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Memorandum

To: Beaver Dam Lake Management District (Board of Commissioners)
From: Barr Engineering Co. (Meg Rattei)
Subject: Proposed 2019 Eurasian Watermilfoil (EWM) Management Program, Monitoring Programs, and Navigation Channel Inspection
Date: February 15, 2019
Project: 49030011.19
c: Alex Smith (WDNR), Mark Sundeen (WDNR), and Jim Bartlett (Lake Restoration, Inc.)

The purpose of this memorandum is to present:

1. 2019 EWM Management Program
2. 2019 Monitoring Programs
3. 2019 Navigation Channel Inspection and Treatment Program

1.0 2019 EWM Management Program

The proposed 2019 EWM management program is a combination of herbicide treatment and mechanical removal of EWM. The total area managed for EWM in 2019 is 56.81 acres, which is about 11 percent of the lake's 530-acre littoral area. A total of 48.22 acres will be treated with herbicide and mechanical removal of EWM will occur in 8.59 acres. Herbicides used for herbicide treatment include 2,4-D, diquat, Aquastrike, and ProcellaCor. Mechanical removal will include Diver Assisted Suction Harvesting (DASH) wherever feasible and rake removal in shallow areas in which the soft bottom would make it difficult to remove EWM by DASH. The EWM plan indicates mechanical removal whenever it is not known whether DASH or rake removal will be used.

EWM, pictured above, will be managed by herbicide treatment and mechanical removal in 2019.

Based upon the results of the 2018 fall plant survey, the following EWM management is planned for 2019: (1) a large scale 2,4-D treatment of Library Lake; (2) diquat spot treatments in West Lake, Williams Bay, Rabbit Island Bay, Norwegian Bay, and City Bay; (3) Aquastrike spot treatments in West Lake; (4) ProcellaCOR spot treatment of Hunt Bay which is located in West Lake; and (5) Mechanical EWM removal (either DASH or rake removal) in West Lake, Williams Bay, and Rabbit Island Bay. The 2,4-D treatment area in Library Lake totals 10.00 acres. The diquat treatment areas total 16.03 acres. The Aquastrike treatment areas total 18.2 acres. The Hunt Bay ProcellaCOR treatment area totals 3.99 acres. Mechanical/DASH removal areas total 8.59 acres. Table 1 summarizes the proposed 2019 Beaver Dam Lake EWM management program and Figures 1 through 3 show the EWM management areas.

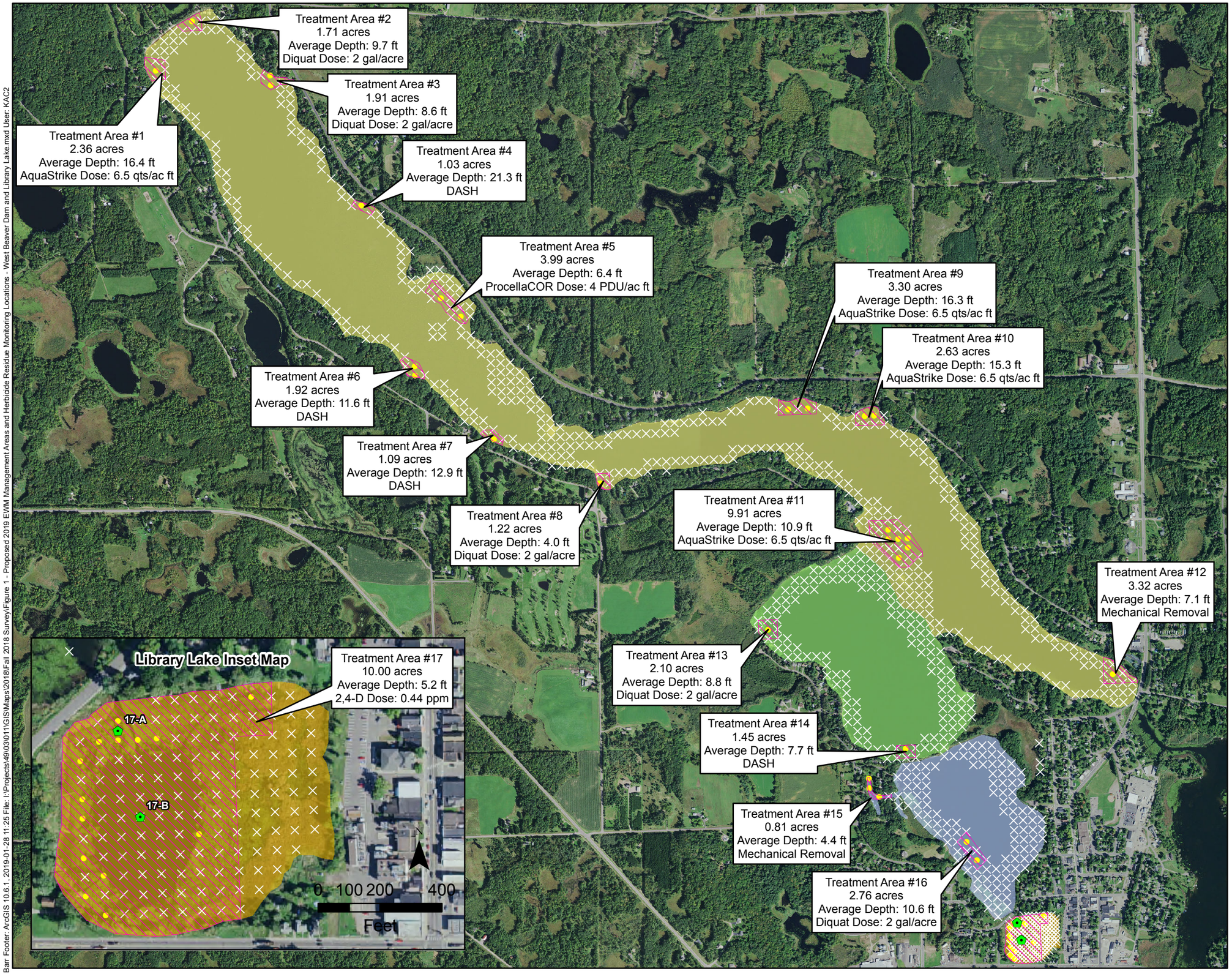
Cemetery Bay and East Lake do not require EWM management in 2019 because EWM was not observed during the 2018 fall plant survey.

Table 1 Proposed 2019 Beaver Dam Lake EWM Management Program

Location	EWM Extent (ac)	EWM Management Method	EWM Management Area	Name of Herbicide	Herbicide Dose Applied to Treatment Area	Expected Whole Bay/Lake Concentration (ppm)
West Lake	12.35	Herbicide	18.20	Aquastrike	6.5 quarts/acre foot	--
		Herbicide	4.84	Diquat	2 gallons/acre	--
		Herbicide	3.99	ProcellaCOR	4 PDU/acre foot	--
		Mechanical/DASH	6.33	--	--	--
Williams Bay	0.54	Herbicide	2.10	Diquat	2 gallons/acre	--
		DASH	1.45	--	--	--
Rabbit Island Bay	1.32	Mechanical	0.81	--	--	--
		Herbicide	2.76	Diquat	2 gallons/acre	
Library Lake	1.85	Herbicide	10.00	2,4-D	0.44 ppm	0.4 ppm
Norwegian Bay	0.65	Herbicide	2.86	Diquat	2 gallons/acre	--
East Lake	0	--	--	--	--	--
City Bay	1.56	Herbicide	3.47	Diquat	2 gallons/acre	--
Cemetery Bay	0	--	--	--	--	--

The herbicide treatments are expected to suppress the EWM infestation in the treated areas to very low levels, but some EWM will likely survive. Removal of surviving EWM throughout the 2019 growing season will be important to keep EWM suppressed to very low levels. EWM spreads explosively in Beaver Dam Lake and a handful of plants becomes hundreds of plants in just a few months. To keep EWM at very low levels, EWM observed in Beaver Dam Lake will be removed using Diver Assisted Suction Harvesting (DASH) whenever it is observed and DASH removal is feasible. Rake removal will be used to remove EWM in shallow areas in which the soft bottom would make it difficult to remove EWM by DASH.

A detailed discussion of the 2019 EWM management program follows.



Proposed 2019 EWM Treatment Areas

Herbicide Residue Monitoring Locations

EWM Observed

No EWM Present

Treatment Zones

Library Lake (0.4 ppm 2,4-D)

Rabbit Island Bay (Spot Treatment with Diquat at 2 gal/acre)

West Lake (Spot Treatment with Diquat at 2 gal/acre or Spot Treatment with Procellacor at label rate)

Williams Bay (Spot Treatment with Diquat at 2 gal/acre)

N

0 750 1,500 3,000

Feet

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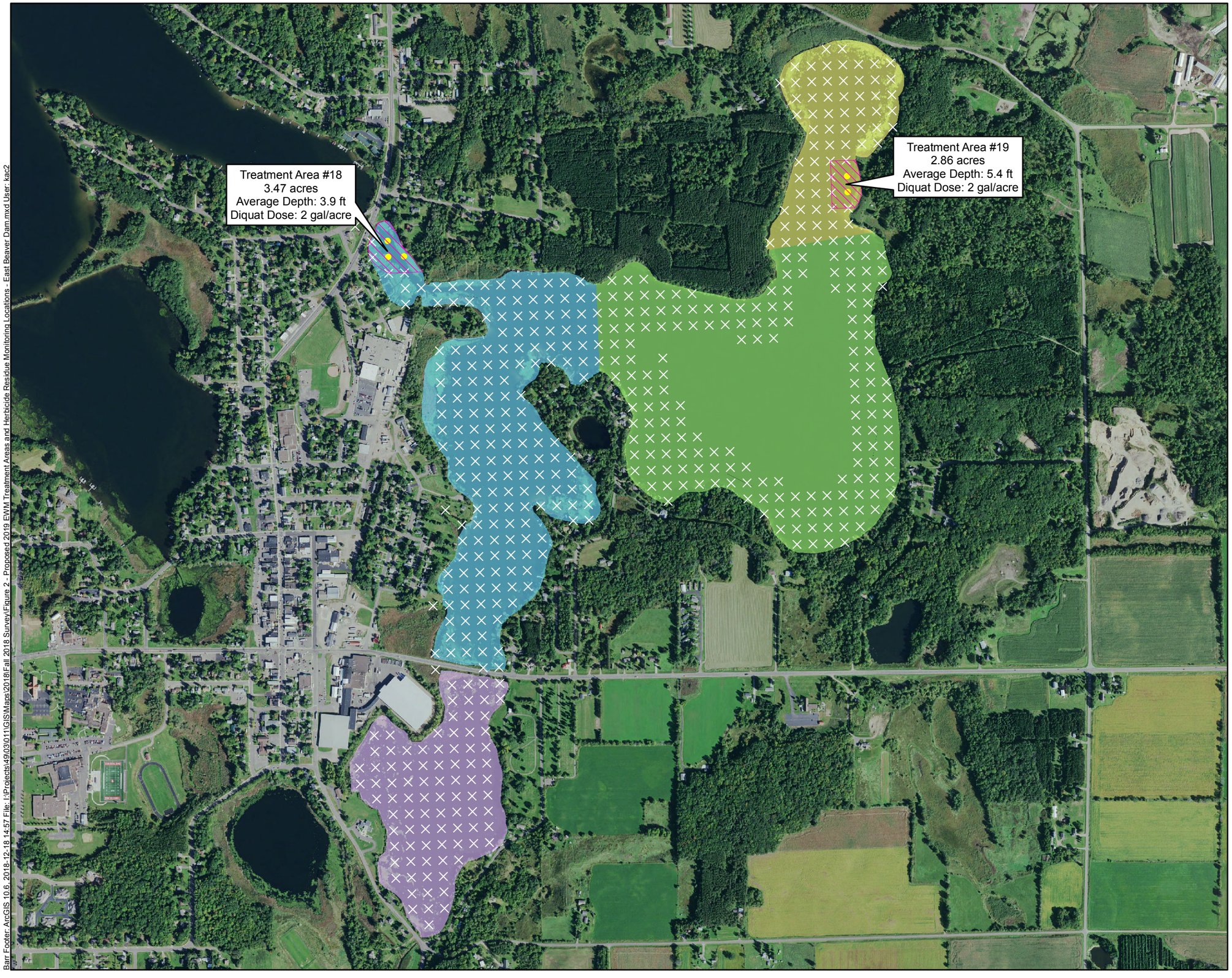
Figure 1

PROPOSED 2019 EURASIAN WATERMILFOIL MANAGEMENT AREAS AND HERBICIDE RESIDUE MONITORING LOCATIONS
Beaver Dam and Library Lake
Barron County, WI

Barr Footer: ArcGIS 10.6.1, 2019-01-28 11:25 File: I:\Projects\49\03\011\GIS\Maps\2018\Fall 2018 Survey\Figure 1 - Proposed 2019 EWM Management Areas and Herbicide Residue Monitoring Locations - West Beaver Dam and Library Lake.mxd User: KAC2



Proposed 2019 EWM Treatment Areas

EWM Observed

No EWM Present

Treatment Zones

East Lake (No Treatment)

City Bay (Spot Treatment with Diquat at 2 gal/acre)

Cemetery Bay (No Treatment)

Norwegian Bay (Spot Treatment with Diquat at 2 gal/acre)

N

0 450 900 1,800

Feet

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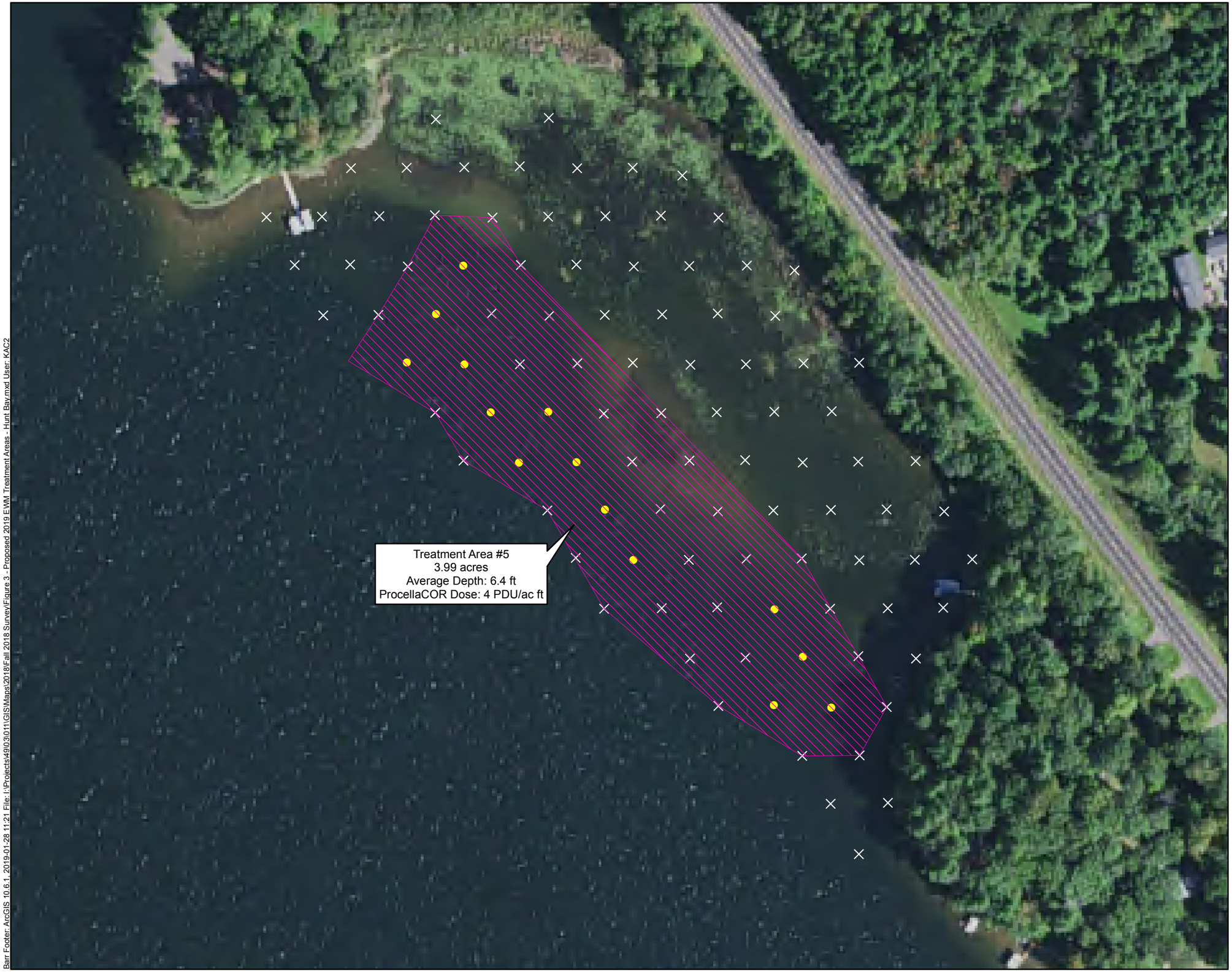
Figure 2

PROPOSED 2019 EURASIAN WATERMILFOIL TREATMENT AREAS
Beaver Dam and Library Lake
Barron County, WI

Barr Footer: ArcGIS 10.6, 2018-12-18 14:57 File: I:\Projects\49\03\011\GIS\Maps\2018\Fall 2018 Survey\Figure 2 - Proposed 2019 EWM Treatment Areas and Herbicide Residue Monitoring Locations - East Beaver Dam.mxd User: kac2



Proposed 2019 EWM Treatment Areas

August EWM Survey Results

EWM Observed

No EWM Present

N

0 60 120 240

Feet

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Figure 3

PROPOSED 2019 EURASIAN WATERMILFOIL TREATMENT AREAS - HUNT BAY
Beaver Dam and Library Lake
Barron County, WI

Barr Footer: ArcGIS 10.6.1, 2019-01-28 11:21 File: I:\Projects\49103\011\GIS\Maps\2018\Fall 2018 Survey\Figure 3 - Proposed 2019 EWM Treatment Areas - Hunt Bay.mxd User: KAC2

1.1 EWM Management in Individual Bays and Basins

1.1.1 Williams Bay

Williams Bay EWM management includes herbicide treatment and DASH removal.

The herbicide treatment will be a spot treatment of 2.10 acres with diquat at a dose of 2 gallons per acre. The treatment will occur within 2 to 3 weeks after ice out under no wind conditions when the water is still to minimize mixing with untreated waters. The herbicide treatment area is Treatment Area 13 on Figure 1.

The DASH removal area is 1.45 acres (Treatment Area 14 on Figure 1).

1.1.2 West Lake

In 2019, EWM management in West Lake, pictured above, will include mechanical removal, including DASH, and spot herbicide treatments with either diquat, Aquastrike, or ProcellaCOR.

EWM management in West Lake will be a combination of herbicide treatment and mechanical removal, including DASH.

Diquat will be used to treat three individual areas in West Lake (treatment areas 2, 3, and 8 shown on Figure 1). The three individual areas range in size from 1.22 acres to 1.91 acres and total 4.84 acres. The three areas will be treated with diquat at a dose of 2 gallons per acre. The treatment will occur within 2 to 3 weeks after ice out under no wind conditions when the water is still to minimize mixing with untreated waters.

Aquastrike will be used to treat four individual areas in West Lake (Treatment Areas 1, 9, 10, and 11 on Figure 1). The four areas range in size from 2.36 acres to 9.91 acres and total 18.20 acres. The four areas will be treated with Aquastrike at a dose of 6.5 quarts per acre foot. The treatment will occur within 2 to 3 weeks after ice out under no wind conditions when the water is still to minimize mixing with untreated waters.

ProcellaCOR will be used to treat Hunt Bay, a 3.99-acre treatment area (Treatment Area 5 on Figure 1 and the area shown in Figure 3). Hunt Bay will be treated with ProcellaCOR at a dose of 4 PDU per acre foot. The herbicide application will be a surface application.

The West Lake DASH removal areas are comprised of three individual areas ranging in size from 1.03 to 1.92 acres (treatment areas 4, 6, and 7 on Figure 1) and totaling 4.04 acres.

Mechanical removal will be used to remove EWM in area 12 on Figure 1. Either DASH or rake removal will be used to remove EWM from this 3.32-acre area.

1.1.3 Rabbit Island Bay

Rabbit Island Bay EWM management includes herbicide treatment and mechanical removal.

Herbicide treatment will be a spot treatment of 2.76 acres with diquat at a dose of 2 gallons per acre. The treatment will occur within 2 to 3 weeks after ice out under no wind conditions when the water is still to minimize mixing with untreated waters. The herbicide treatment area is Treatment Area 16 on Figure 1.

Mechanical removal will be used to remove EWM in Treatment Area 15, located in the west canal. Rake removal will likely be used to remove EWM in this 0.81-acre area.

1.1.4 Library Lake

EWM management in Library Lake will be a large scale herbicide treatment. A 10.00-acre area (Treatment Area 17 on Figure 1) will be treated with 2,4-D at a dose of 0.44 ppm. The treatment is expected to result in a whole basin concentration of 0.4 ppm.

The Library Lake herbicide treatment will be completed in a single day. Herbicide treatment will occur when the average water column temperature is 60 degrees Fahrenheit or less. It is expected that the average water column temperature will be at least 55 degrees Fahrenheit at the time of herbicide treatment. However, if Wisconsin Department of Natural Resources (WDNR) staff determines the EWM is ready for treatment when the average water column temperature is less than 55 degrees Fahrenheit and recommends that treatment proceed, the treatment will proceed per the recommendation of WDNR staff. Treating Library Lake when the average water column temperature is 60 degrees Fahrenheit or less protects the native plant species from harm. Native plant species typically begin growing after the average water column temperature reaches 60 degrees Fahrenheit. Experience in Beaver Dam Lake during 2015 indicated applying a lethal dose of herbicide at or shortly prior to the start of the native plant growing season exposed infant plants to a lethal dose of herbicide and harmed the natives. The 2018 herbicide treatment plan protects natives by applying the herbicide when the average water column temperature is 60 degrees Fahrenheit or less.

Daily water temperature measurements will occur beginning 1 week after ice-out and continuing through and including the day of herbicide treatment. The daily water temperatures will be measured at 1 meter intervals from the surface to bottom of Library Lake at Location 17B shown in Figure 1. If unforeseen circumstances prevent the large scale Library Lake herbicide treatment from occurring when the average water column temperature is 60 degrees Fahrenheit or less, the large scale herbicide treatment of Library Lake will not occur in 2019.

1.1.5 Norwegian Bay

Herbicide treatment will be a spot treatment of 2.86 acres with diquat at a dose of 2 gallons per acre. The treatment will occur within 2 to 3 weeks after ice out under no wind conditions when the water is still to minimize mixing with untreated waters. The herbicide treatment area is Treatment Area 19 on Figure 2.

1.1.6 City Bay

Herbicide treatment will be a spot treatment of 3.47 acres with diquat at a dose of 2 gallons per acre. The treatment will occur within 2 to 3 weeks after ice out under no wind conditions when the water is still to minimize mixing with untreated waters. The herbicide treatment area is Treatment Area 18 on Figure 2.

2.0 2019 Monitoring Programs

The 2019 monitoring programs consist of temperature measurements prior to the herbicide treatment of Library Lake, 2,4-D herbicide residue monitoring after the herbicide treatment of Library Lake, and aquatic plant surveys during July and October. The temperature monitoring program of Library Lake is discussed in Section 1.1.4 Library Lake. The herbicide residue monitoring and aquatic plant monitoring programs are discussed in the following paragraphs.

2.1 2,4-D Residue Monitoring

In 2019, 2,4-D herbicide residue monitoring will occur at 2 representative locations in Library Lake to determine whether the target dose was attained as well as the rate of herbicide decline due to dilution, mixing, and natural degradation of the 2,4-D, Monitoring locations 17 A and 17 B are shown in Figure 1. Samples will be collected at mid-depth from both locations during the monitoring period. Specific sample collection times for the treatment areas are shown in Table 2. It should be noted that if weather conditions make sample collection unsafe during any of the scheduled sample collection times, samples will not be collected during those unsafe times.

Table 2 2019 2,4-D Residue Monitoring Plan

Treatment Area	Sample Site ID	Sample Collection Time (Hours After Treatment	Sample Collection Time (Days After Treatment)
Library Lake	17A and 17B	1 and 4	1, 2, 3, 5, 7, 12, 19, and 26

2.2 2019 Aquatic Plant Monitoring Programs

The 2019 aquatic plant monitoring programs will include a July survey of all plant species and an October survey of aquatic invasive species (EWM and CLP). Details of the aquatic plant monitoring programs follow.

2.2.1 July Aquatic Plant Survey – All Species

During July, a point intercept survey of about 1,346 sample points will assess the entire plant community in Beaver Dam Lake. Maps showing the sample locations are found in Appendix E of the Beaver Dam Lake APM Plan (http://www.beaverdamlake.org/apmp). Data will be summarized in tabular format using the WDNR pre-treatment/post-treatment spreadsheet. Maps will be prepared showing location and density of each species identified in the July plant survey. Maps will also be prepared that show bottom substrate, lake depth, littoral zone, native species richness, and total rake fullness. Chi squared analysis will compare 2019 data with 2018 data to identify significant changes in frequency of occurrence of native species. The July monitoring program duplicates monitoring programs completed during 2009 through 2018.

2.2.2 Fall Aquatic Invasive Species Survey

During October, a fall point intercept survey of about 1,346 sample points will assess aquatic invasive species (EWM and CLP) extent in Beaver Dam Lake. Maps showing the sample locations are found in Appendix E of the Beaver Dam Lake APM Plan (http://www.beaverdamlake.org/apmp). The results of the EWM data collected during the fall aquatic invasive species survey will determine 2020 EWM management areas and will be used to design the 2020 EWM management program. The results of the CLP data collected during the fall aquatic invasive species survey will be evaluated to determine whether any areas would need additional CLP monitoring during June of 2020 when CLP is at its peak growth stage. The fall aquatic invasive species monitoring program duplicates monitoring programs completed during 2006 through 2018.

3.0 2019 Navigation Channel Inspection

In 2019, an inspection of navigation channels within Beaver Dam Lake will determine whether plant growth impedes navigation. The inspection of navigation channels will occur during the July plant survey and will document any impairment of navigation channels and access corridors by plants. If impairment of navigation channels and access corridors by plants is documented, the Beaver Dam Lake Management District will contact WDNR staff to discuss the issue. If herbicide treatment of plants is warranted to alleviate navigation problems and WDNR staff will permit herbicide treatment of the plants, the Beaver Dam Lake Management District will work with a herbicide applicator to obtain a treatment permit and perform the herbicide treatment.