HANSON ENVIRONMENTAL

Post-treatment Assessment of 2015 Treatment Plots on Noxon and Cabinet Gorge Reservoirs

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Introduction

Ten plots (149 acres) in Noxon Reservoir and two experimental plots (20 acres) were chosen for herbicide treatment in 2015. The aquatic herbicide treatments were performed from July 22nd to 30th. At 12 months after treatment there was a substantial decrease in Eurasian Watermilfoil levels (68% to 95%) (Table 1). Nox-58 had the least amount of control on Eurasian watermilfoil with a 57% reduction. Variability in treatment effectiveness is likely a reflection of the size, depth and location of the treatment plots. Small and shallow shoreline plots such as Nox-58 likely experience a greater amount of water movement that decreases the contact time and herbicide concentration.

Methods

A point intercept survey of plots treated for Eurasian watermilfoil in 2015 was performed at 12 months after treatment (MAT). Fifty percent of sample points were pre-selected using GIS software on a 45 meter grid. Fifty percent of sample points were selected in the field in areas of high Eurasian watermilfoil density for Noxon Reservoir. All sample points in Cabinet Gorge were pre-selected using GIS software. A minimum of two points per acre in each plot were sampled. Surveys were conducted by boat using Global Positioning System 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 used twice to sample for plant species. For each sample, the species and relative density were recorded. Density was measured on a one to five scale based upon the percentage of the rake covered with five being completely covered.

Results

The effectiveness of the treatments was measured by a reduction in detections and densities at sample points. Most treatment plots saw a substantial decrease in Eurasian Watermilfoil levels (68% to 95%) (Table 1). Nox-58 had the least amount of control on Eurasian watermilfoil with a 57% reduction. Plot Nox-8 and the test plots in Cab-2 and Cab-3 were not sampled during the pre-treatment survey and so a percent reduction was not calculated for these plots.

Variability in treatment effectiveness is likely a reflection of the size, depth and location of the treatment plots. Small and shallow shoreline plots such as Nox-58 likely experience a greater amount of water movement that decreases the contact time and herbicide concentration.

Table 1: Treatment Plot Control

				Pre-Treatment		Post-Treatment		
Plot	Acres	Average Sample Depth	Total Sample Points	EWM Positive Points	EWM Average Density	EWM Positive Points	EWM Average Density	Percent Reduction
NOX-4	28.2	4.9	56	45	4.4	33	1.6	73
NOX-5	11.8	6.7	24	22	3.6	13	1.9	69
NOX-6	23.1	7	46	39	4.5	24	2.2	70
NOX-8*	0.5	7	8			3	2	
NOX-10	2.6	3.5	6	5	3.8	2	1.3	86
NOX-25	13.1	6	26	23	4.5	3	2.3	93
NOX-56	2.6	5	5	4	4	3	1.7	68
NOX-57	6.6	4.5	13	10	4.3	2	1	95
NOX-58	2.3	6.5	6	6	3.7	4	2.4	57
NOX-59	58	5.4	116	87	4.4	25	1.7	89
CAB-2*	10	6	20			32	2	
CAB-3*	10	6	20			31	3.8	
*These treatment plots were selected for treatment after the pre-treatment survey								

Plot Maps

Figure 1: CAB-2 and CAB-3

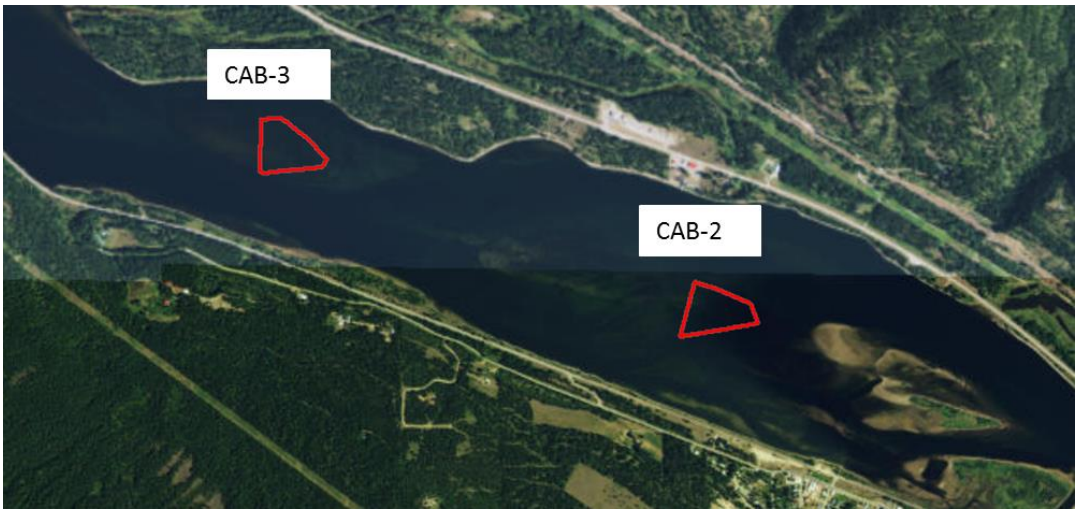
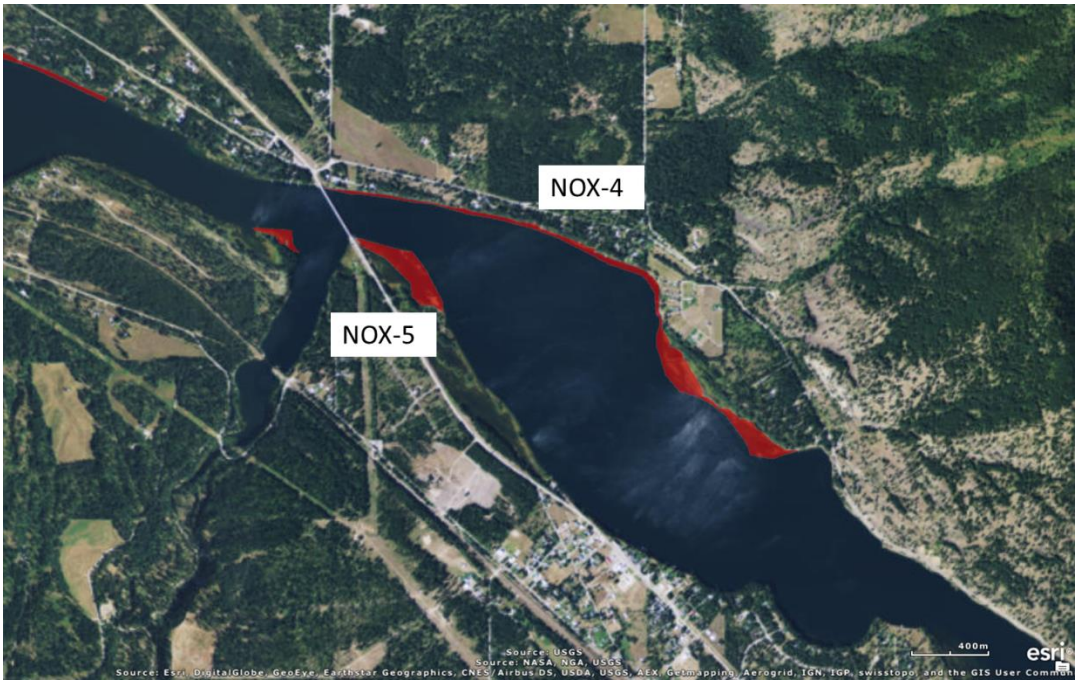
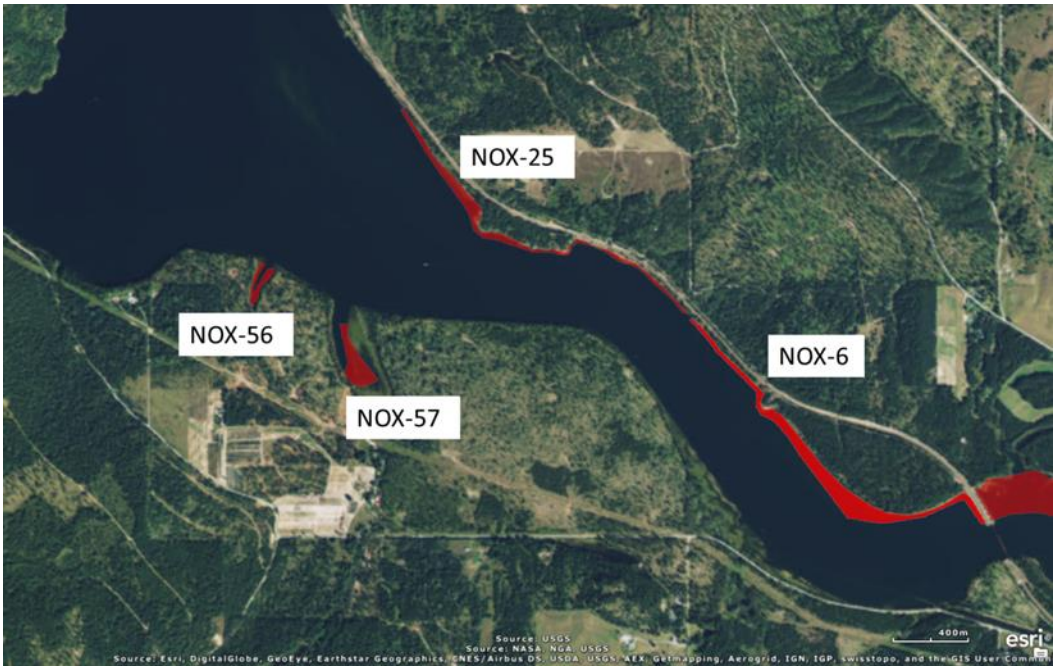


Figure 2: NOX-4 and NOX-5



Control: NOX-4: 73% and NOX-5: 69%

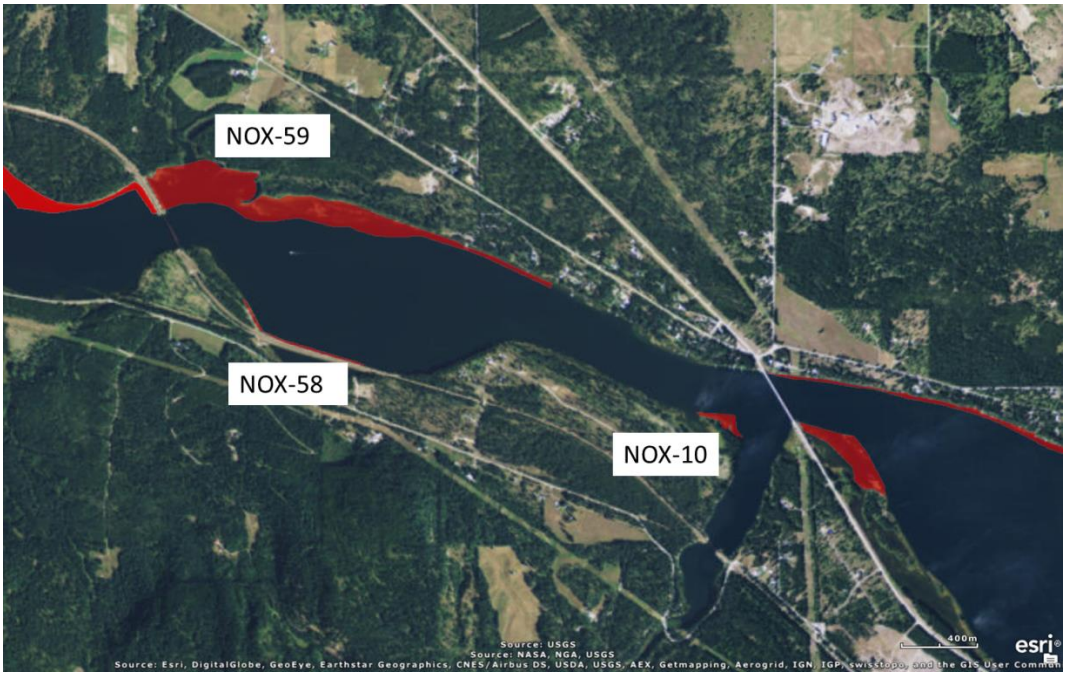
Figure 3: NOX-6, NOX-25, NOX-56 and NOX-57



Control: NOX-6: 70%, NOX-25: 93%, NOX-56: 68% and NOX-57: 95%

Figure 4: NOX-8

Figure 5: NOX-10, NOX-58 and NOX-59



Control: NOX-10: 86%, NOX 58: 57% and NOX-59: 89%

Frequency of aquatic plant occurrence in plots

CAB-2

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	35
Chara sp	chara	0
Elodea canadensis	common elodea	45
Myriophyllum sibiricum	northern watermilfoil	3
Myriophyllum spicatum	Eurasian watermilfoil	80
Potamogeton crispus	curly leaf pondweed	85
Potamogeton foliosis	leafy pondweed	8
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	25
Potamogeton pectinatus	sago pondweed	3
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	0

CAB-3

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	18
Chara sp	chara	0
Elodea canadensis	common elodea	25
Myriophyllum sibiricum	northern watermilfoil	0
Myriophyllum spicatum	Eurasian watermilfoil	78
Potamogeton crispus	curly leaf pondweed	60
Potamogeton foliosis	leafy pondweed	32
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	25
Potamogeton pectinatus	sago pondweed	12
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	0

NOX-4

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	38
Chara sp	chara	0
Elodea canadensis	common elodea	21
Myriophyllum sibiricum	northern watermilfoil	0
Myriophyllum spicatum	Eurasian watermilfoil	59
Potamogeton crispus	curly leaf pondweed	25
Potamogeton foliosis	leafy pondweed	18
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	0
Potamogeton pectinatus	sago pondweed	2
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	14

NOX-5

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	54
Chara sp	chara	0
Elodea canadensis	common elodea	13
Myriophyllum sibiricum	northern watermilfoil	13
Myriophyllum spicatum	Eurasian watermilfoil	54
Potamogeton crispus	curly leaf pondweed	21
Potamogeton foliosis	leafy pondweed	4
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	0
Potamogeton pectinatus	sago pondweed	4
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	42

NOX-6

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	46
Chara sp	chara	0
Elodea canadensis	common elodea	4
Myriophyllum sibiricum	northern watermilfoil	9
Myriophyllum spicatum	Eurasian watermilfoil	52
Potamogeton crispus	curly leaf pondweed	22
Potamogeton foliosis	leafy pondweed	0
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	0
Potamogeton pectinatus	sago pondweed	0
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	9

NOX-8

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	13
Chara sp	chara	0
Elodea canadensis	common elodea	25
Myriophyllum sibiricum	northern watermilfoil	0
Myriophyllum spicatum	Eurasian watermilfoil	38
Potamogeton crispus	curly leaf pondweed	25
Potamogeton foliosis	leafy pondweed	0
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	0
Potamogeton pectinatus	sago pondweed	0
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	0

NOX-10

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	50
Chara sp	chara	0
Elodea canadensis	common elodea	0
Myriophyllum sibiricum	northern watermilfoil	0
Myriophyllum spicatum	Eurasian watermilfoil	33
Potamogeton crispus	curly leaf pondweed	50
Potamogeton foliosis	leafy pondweed	0
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	0
Potamogeton pectinatus	sago pondweed	0
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	33

NOX-25

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	46
Chara sp	chara	0
Elodea canadensis	common elodea	35
Myriophyllum sibiricum	northern watermilfoil	0
Myriophyllum spicatum	Eurasian watermilfoil	12
Potamogeton crispus	curly leaf pondweed	15
Potamogeton foliosis	leafy pondweed	0
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	0
Potamogeton pectinatus	sago pondweed	8
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	31

NOX-56

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	20
Chara sp	chara	0
Elodea canadensis	common elodea	20
Myriophyllum sibiricum	northern watermilfoil	0
Myriophyllum spicatum	Eurasian watermilfoil	60
Potamogeton crispus	curly leaf pondweed	20
Potamogeton foliosis	leafy pondweed	0
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	20
Potamogeton pectinatus	sago pondweed	20
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	20

NOX-57

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	8
Chara sp	chara	8
Elodea canadensis	common elodea	8
Myriophyllum sibiricum	northern watermilfoil	0
Myriophyllum spicatum	Eurasian watermilfoil	15
Potamogeton crispus	curly leaf pondweed	8
Potamogeton foliosis	leafy pondweed	0
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	0
Potamogeton pectinatus	sago pondweed	8
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	15

NOX-58

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	17
Chara sp	chara	0
Elodea canadensis	common elodea	33
Myriophyllum sibiricum	northern watermilfoil	0
Myriophyllum spicatum	Eurasian watermilfoil	67
Potamogeton crispus	curly leaf pondweed	17
Potamogeton foliosis	leafy pondweed	0
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	0
Potamogeton pectinatus	sago pondweed	0
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	17

NOX-59

Scientific Name	Common Name	% Occurrence
Butomus umbellatus	flowering rush	0
Ceratophyllum demersum	coontail	37
Chara sp	chara	2
Elodea canadensis	common elodea	15
Myriophyllum sibiricum	northern watermilfoil	5
Myriophyllum spicatum	Eurasian watermilfoil	22
Potamogeton crispus	curly leaf pondweed	11
Potamogeton foliosis	leafy pondweed	0
Potamogeton illinoensis	Illinois pondweed	0
Potamogeton richardsonii	Richardson's pondweed	1
Potamogeton pectinatus	sago pondweed	14
Potamogeton praelongus	whitestem pondweed	0
Potamogeton zosteriformis	flatstem pondweed	0
Ranuculus aquatilis	white waterbuttercup	19