Report: Post-treatment Survey of 2016 treatment plots in Noxon Reservoir

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Introduction

A point intercept survey of all plots treated for Eurasian watermilfoil (EWM) was performed the weeks of July 24th and July 31st 2017, approximately 52 weeks after 2016 treatments. Pre-treatment data was collected the weeks of July 4th and July 11th. The same points sampled for pretreatment were resampled as post-treatment points. A minimum of two points per acre in each plot were sampled. Surveys were conducted by boat using Global Positioning System (GPS) technology to navigate to each point. Survey accuracy was 1 -3 meters (3 to 10 ft) depending upon satellite reception. At each survey point, a weighted plant rake was utilized twice to sample for plant species. For each sample, the species and relative density were recorded. Sample density for EWM and curlyleaf pondweed (CLP) was measured on a one to five scale based upon the percentage of the rake covered with five being completely covered. Aquatic plant occurrence data for all plant species is included in the appendix. Pre-and post-treatment occurrence data and sample densities are provided in Table 1.

NOTE: Throughout this report, EWM refers to any watermilfoil other than native northern watermilfoil. There are numerous hybrid strains and many of the samples may have contained hybrids, but distinguishing hybrid watermilfoil from EWM based solely on physical characteristics is difficult, so some of what is called EWM is likely to be hybrid watermilfoil.

Figure 1: Table of plots

					Pre-treat	Post-treat		Pre-treat		Post-treat			Herbicide Treatment (ppm)		
Plot	**Year and (acres) treated**	**2016 acres Treated**	**Average depth (ft)**	**Sample points**	**EWM percent Occurence**	**EWM percent Occurence**	**EWM percent reduction**	**EWM positive points**	**EWM sample density (1 to 5 scale)**	**EWM positive points**	**EWM sample density (1 to 5 scale)**	**EWM sample point reduction**	**Triclopyr**	**Endothall**	**Aquastrike (endothall /Diquat)**
Nox-1	2009 (20.2)	85.5	5	175	80%	24%	56%	140	3	42	1	84%	1	2	
Nox-2	2012 (24)	50.7	8	106	72%	20%	52%	75	3	21	1	76%			1.8/0.36
Nox-4a	2012 (28.1)	2.2	5	5	100%	20%	80%	5	4	1	1	80%			1.8/0.36
Nox-4b	2015 (28.2)	3.2	6	6	100%	33%	67%	6	4	2	1	67%			1.8/0.36
Nox-7	2010 (24.4)	18.6	6	30	97%	17%	80%	29	3	5	1	83%	1	2	
Nox-8	2010 (15.8) 2012 (11.4) 2014 (9.4)	20.3	6	36	100%	25%	75%	36	3	9	2	78%			1.8/0.36
Nox-10	2012 (15.3) 2015 (2.6)	4.3	6	8	100%	25%	75%	8	3	2	1	75%			1.8/0.36
Nox-30	2013 (18.6)	6.5	6	13	100%	15%	85%	13	4	2	1	85%			1.8/0.36
Nox-31	2013 (5.1) 2014 (2.3)	4.6	6	12	100%	25%	75%	12	3	3	1	75%			1.8/0.36
Nox-60		3.3	5	9	89%	22%	67%	8	3	2	1	75%	1	2	
Total		**199.2**													

Treatment Plots

The following areas received herbicide treatment in 2016. In these plots, the Eurasian watermilfoil was visually estimated to be 50% or greater of the plant biomass and covering an area larger than 0.5 acres prior to treatments.

Nox-1

Nox-1 is a large shallow bed of Eurasian watermilfoil just upstream of Noxon Dam, near Rock Island, totaling 85.5 acres. There were significant areas where the Eurasian watermilfoil was greater than 80% of the biomass and solid to the water's surface prior to treatments. Over the total plot, the Eurasian watermilfoil occurred at over 80% of the treatment plot sample points prior to treatment and at 24% post-treatment, a reduction of 56%.

Figure 2: Nox-1

Nox-2

Nox-2 is a large deep bed of Eurasian watermilfoil, near the mouth of Martin Creek Bay, totaling 50.7 acres. There were significant areas where the Eurasian watermilfoil was visually estimated to be greater than 70% of the plant biomass prior to treatment. The Eurasian watermilfoil does not reach the water's surface. Over the total plot, the Eurasian watermilfoil occurred at 72% of the treatment plot sample points prior to treatment and at 20% post-treatment, a reduction of 52%.

Figure 3: Nox-2

Nox-4a

Nox-4a is a shoreline strip of Eurasian watermilfoil, across the reservoir from the town of Trout Creek, totaling 2.2 acres. The Eurasian watermilfoil occurred primarily as a solid strip along the shore before treatments with a significant strip of curlyleaf pondweed on the outside. The Eurasian watermilfoil was at the water's surface and forming dense mats before treatment. Over the total plot, the Eurasian watermilfoil occurred at 100% of the treatment plot sample points prior to treatment and at 20% post-treatment, a reduction of 80%.

Figure 4: Nox-4a

Nox-4b

Nox-4b is a shoreline strip of Eurasian watermilfoil, just upstream of the highway 200 where it crosses the reservoir at the town of Trout Creek, totaling 3.2 acres. The Eurasian watermilfoil occurred primarily as a solid strip along the shore with a significant strip of curlyleaf pondweed on the outside prior to treatments. The Eurasian watermilfoil was at the water's surface and forming dense mats before treatments. Over the total plot, the Eurasian watermilfoil occurred at 100% of the treatment plot sample points prior to treatment and at 33% post-treatment, a reduction of 67%.

Figure 5: Nox-4b

Nox-7

Nox-7 is a shoreline strip of Eurasian watermilfoil totaling 18.6 acres in the vicinity of Beacher Flats just upstream of North Shore Recreation Area. The Eurasian watermilfoil occurred primarily as a solid 20 to 40 foot wide strip along the shore with a significant strip of curlyleaf pondweed on the outside. The Eurasian watermilfoil was at the water's surface and forming dense mats prior to treatments. Over the total plot, the Eurasian watermilfoil occurred at 97% of the treatment plot sample points prior to treatment and at 17% post-treatment, a reduction of 80%.

Figure 6: Nox-7

Nox-8

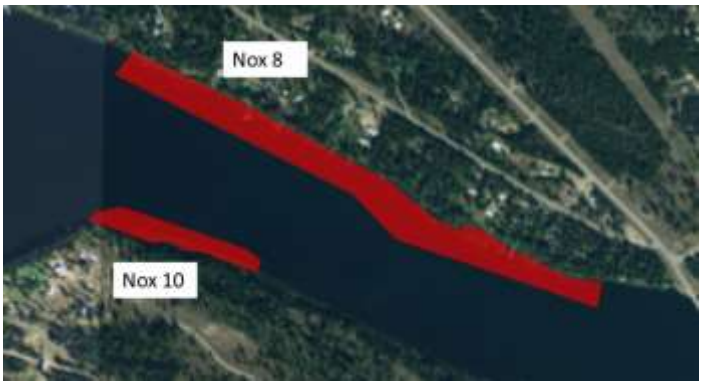
Nox-8 is a shoreline strip of Eurasian watermilfoil totaling 20.3 acres, adjacent to the North Shore homes area. The Eurasian watermilfoil occurs primarily as a solid 10 to 30 foot wide strip along the shore with a significant strip of curlyleaf pondweed on the outside. The Eurasian watermilfoil was at the water's surface and forming dense mats prior to treatments. Over the total plot, the Eurasian watermilfoil occured at 100% of the treatment plot sample points prior to treatment and at 25% post-treatment, a reduction of 75%.

Figure 7: Nox-8

Nox-10

Nox-10 is a shoreline strip of Eurasian watermilfoil totaling 4.3 acres, across from the North Shore homes area. The Eurasian watermilfoil occurred primarily as a solid 10 to 20 foot wide strip along the shore with a significant strip of curlyleaf pondweed on the outside. The Eurasian watermilfoil was at the water's surface and forming dense mats before treatments. Over the total plot, the Eurasian watermilfoil occured at 100% of the treatment plot sample points prior to treatment and at 25% post-treatment, a reduction of 75%.

Figure 8: Nox-10



Nox-30

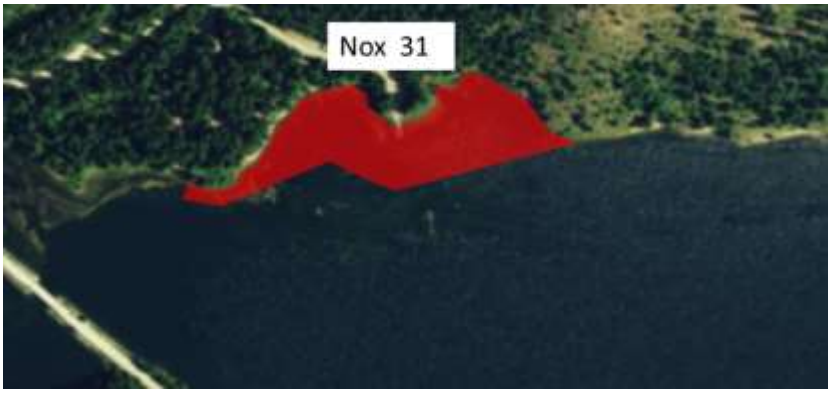
Nox-30 is a shoreline strip of Eurasian watermilfoil totaling 6.5 acres, along the south shoreline just downstream of the railroad trestle. The Eurasian watermilfoil occurred primarily as a solid 20 to 40 foot wide strip along the shore with a significant strip of curlyleaf pondweed on the outside. The Eurasian watermilfoil was at the water's surface and forming dense mats prior to treatments. Over the total plot, the Eurasian watermilfoil occurred at 100% of the treatment plot sample points prior to treatment and at 15% post-treatment, a reduction of 85%.

Figure 9: Nox-30

Nox-31

Nox-31 is a shoreline area of Eurasian watermilfoil totaling 4.6 acres, around the Marten Creek Campground and Boat Launch. The Eurasian watermilfoil occurred throughout the plot with significant dense areas. The Eurasian watermilfoil was at the water's surface and forming dense mats prior to treatment. Over the total plot, the Eurasian watermilfoil occurred at 100% of treatment plot sample points prior to treatment and at 25% post-treatment, a reduction of 75%.

Figure 10: Nox-31



Nox- 60

Nox-60 is a small bay downstream of Blacktail Creek Cove with significant amounts of Eurasian watermilfoil throughout the bay. The total area is 3.3 acres. The Eurasian watermilfoil was at the water's surface and forming dense mats prior to treatments. Over the total plot, the Eurasian watermilfoil occurred at 89% of the treatment plot sample points prior to treatment and at 22% post-treatment, a reduction of 67%.

Figure 11: Nox-60

Results

The herbicide treatment in 2016 resulted in an overall 52% to 85% reduction in the EWM occurrence in all plots with an average of 71%. In all plots there was a significant reduction in the overall EWM biomass with sample densities from 3 to 4 on a 1 to 5 scale to 1 in all but one plot (nox-8).There was a reduction of 67% to 85% of the number of sample points that were positive for EWM with an average of 78%.

There appeared to be no difference in the treatment success based upon plot depth or location.

Appendix: Aquatic plant occurrence data

Figure 12: Nox-1

Scientific Name	Common Name	% Occurrence
Myriophyllum spicatum	Eurasian watermilfoil	24
Potamogeton crispus	curly leaf pondweed	43
Butomus umbellatus	flowering rush	1
Ceratophyllum demersum	coontail	31
Chara spp	chara	63
Elodea canadensis	common Elodea	42
Myriophyllum sibiricum	northern watermilfoil	
Potamogeton amlifolus	bigleaf pondweed	1
Potamogeton foliosis	leafy pondweed	1
Potamogeton richardsonii	Richardson's pondweed	2
Potamogeton pectinatus	sago pondweed	4
Potamogeton zosteriformis	flatstem pondweed	
Potamogeton praelongus	whitestem pondweed	
Potamogeton illinoensis	Illinois pondweed	
Ranuculus aquatilis	white waterbuttercup	

Figure 13: Nox-2

Scientific Name	Common Name	% Occurrence
Myriophyllum spicatum	Eurasian watermilfoil	20
Potamogeton crispus	curly leaf pondweed	58
Butomus umbellatus	flowering rush	
Ceratophyllum demersum	coontail	74
Chara spp	chara	8
Elodea canadensis	common Elodea	39
Myriophyllum sibiricum	northern watermilfoil	
Potamogeton amlifolus	bigleaf pondweed	
Potamogeton foliosis	leafy pondweed	
Potamogeton richardsonii	Richardson's pondweed	3
Potamogeton pectinatus	sago pondweed	
Potamogeton zosteriformis	flatstem pondweed	
Potamogeton praelongus	whitestem pondweed	3
Potamogeton illinoensis	Illinois pondweed	
Ranuculus aquatilis	white waterbuttercup	4

Figure 14: Nox-4a

Scientific Name	Common Name	% Occurrence
Myriophyllum spicatum	Eurasian watermilfoil	20
Potamogeton crispus	curly leaf pondweed	100
Butomus umbellatus	flowering rush	
Ceratophyllum demersum	coontail	80
Chara spp	chara	
Elodea canadensis	common Elodea	40
Myriophyllum sibiricum	northern watermilfoil	
Potamogeton amlifolus	bigleaf pondweed	
Potamogeton foliosis	leafy pondweed	
Potamogeton richardsonii	Richardson's pondweed	
Potamogeton pectinatus	sago pondweed	
Potamogeton zosteriformis	flatstem pondweed	
Potamogeton praelongus	whitestem pondweed	
Potamogeton illinoensis	Illinois pondweed	
Ranuculus aquatilis	white waterbuttercup	20

Figure 15: Nox-4b

Scientific Name	Common Name	% Occurrence
Myriophyllum spicatum	Eurasian watermilfoil	33
Potamogeton crispus	curly leaf pondweed	83
Butomus umbellatus	flowering rush	
Ceratophyllum demersum	coontail	83
Chara spp	chara	
Elodea canadensis	common Elodea	67
Myriophyllum sibiricum	northern watermilfoil	
Potamogeton amlifolus	bigleaf pondweed	
Potamogeton foliosis	leafy pondweed	
Potamogeton richardsonii	Richardson's pondweed	
Potamogeton pectinatus	sago pondweed	
Potamogeton zosteriformis	flatstem pondweed	
Potamogeton praelongus	whitestem pondweed	
Potamogeton illinoensis	Illinois pondweed	
Ranuculus aquatilis	white waterbuttercup	33

Figure 16: Nox-7

Scientific Name	Common Name	% Occurrence
Myriophyllum spicatum	Eurasian watermilfoil	17
Potamogeton crispus	curly leaf pondweed	93
Butomus umbellatus	flowering rush	
Ceratophyllum demersum	coontail	27
Chara spp	chara	
Elodea canadensis	common Elodea	27
Myriophyllum sibiricum	northern watermilfoil	
Potamogeton amlifolus	bigleaf pondweed	
Potamogeton foliosis	leafy pondweed	
Potamogeton richardsonii	Richardson's pondweed	
Potamogeton pectinatus	sago pondweed	3
Potamogeton zosteriformis	flatstem pondweed	
Potamogeton praelongus	whitestem pondweed	
Potamogeton illinoensis	Illinois pondweed	
Ranuculus aquatilis	white waterbuttercup	17

Figure 17: Nox-8

Scientific Name	Common Name	% Occurrence
Myriophyllum spicatum	Eurasian watermilfoil	24
Potamogeton crispus	curly leaf pondweed	63
Butomus umbellatus	flowering rush	
Ceratophyllum demersum	coontail	76
Chara spp	chara	
Elodea canadensis	common Elodea	24
Myriophyllum sibiricum	northern watermilfoil	
Potamogeton amlifolus	bigleaf pondweed	
Potamogeton foliosis	leafy pondweed	
Potamogeton richardsonii	Richardson's pondweed	
Potamogeton pectinatus	sago pondweed	
Potamogeton zosteriformis	flatstem pondweed	
Potamogeton praelongus	whitestem pondweed	
Potamogeton illinoensis	Illinois pondweed	
Ranuculus aquatilis	white waterbuttercup	12

Figure 18: Nox-10

Scientific Name	Common Name	% Occurrence
Myriophyllum spicatum	Eurasian watermilfoil	25
Potamogeton crispus	curly leaf pondweed	75
Butomus umbellatus	flowering rush	
Ceratophyllum demersum	coontail	25
Chara spp	chara	
Elodea canadensis	common Elodea	38
Myriophyllum sibiricum	northern watermilfoil	
Potamogeton amlifolus	bigleaf pondweed	
Potamogeton foliosis	leafy pondweed	63
Potamogeton richardsonii	Richardson's pondweed	
Potamogeton pectinatus	sago pondweed	
Potamogeton zosteriformis	flatstem pondweed	
Potamogeton praelongus	whitestem pondweed	
Potamogeton illinoensis	Illinois pondweed	
Ranuculus aquatilis	white waterbuttercup	13

Figure 19: Nox-30

Scientific Name	Common Name	% Occurrence
Myriophyllum spicatum	Eurasian watermilfoil	15
Potamogeton crispus	curly leaf pondweed	62
Butomus umbellatus	flowering rush	
Ceratophyllum demersum	coontail	46
Chara spp	chara	
Elodea canadensis	common Elodea	31
Myriophyllum sibiricum	northern watermilfoil	
Potamogeton amlifolus	bigleaf pondweed	
Potamogeton foliosis	leafy pondweed	8
Potamogeton richardsonii	Richardson's pondweed	
Potamogeton pectinatus	sago pondweed	
Potamogeton zosteriformis	flatstem pondweed	
Potamogeton praelongus	whitestem pondweed	
Potamogeton illinoensis	Illinois pondweed	
Ranuculus aquatilis	white waterbuttercup	15

Figure 20: Nox-31

Scientific Name	Common Name	% Occurrence
Myriophyllum spicatum	Eurasian watermilfoil	25
Potamogeton crispus	curly leaf pondweed	83
Butomus umbellatus	flowering rush	
Ceratophyllum demersum	coontail	25
Chara spp	chara	
Elodea canadensis	common Elodea	58
Myriophyllum sibiricum	northern watermilfoil	
Potamogeton amlifolus	bigleaf pondweed	
Potamogeton foliosis	leafy pondweed	8
Potamogeton richardsonii	Richardson's pondweed	
Potamogeton pectinatus	sago pondweed	8
Potamogeton zosteriformis	flatstem pondweed	
Potamogeton praelongus	whitestem pondweed	
Potamogeton illinoensis	Illinois pondweed	
Ranuculus aquatilis	white waterbuttercup	

Figure 21: Nox-60

Scientific Name	Common Name	% Occurrence
Myriophyllum spicatum	Eurasian watermilfoil	22
Potamogeton crispus	curly leaf pondweed	78
Butomus umbellatus	flowering rush	
Ceratophyllum demersum	coontail	
Chara spp	chara	22
Elodea canadensis	common Elodea	67
Myriophyllum sibiricum	northern watermilfoil	
Potamogeton amlifolus	bigleaf pondweed	
Potamogeton foliosis	leafy pondweed	
Potamogeton richardsonii	Richardson's pondweed	
Potamogeton pectinatus	sago pondweed	
Potamogeton zosteriformis	flatstem pondweed	
Potamogeton praelongus	whitestem pondweed	
Potamogeton illinoensis	Illinois pondweed	
Ranuculus aquatilis	white waterbuttercup	22