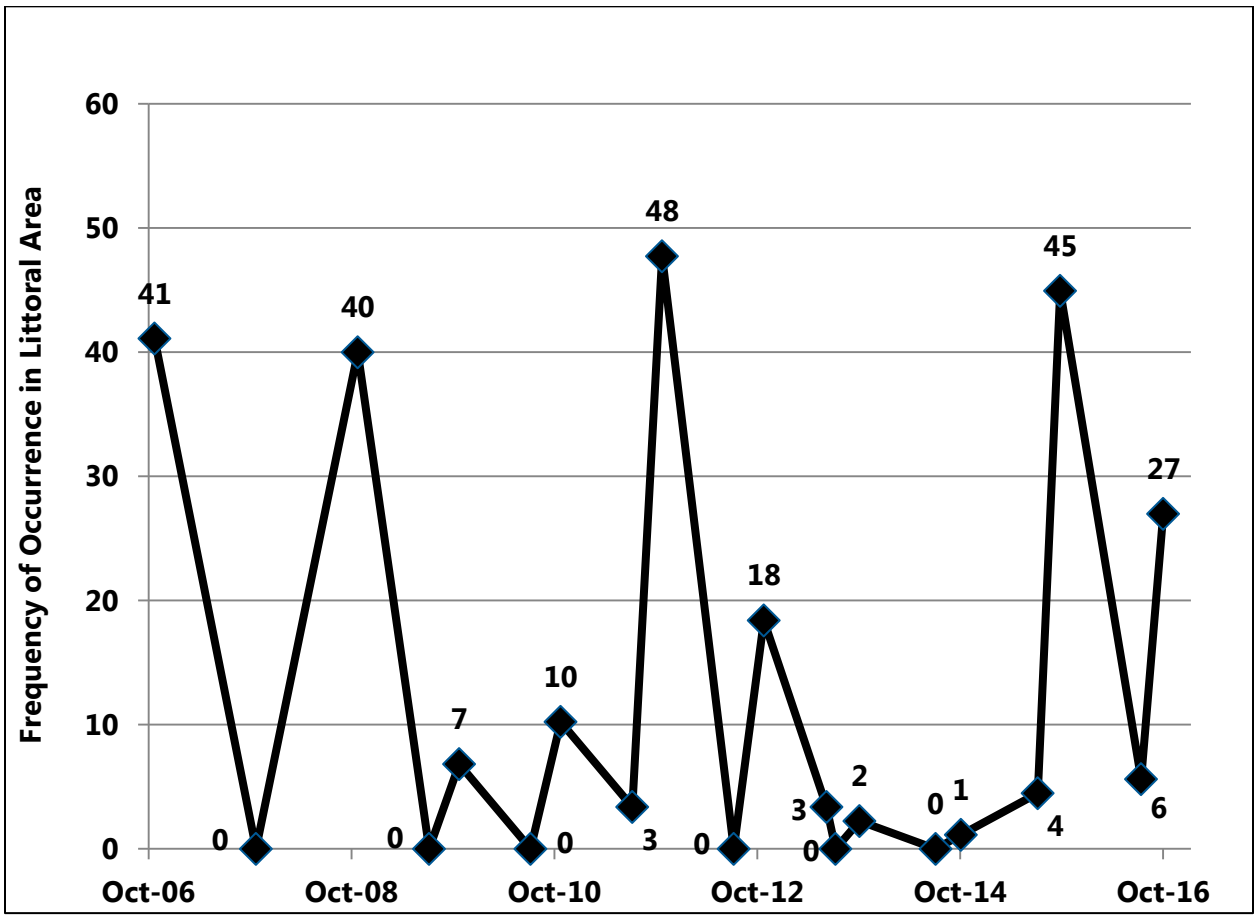

Figure 24: 2006-2016 Beaver Dam Lake Frequency of Occurrence in Littoral Zone: Cemetery Bay

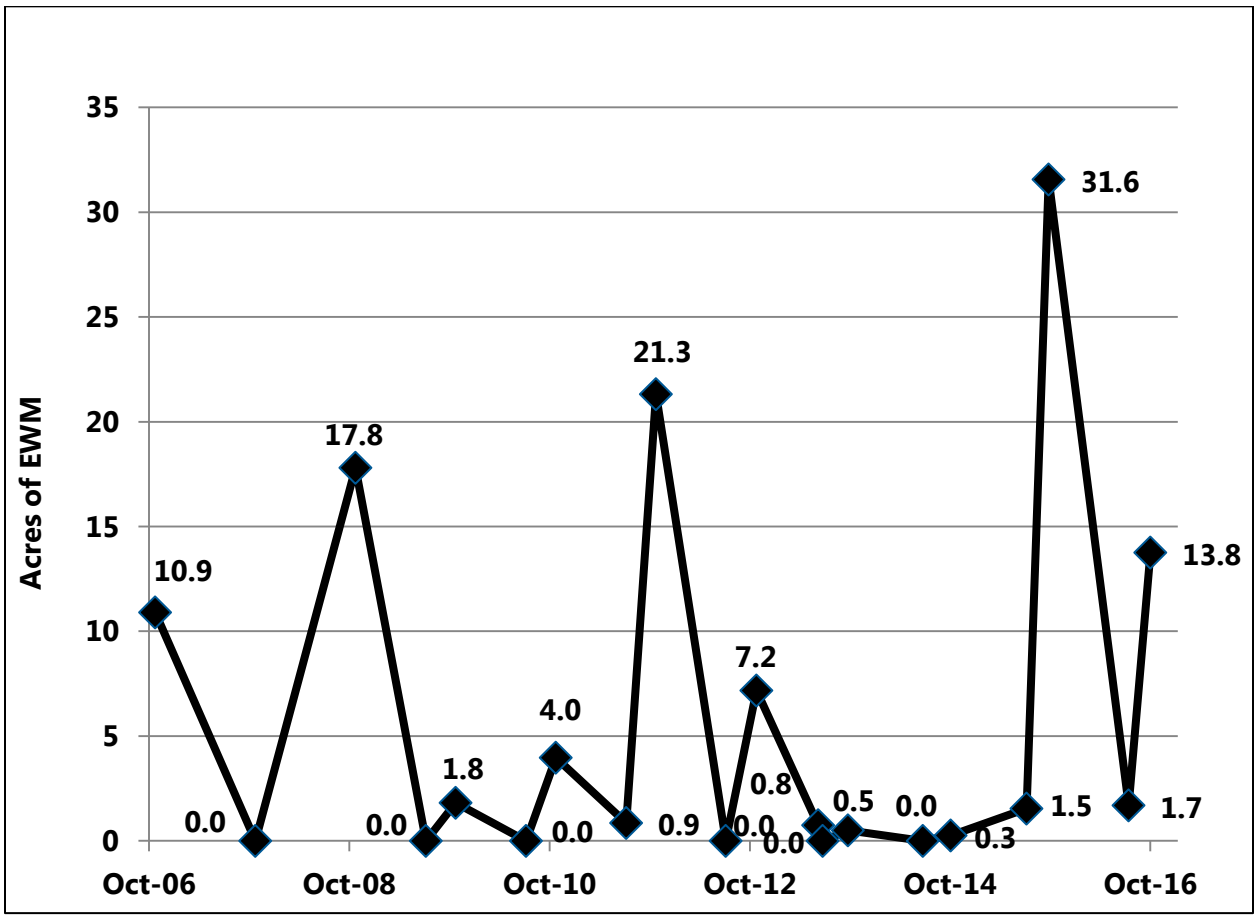

Figure 25: 2006-2016 Beaver Dam Lake EWM Acreage: Cemetery Bay

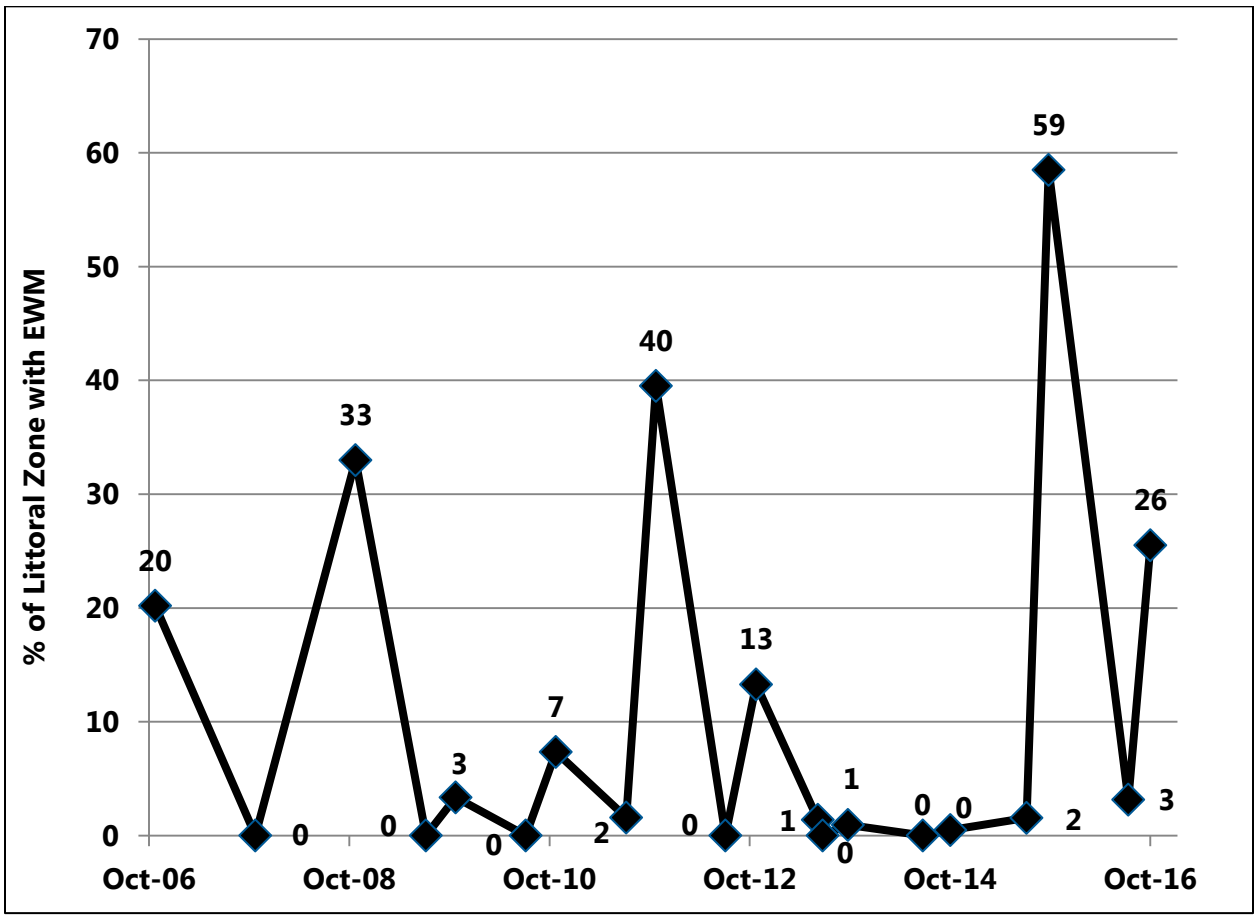

Figure 26: 2006-2016 Percent of Littoral Zone with EWM: Cemetery Bay

4.6 City Bay

In 2016, EWM management consisted of a spring herbicide treatment and manual removal of EWM in August.

City Bay treatment was a whole bay treatment with a target 2,4-D concentration of 0.8 ppm (800 µg/L ae^2) (Figure 2 and Table 4). Herbicide application occurred on May 2. Water samples were collected from three sites within the treatment area (Figure 2) during 1 hour after treatment to 26 days after treatment. During 0.04 to 1 day after treatment, concentrations of 2,4-D ranged from 0.03 to 1.4 ppm ae^2 (30 to 1,400 µg/L ae^2). During 2 to 7 days after treatment, concentrations of 2,4-D ranged from 0.02 to 0.7 ppm ae^2 (20 to 700 µg/L ae^2) (Figure 27). Lowest herbicide concentrations were observed in the northern one third of City Bay and highest concentrations were observed in the southern two thirds of City Bay. 2,4-D concentrations from Sites 2B and 2C, located in the southern two thirds of the bay, were lethal to EWM, while concentrations from Site 2A, located in the northern one third of the bay, were not lethal to EWM (locations shown in Figure 2, concentrations shown in Figure 17). The mean bay wide 2,4-D concentration in samples collected from all three sites during 0.04 to 7 days after treatment was 0.449 ppm ae^2 (449 µg/L ae^2) compared with a target bay wide concentration of 0.8 ppm ae^2 (800 µg/L ae^2).

As expected, at 26 days after treatment, concentrations of 2,4-D were very low, ranging from 3.8 µg/L ae^2 to not detected.

The herbicide treatment of City Bay effectively controlled EWM—EWM was not observed during the July plant survey. However, individual EWM plants were found at each of 11 locations in August primarily near the 63 bridge tunnel and were manually removed (Figure 28). In addition, about 15 floating fragments were observed entangled in lily pads near the 63 Bridge tunnel in August, suggesting that currents are carrying fragments in from West Lake.

The spring herbicide treatment and August manual removal effectively reduced EWM in City Bay. However, EWM was present in City Bay in October—EWM frequency was 1.7 percent and extent was 1.5 acres which was 1.5 percent of the littoral zone (Figures 29 through 31). Hence, EWM management will be required in 2017. Due to the small EWM infestation, management by manual removal appears feasible. Most of City Bay has a soft muck bottom making rake removal possible and potentially effective. However, the organic muck might make DASH difficult as these areas tend to go to zero visibility quickly once they get stirred up.

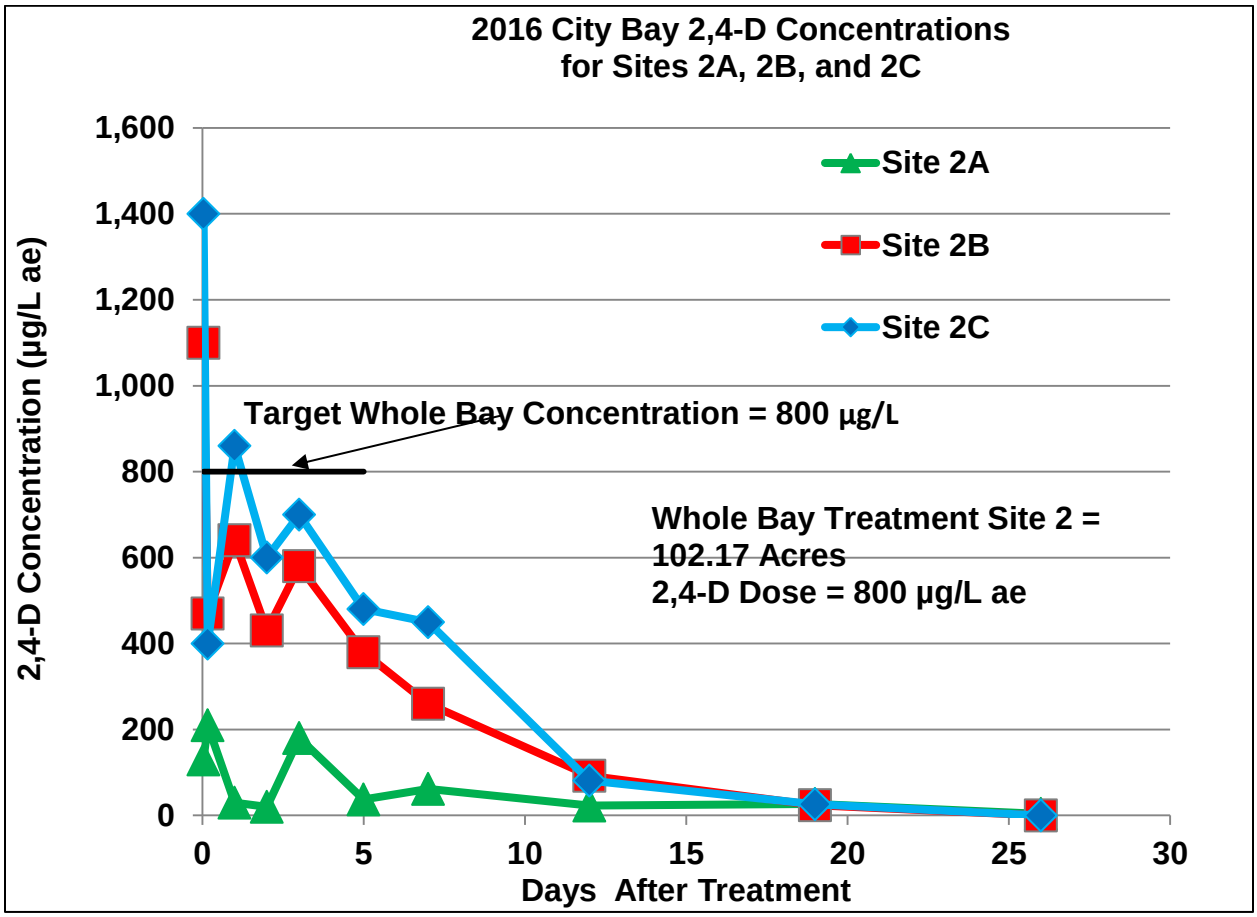

Figure 27: 2016 City Bay 2,4-D Concentrations

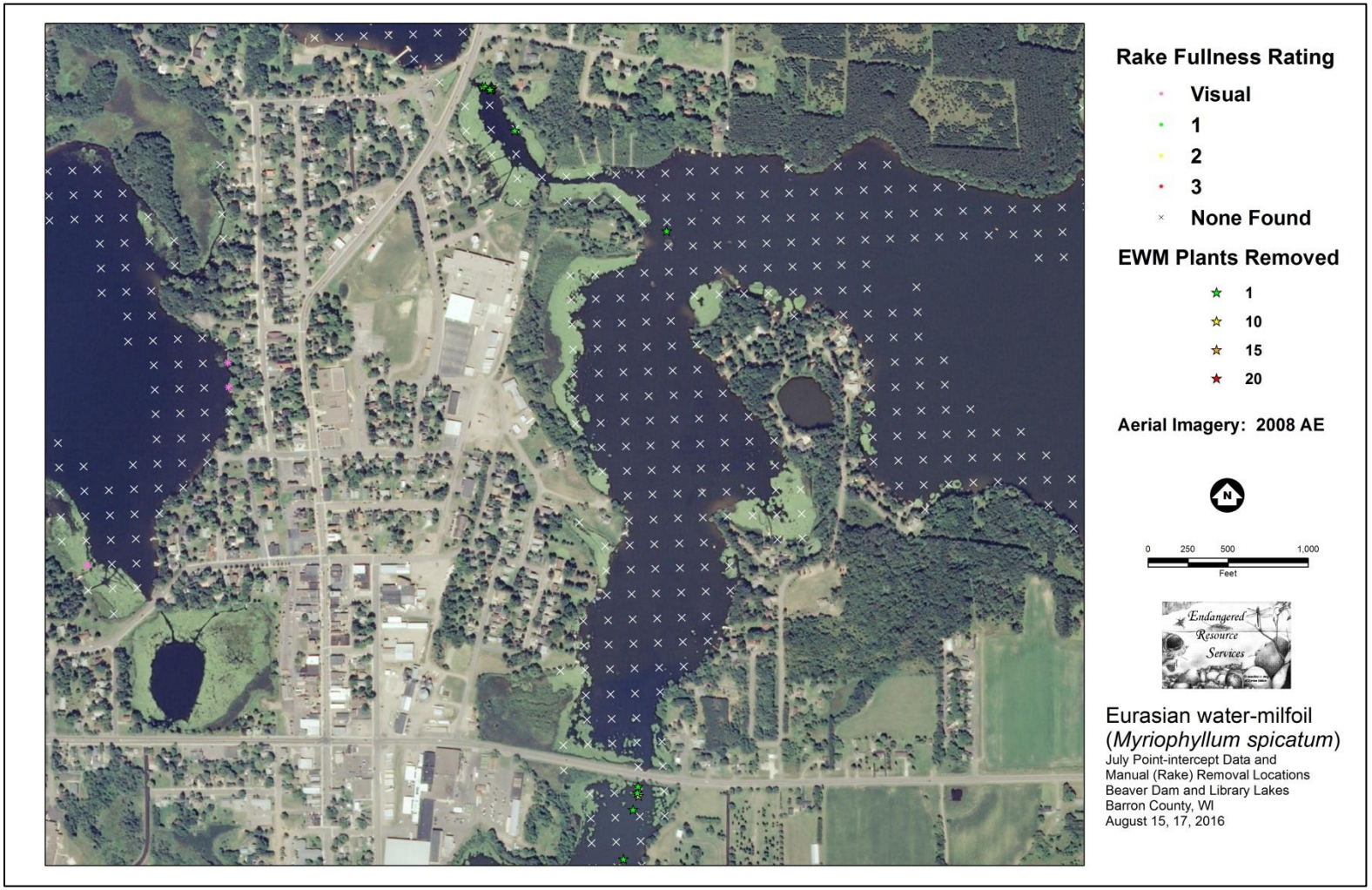

Figure 28: August 2016 EWM Manual Removal in City Bay

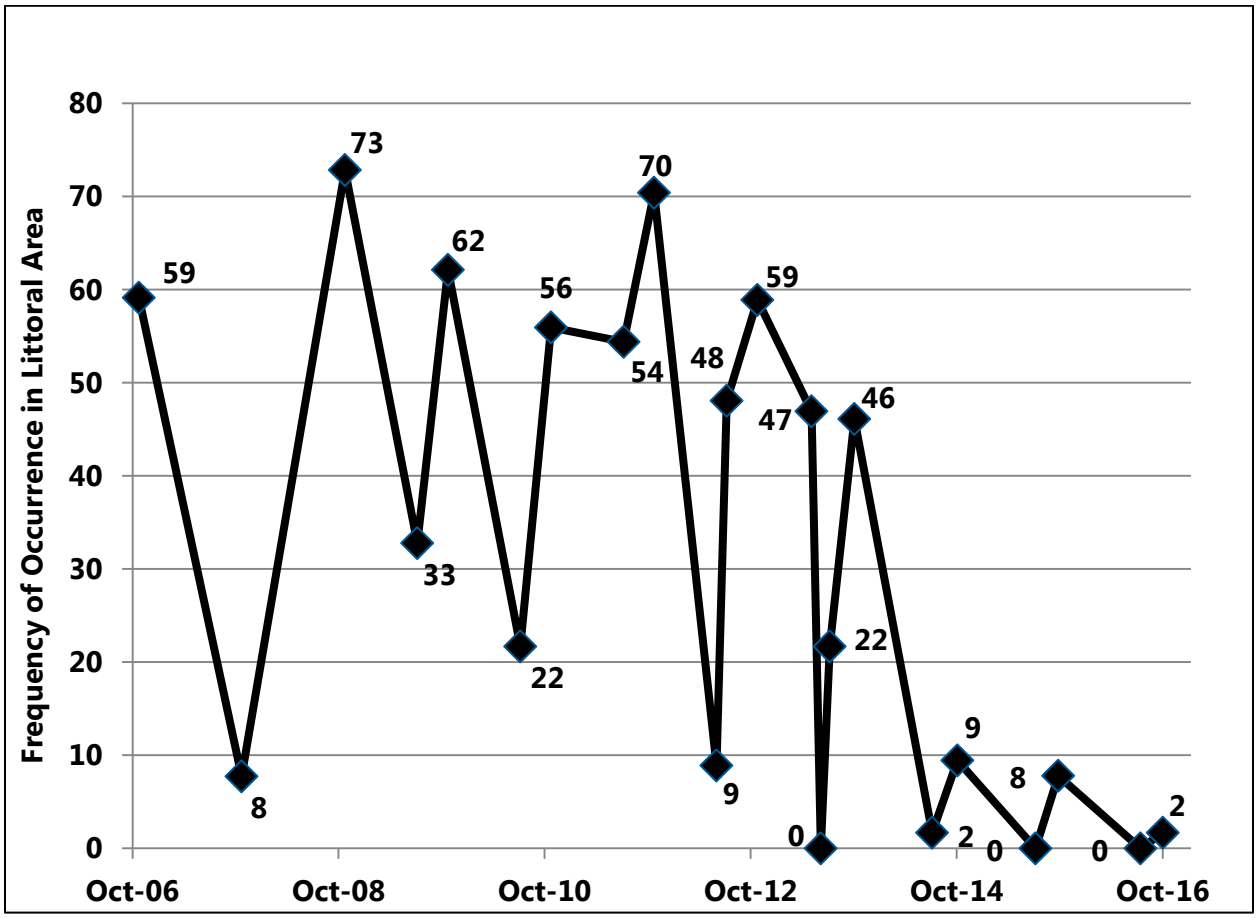

Figure 29: 2006-2016 Beaver Dam Lake Frequency of Occurrence in Littoral Zone: City Bay

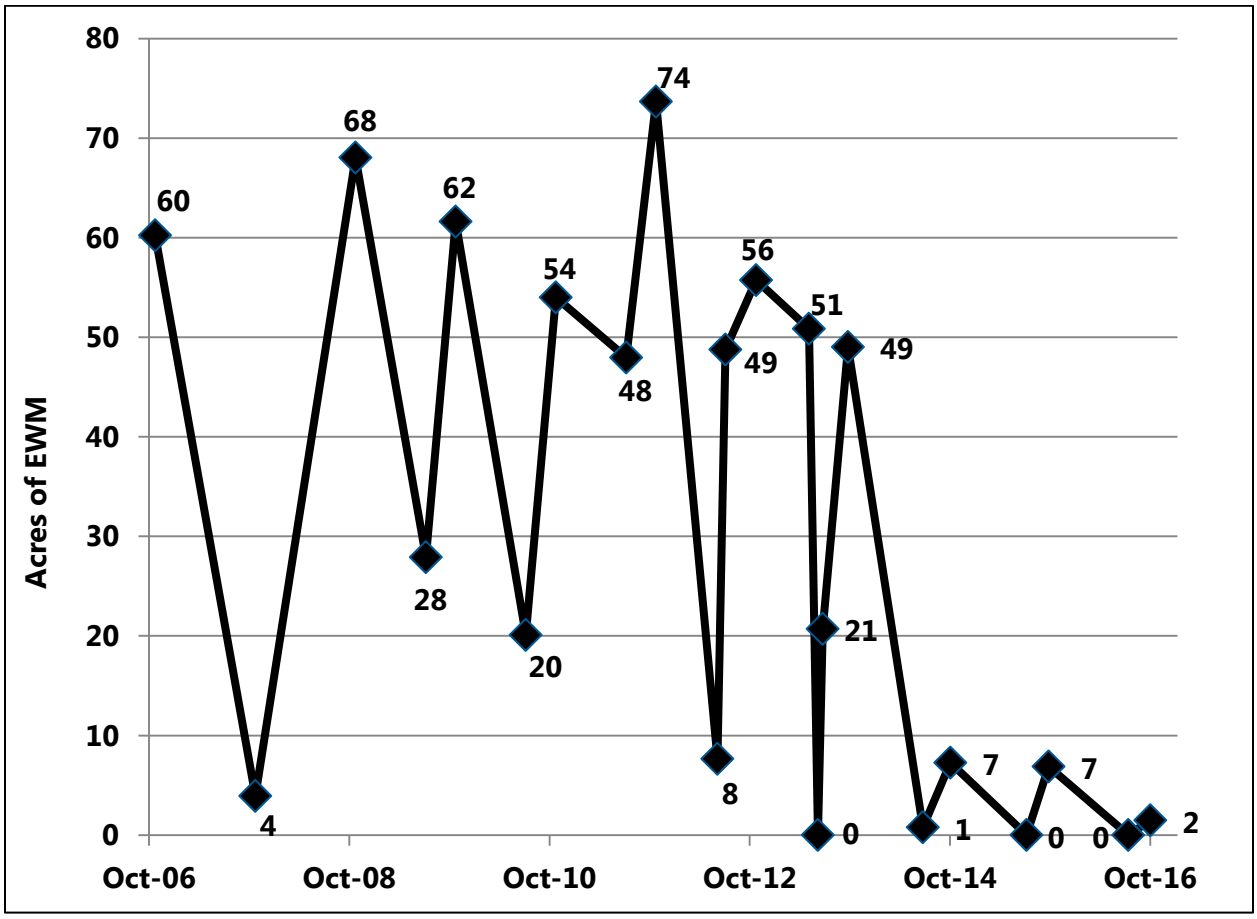

Figure 30: 2006-2016 Beaver Dam Lake EWM Acreage: City Bay

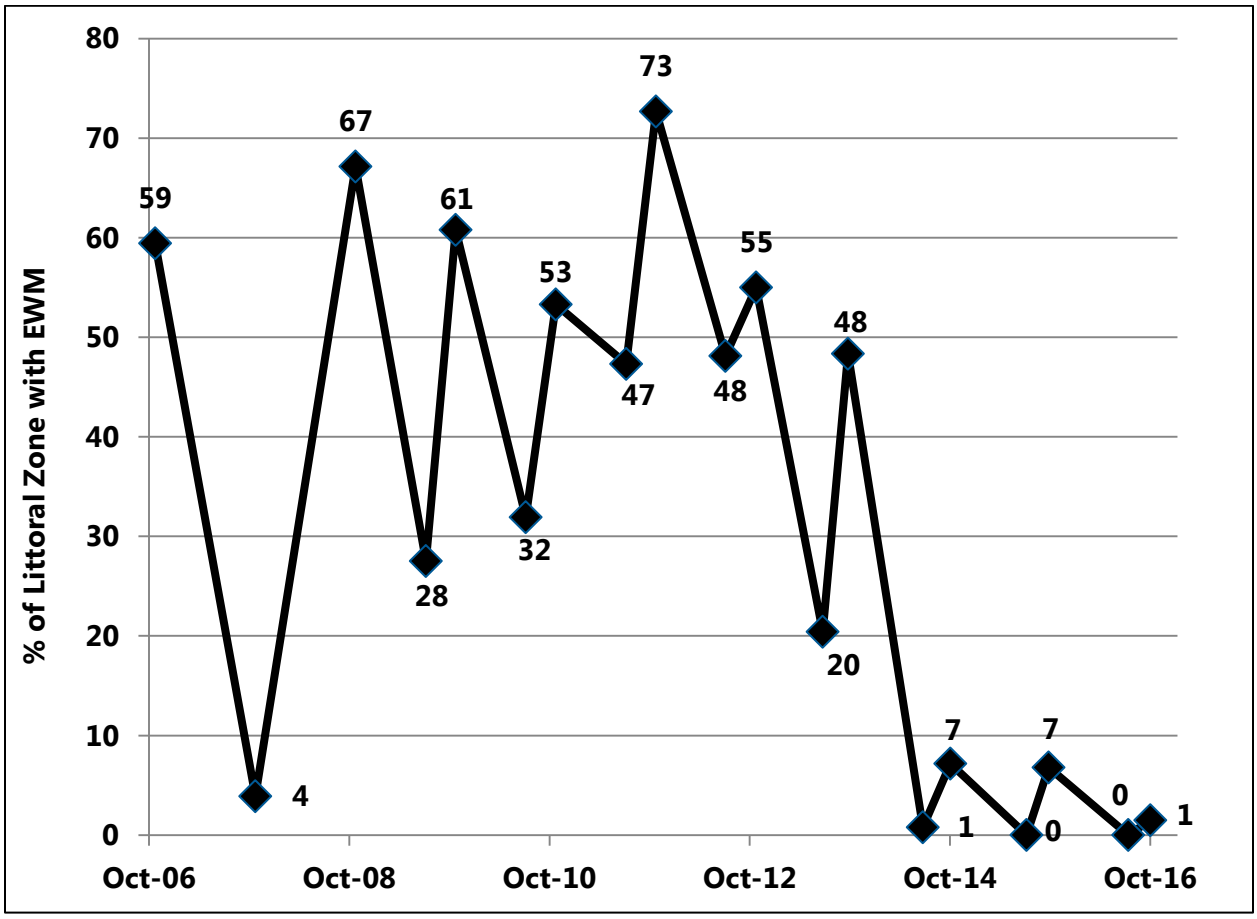

Figure 31: 2006-2016 Percent of Littoral Zone with EWM: City Bay

4.7 East Lake

Because EWM was not observed in East Lake during October of 2015 or July of 2016, EWM management did not occur in 2016. Although EWM was also not observed in August of 2016, by October single stems of EWM were starting to appear in the southeast corner of the bay. In October of 2016, EWM frequency in East Lake was 1.4 percent and EWM extent was 2 acres, which was 8 percent of the littoral area (Figures 32 through 34). Hence, EWM management will be needed in 2017. The good water clarity of East Lake would lend itself to DASH removal.

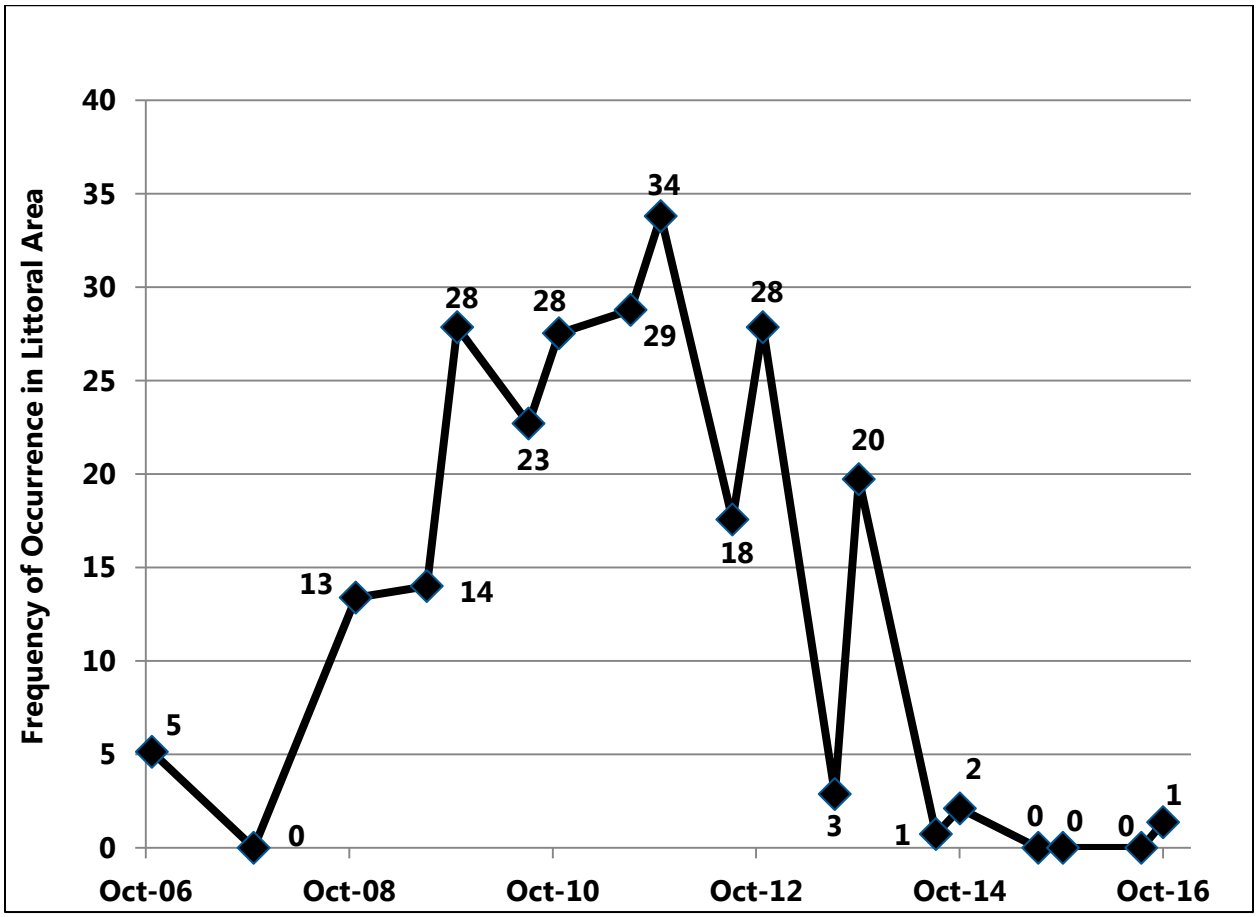

Figure 32: 2006-2016 Beaver Dam Lake Frequency of Occurrence in Littoral Zone: East Lake

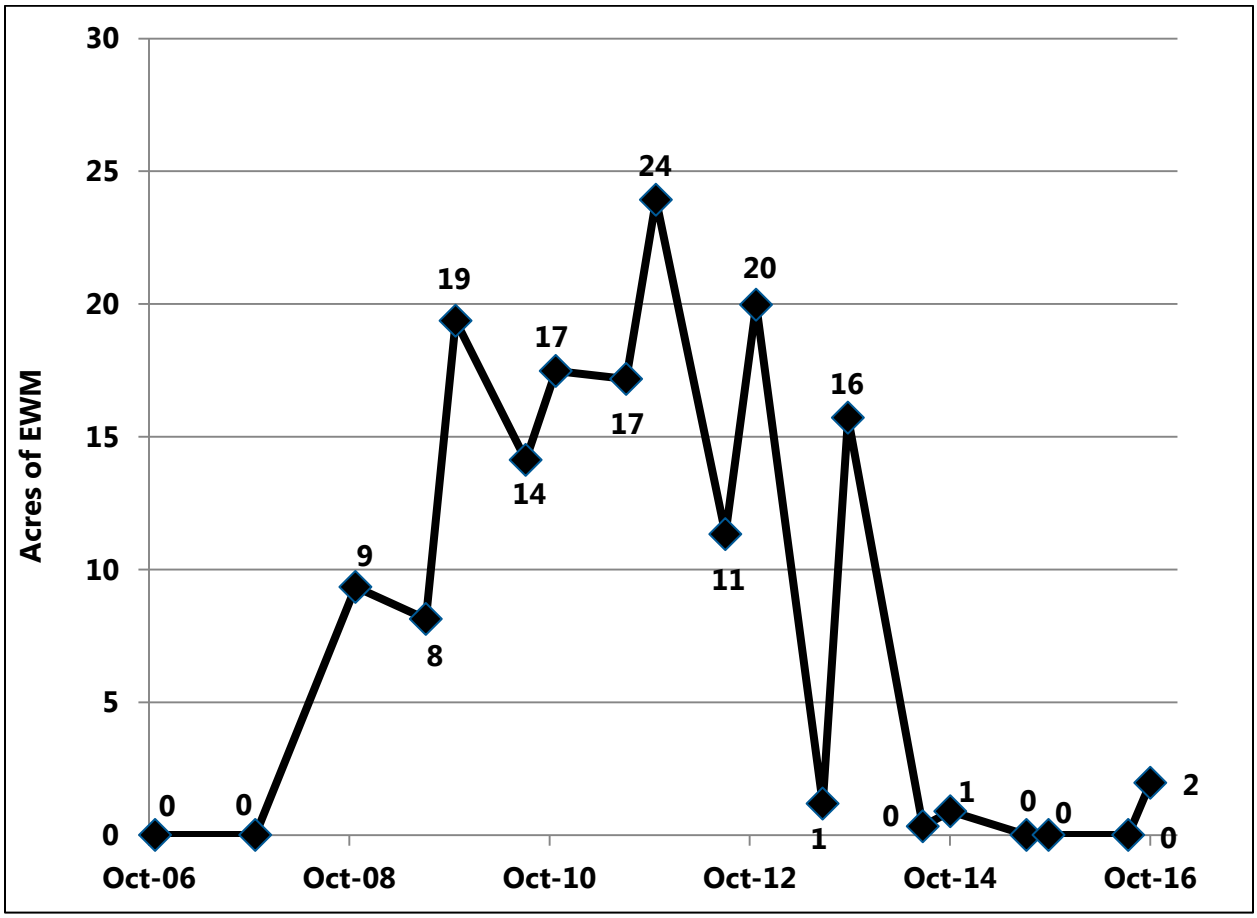

Figure 33: 2006-2016 Beaver Dam Lake EWM Acreage: East Lake

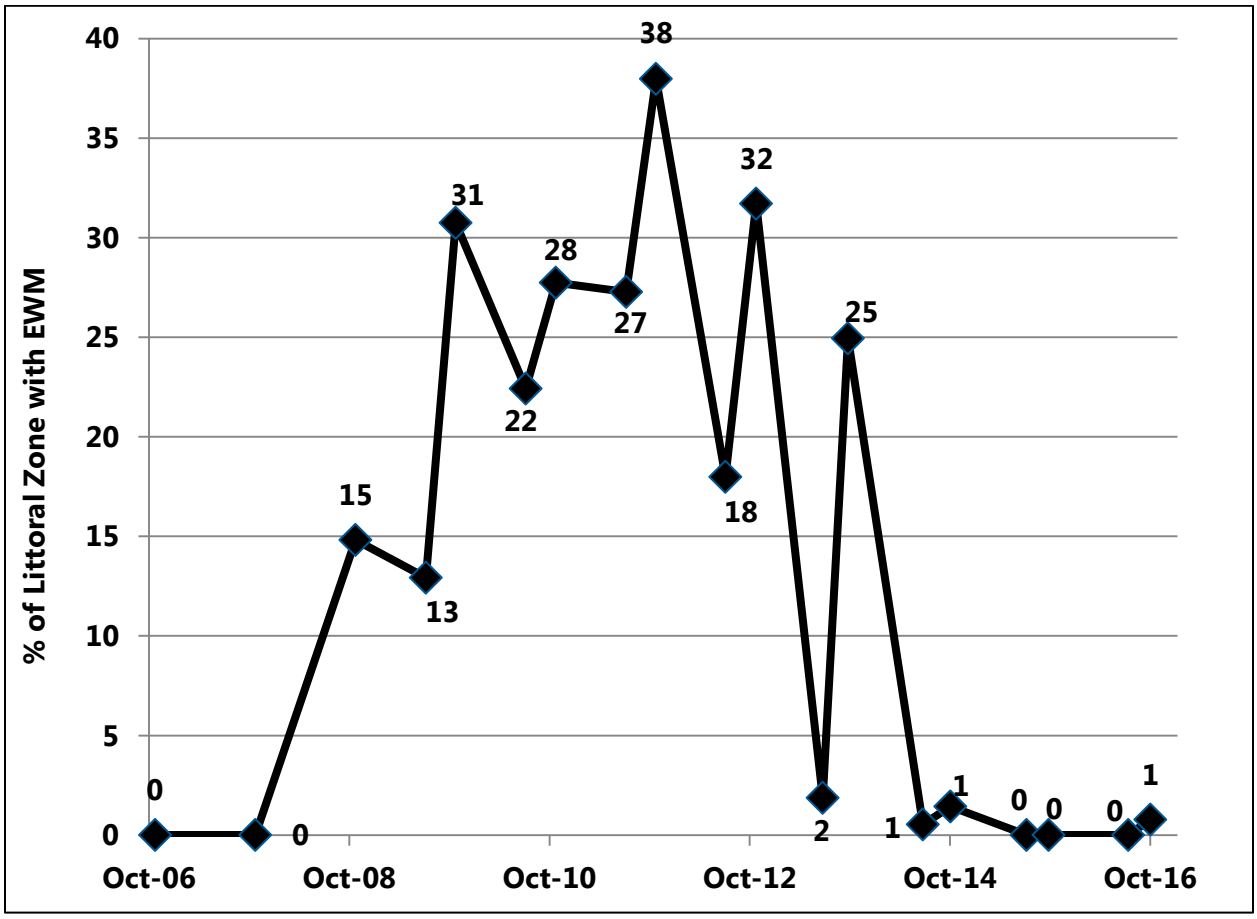

Figure 34: 2006-2016 Percent of Littoral Zone with EWM: East Lake

4.8 Norwegian Bay

In 2016, EWM management consisted of manual removal from 42 locations in Norwegian Bay during August 15 through 19 (Figure 35). The number of plants removed per location ranged from 1 to 200 and it is estimated that at least 1,256 EWM plants were removed from Norwegian Bay. However, not all EWM plants were removed in one of the significant EWM patches.

Norwegian Bay is ideal for rake removal as the sediments are soft. This is not the case in the "neck" leading to the bay where both the west shoreline and (especially) the east shoreline adjacent to the cow pasture are hard bottomed. The manual EWM removal made a significant impact in the bay and around the boat landing. However, it is harder to determine the impact of manual EWM removal in the "neck" leading to the bay. Although hundreds of EWM plants were removed here, the plants were very dense and the bottom was very compacted, resulting in fragments breaking off during removal. In the future, this could be a potential DASH area. The soft bottomed areas in Norwegian Bay proper are unlikely to work well with DASH as the thick organic sediments will be easily stirred up creating zero visibility conditions. However, rake removal will work well in the soft bottomed areas.

Pictured above, EWM rake removed from Norwegian Bay.

Despite efforts to manage EWM by manual removal in 2016, EWM expanded rapidly throughout the growing season. EWM frequency increased from 1 percent in October of 2015 to 8 percent in July of 2016 to 22 percent in October of 2016. EWM extent increased from 0.8 acres in October of 2015 to 2.5 acres in July of 2016 to 6.9 acres in October of 2016. The extent of littoral area infested by EWM increased from 2 percent in October of 2015 to 6 percent in July of 2016 to 18 percent in October of 2016 (Figures 36 through 38).

There is now so much EWM throughout the bay that a herbicide "reset" will be necessary before shifting to manual removal for EWM management in Norwegian Bay. Future management of EWM in Norwegian Bay by manual removal (DASH or rake removal) will require regular EWM checks—perhaps every month at a minimum. Regular manual removal of the EWM observed by the regular checks is essential for success because EWM spreads explosively in these shallow muck environments and a handful of plants becomes hundreds of plants in just a few months. Hence, EWM assessment should start soon after the herbicide treatment and regular EWM checks and removal should occur throughout the growing season.

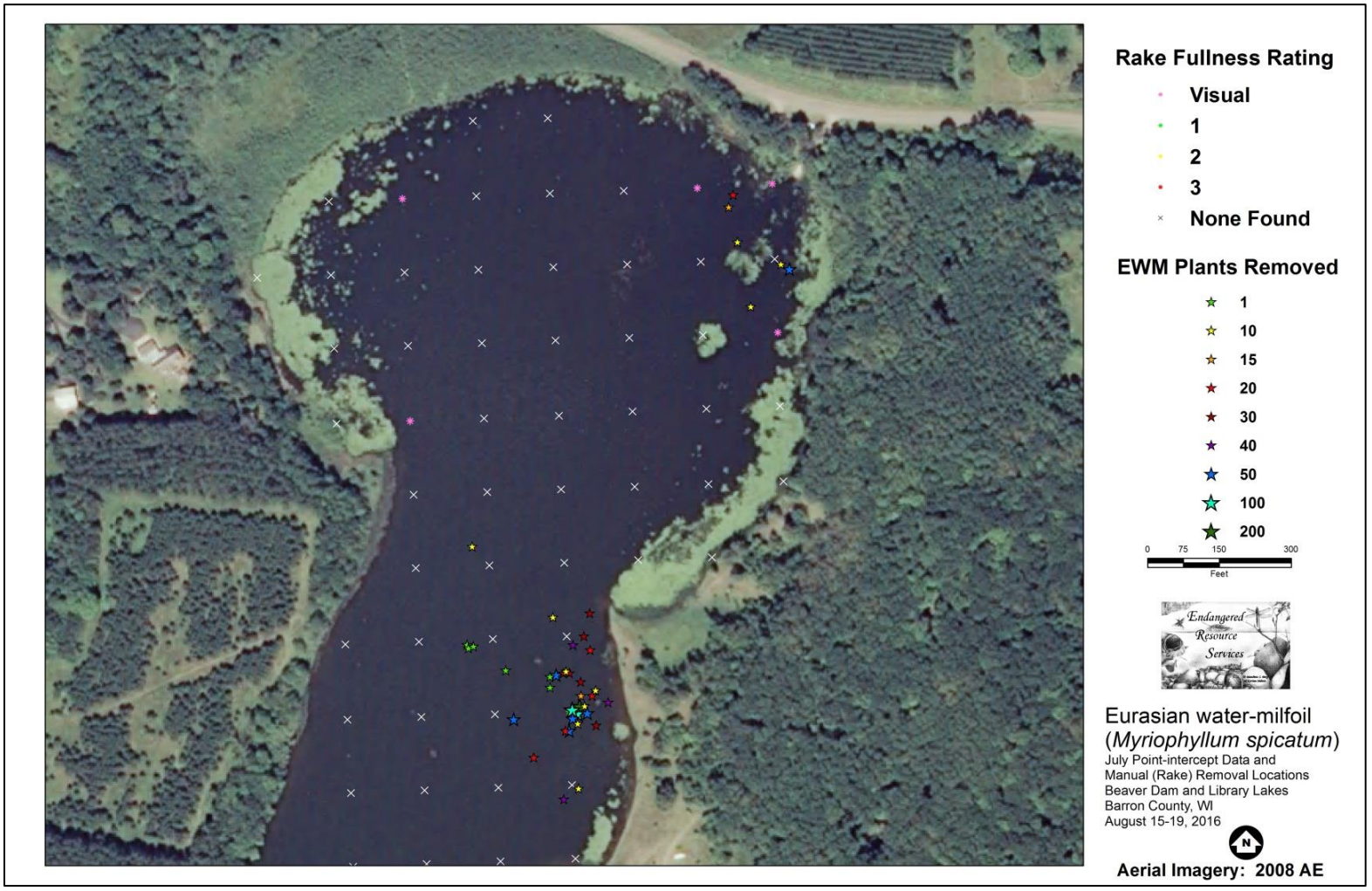

Figure 35: August 2016 Manual (Rake) Removal Locations in Norwegian Bay

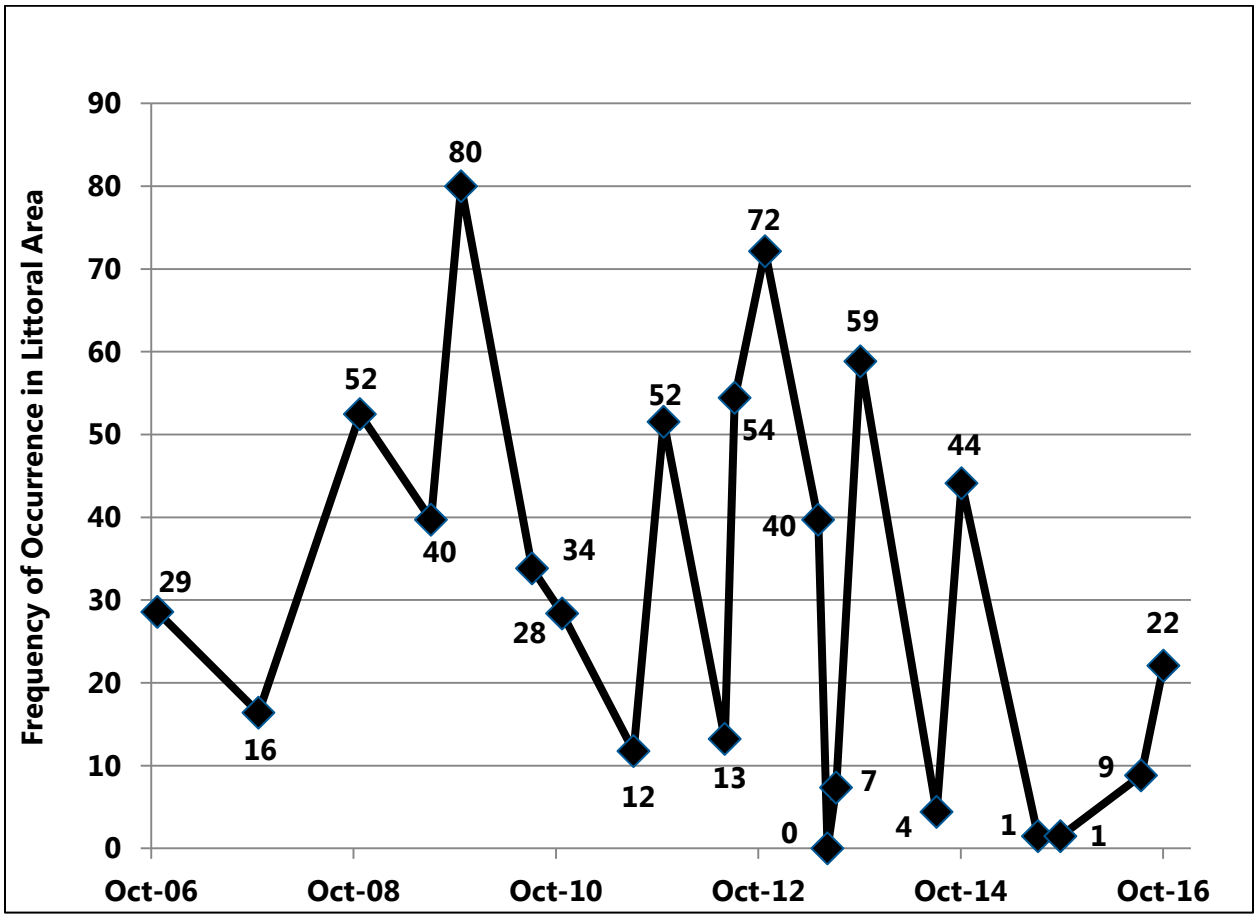

Figure 36: 2006-2016 Beaver Dam Lake Frequency of Occurrence in Littoral Zone: Norwegian Bay

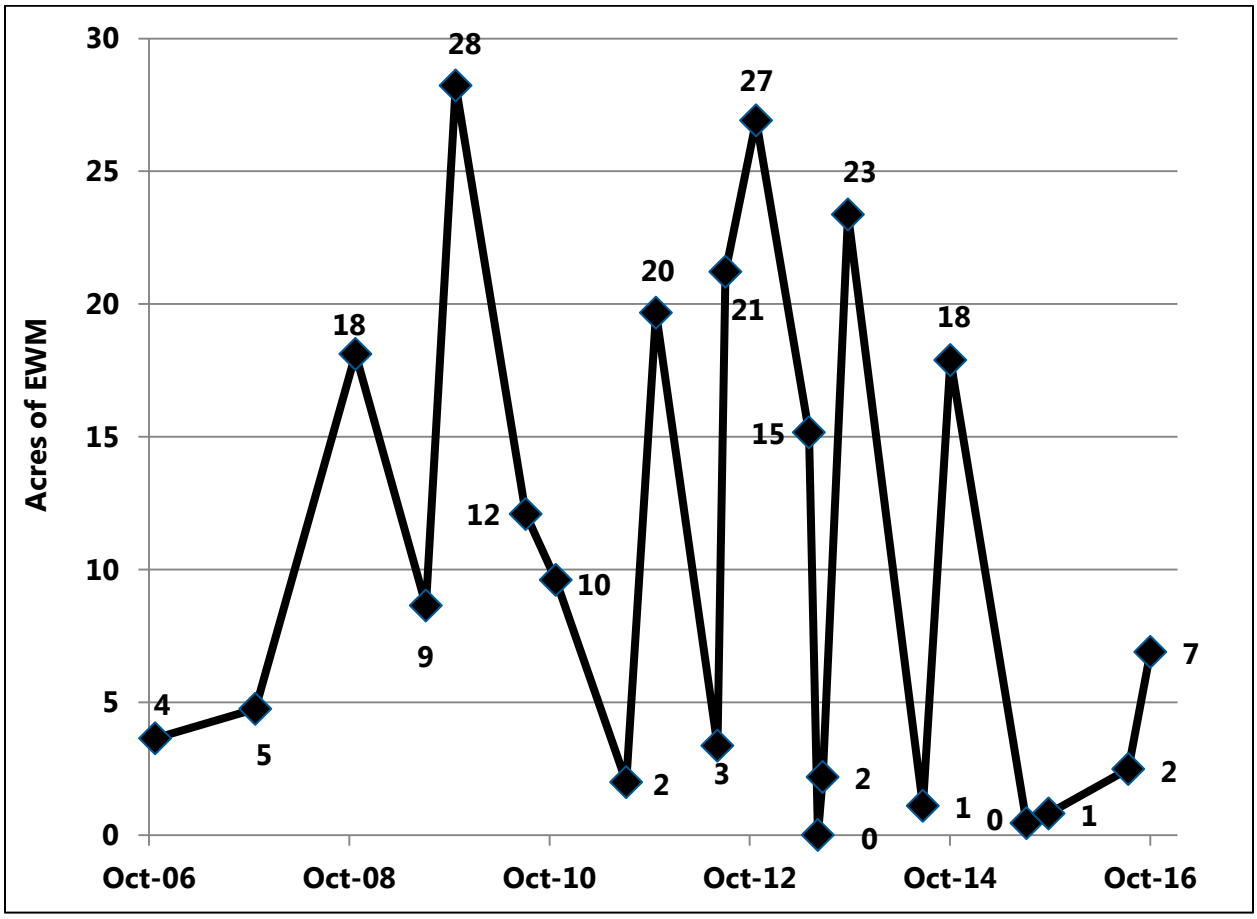

Figure 37: 2006-2016 Beaver Dam Lake EWM Acreage: Norwegian Bay

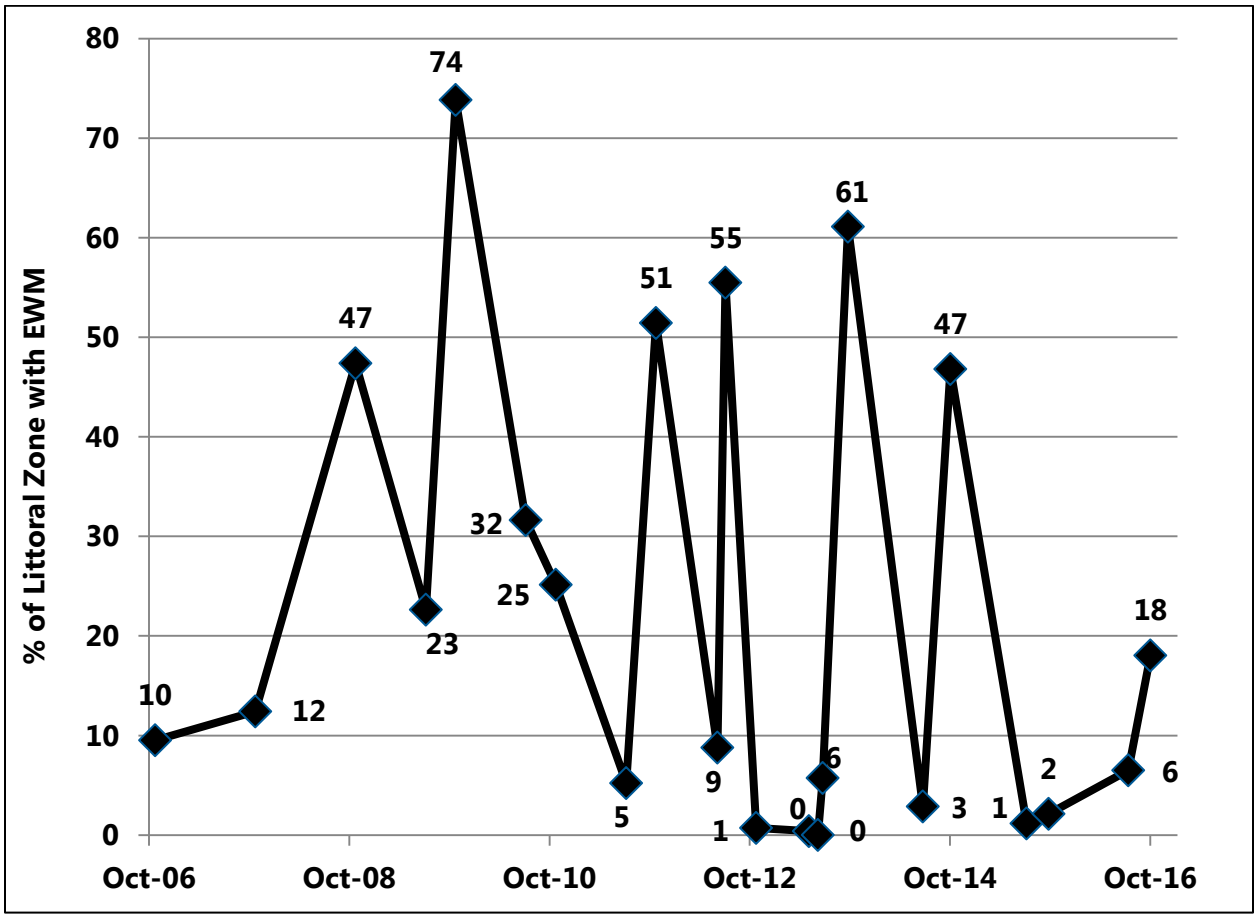

Figure 38: 2006-2016 Percent of Littoral Zone with EWM: Norwegian Bay

5.0 Summary

In 2016, herbicide treatment area was much reduced from previous years and manual removal area was much increased. Three areas of Beaver Dam Lake were treated with herbicide in 2016—Library Lake (10.99 acres on April 22), City Bay (102.17 acres on May 2) and Cemetery Bay (53.17 acres on May 2). EWM was manually removed from five areas during August 15 through 19—Norwegian Bay, City Bay, Cemetery Bay, Rabbit Island Bay, and the channel between Rabbit Island Bay and Library Lake.

The lake-wide EWM extent declined by two thirds between October of 2015 and July of 2016—from 9 percent of the littoral zone to 3 percent of the littoral zone. The decline is attributed to the spring herbicide treatment. Despite manual EWM removal in August, rapid expansion of EWM quadrupled lake-wide EWM extent between July and October of 2016—from 3 percent of the littoral zone in July to 12 percent of the littoral zone in October.

The Library Lake herbicide treatment attained and sustained a 2,4-D concentration that was lethal to EWM. The treatment was effective and EWM during July consisted solely of 2 plants at the lake's entrance that were manually removed. In August, EWM was not observed within Library Lake, but single EWM plants were observed and removed from 10 locations in the channel between Library Lake and Rabbit Island Bay. EWM was not observed in Library Lake during the 2016 fall survey.

The City Bay herbicide treatment attained and sustained 2,4-D concentrations lethal to EWM in the southern two thirds of the bay, while concentrations in the northern third of the bay were not lethal to EWM. Nonetheless, the treatment was effective and EWM was not observed during the July plant survey. In August, individual EWM plants were found and removed from 11 locations in the northern end of the bay, primarily near the 63 bridge tunnel. In addition, about 15 floating fragments were observed entangled in lily pads near the 63 bridge tunnel in August, suggesting that currents are carrying fragments in from West Lake. Despite the effective May herbicide treatment and August manual removal, EWM was present in 1.5 percent of the littoral zone in October of 2016. Due to the small EWM infestation, management by manual removal in 2017 appears feasible. Because most of City Bay has a soft muck bottom, rake removal is possible. The organic muck might make DASH difficult as these areas tend to go to zero visibility quickly once they get stirred up.

The Cemetery Bay herbicide treatment did not attain and sustain a 2,4-D concentration lethal to EWM. The EWM was knocked back, but not killed by the herbicide treatment. In July, EWM extent was 1.7 acres. EWM continued to expand and by August, several beds of EWM were established. EWM was manually removed from 136 locations in Cemetery Bay in August. Although not all of the EWM plants were removed in August, it is believed that the August removal thwarted EWM expansion in Cemetery Bay.

Nonetheless, EWM continued to expand and by October was present in 26 percent of the littoral zone. There is now so much EWM in Cemetery Bay that a herbicide "reset" will be necessary before shifting to manual removal (rake removal or DASH).

In 2016, Norwegian Bay EWM management consisted of manual removal from 42 locations. Despite manual removal, EWM expanded rapidly between July and October of 2016—from 6 percent of the littoral zone in July to 18 percent of the littoral zone in October. There is now so much EWM in Norwegian Bay that a herbicide "reset" will be necessary before shifting to manual removal (rake removal or DASH). Once EWM has been reduced to a small enough area to proceed with manual removal, Norwegian Bay is ideal for rake removal as the sediments are soft. These soft bottomed areas are unlikely to work well with DASH as the thick organic sediments will be easily stirred up creating zero visibility conditions. However, the "'neck" leading to the bay is ideal for DASH as the bottom is hard.

Because EWM was not observed in East Lake during October of 2015 or July of 2016, EWM management did not occur in 2016. In October of 2016, single stems of EWM were starting to appear in the southeast corner of the bay and EWM was present in 8 percent of the littoral zone. Due to the small EWM infestation, management by manual removal in 2017 appears feasible. The good water clarity of East Lake would lend itself to DASH removal.

In 2016, EWM management in Rabbit Island Bay consisted of manual removal of EWM from 41 locations in August. It was difficult to remove EWM by rake due to the bay's hard bottom. When the EWM beds on the West shore were discovered, manual removal was discontinued due to the futility of the endeavor. There is now so much deep water EWM throughout the bay that a herbicide "reset" will be necessary before shifting to DASH for EWM management in Rabbit Island Bay.

EWM management did not occur in West Lake or Williams Bay during 2016. In the absence of management, EWM expanded rapidly. In West Lake, EWM expanded by an order of magnitude between October of 2015 and October of 2016—from 1 percent of the littoral zone in October of 2015 to 14 percent of the littoral zone in October of 2016. In Williams Bay, EWM was not present in October of 2015 and was found in 12 percent of the littoral zone in October of 2016. Both West Lake and Williams Bay will require a herbicide "reset" before shifting to DASH for EWM management.