2016 Vegetation and Weevil Population Surveys

Prepared for:

Les Cheneaux Watershed Council

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1.0 Introduction

The native milfoil weevil (*Euhrychiopsis lecontei*), a specialist herbivore on Eurasian watermilfoil (*Myriophyllum spicatum*) (EWM), was augmented to an indigenous population in several bays of the Les Cheneaux Islands; Cedarville, Sheppard's and Smith's Bays. This aquatic insect was used as a management technique, called Milfoil Solutions®, to maintain dense stands of EWM by disrupting gas exchange and vital nutrients needed for stems to successfully overwinter. The purpose of the management approach is to allow more desirable native species an opportunity to compete with weakened milfoil.

EnviroScience (ES) biologists have been monitoring the changes to the plant community in these areas directly related to the milfoil weevil and its' impact on EWM since the inception of the program in 2007. However since 2013, ES was requested to capture a more detailed inventory of submersed and emergent aquatic plant community of the shorelines of the Les Cheneaux Chain of Islands (LCI) on Lake Huron. This was initiated after the infestation of EWM increased to approximately 1,000 acres throughout LCI in 2012. The first survey was to compile a complete inventory of native and invasive species throughout LCI (24 bays). The second and third year surveys focused more on 'high traffic areas' or where EWM was once recorded as dense. The 2016 survey, performed August 19th through the 25th, included more bays where EWM was notably starting to resurge (Table 1.0).

Table 1.0. Summary of 2016 Survey Areas

Survey Area	Abbreviation	Vegetation Survey Type	# Survey Points	Length Between Points/Transects (ft)	2016 Survey Date
Cedarville Bay	CB	AVAS	3	1000	8/23
Cedarville Bay	CVB	AVAS	1	350	8/22
Cedarville Bay*	CDB	PI	146	350	8/23-8/24
East LaSalle Channel	ESL	AVAS	9	500	8/22
Government Island	GVT	AVAS	4	1000	8/23
Hessel Harbor	HH	AVAS	7	500	8/19
Hill's Channel	HC	AVAS	8	1000	8/23
Islington Channel	IC	AVAS	26	250	8/21
Middle Entrance	ME	AVAS	3	500	8/22
Millpond	MLP	AVAS	1	Entire Surface Area of Pond	8/19
Muskellunge Bay	MSK	AVAS	16	500	8/20,8/22
North LaSalle Channel	NLS	AVAS	4	550	8/22
Sheppard's Bay*	SHP	PI	147	150, 350	8/21-8/22
Sheppard's Bay	SHP	AVAS	11	500	8/22
Smith's Bay*	SM	AVAS	9	500	8/19
Snow's Channel	SNO	AVAS	40	500	8/19-8/20
Wilderness Bay	WDS	AVAS	19	350	8/19

*Weevil Population Survey 8/24-8/25

2.0 Methods

Two vegetation survey methods were implemented throughout the chain of islands: an Aquatic Vegetation Assessment Site (AVAS) survey and a Point Intercept survey (Section 3.1). A weevil population survey was conducted in Cedarville Bay, Sheppard's Bay, and Smith's Bay following protocols established by EnviroScience (Section 3.2).

2.1 Aquatic Vegetation Assessment Sites (AVAS) Survey Methods

Qualitative vegetation sampling was performed using the Michigan DEQ guidance contained in Standard Procedures for Surveying Aquatic Plants. Survey areas were selected based on input from the Les Cheneaux Watershed Council (LCWC) and EnviroScience biologists in 2013 and repeated annually around the same time of the year for consistency. The boundary of each AVAS was determined using differential GPS technology. Plant community data was collected through visual and rake tow surveys along evenly-spaced transects of the littoral zone. In each of these transect zones, the presence and relative density of each aquatic plant species was determined and the information was recorded on the Standard Aquatic Vegetation Assessment Site Species Density Sheet developed by the State of Michigan. Visual and rake surveys were performed at each site until no new species were encountered and the biologists conducting the survey were confident that adequate information had been obtained to estimate the density of each species encountered. Species of unknown identity were placed in a sample bag, appropriately labeled, and identified using taxonomic keys at the completion of the survey. The approximate percentage of cumulative cover (%CC) was reported as cover codes A, B, C, and D to describe the approximate coverage of each plant between each transect and within each AVAS.

Cover Code and Map Color	Percent Cumulative Cover (%CC) Range
A	1-2%
B	3-20%
C	21-60%
D	61-100%

2.2 Point Intercept Survey Methods

A Point Intercept Survey (PI) was conducted in Cedarville Bay (CDB) and Sheppard's Bay (SHP) following methods outlined in Point Intercept and Line Intercept Methods for Aquatic Plant Management (Madsen, 1999). This survey method was chosen based on the relatively shallow depths and larger areas of both bays. A grid of evenly-spaced Point Intercepts was created using GPS technology and the surveyors navigated to each point along the grid. In each PI, the presence and relative density of each aquatic plant species was determined by a single rake tow. Once the rake was retrieved from a point, each species found on the rake was identified and assigned a density code for rake cover similar to the AVAS method. Species of questionable identity were identified at the completion of the survey.

2.3 Weevil Population Survey Methods

Survey methods developed by EnviroScience include qualitative and quantitative information to monitor changes occurring in both the weevil population and milfoil density over the course of time. Qualitative observations in these surveys included the overall density and health of milfoil, identification of native plant species present, and the presence of weevils and weevil-induced damage. Quantitative measurements included milfoil density and weevil population density. Milfoil density was determined by using a 0.09 meter PVC quadrat, randomly tossing it throughout the milfoil bed, and counting the stems within the quadrat. This count was converted to the number of milfoil stems per square meter (stems/m^2). Weevil population density (the average number of weevils per stem) was determined through lab analysis of 30 random stems collected at each site.

However with the decreasing density of EWM over the past two seasons, these quantitative measurements have been nearly impossible to collect. In 2016, EnviroScience biologists decided to collect stems of milfoil for the weevil population calculation by tossing the vegetation rake instead of tiring, swimming efforts. This method still proved to be difficult as 20-30 tosses were made to get enough stems from each site for analysis with the exception of Smith's Bay.

3.0 Vegetation Survey (AVAS and PI)

A total of 41 species were identified in the 2016 survey areas (Table 3.0) of which included five non-native species; Eurasian watermilfoil, Curlyleaf pondweed, Narrowleaf cattail, Purple loosestrife and Reed Canary grass.

Table 3.0 Vegetation Species Summary

Common Name	Scientific Name
Alternate watermilfoil	*Myriophyllum alterniflorum*
Arrowhead	*Sagittaria spp.*
Bladderwort	*Utricularia macrorhiza*
Blunt pondweed	*Potamogeton obtusifolius*
Bulrush	*Scirpus spp.*
Bushy pondweed/Slender naiad	*Najas flexilis*
Buttercup/White water buttercup	*Ranunculus aquatilis*
Cattail	*Typha latifolia*
Cattail (Narrowleaf)	*Typha angustifolia*
Chara	*Chara spp.*
Clasping Leaf pondweed	*Potamogeton richardsonii*
Coontail	*Ceratophyllum demersum*
Curlyleaf pondweed	*Potamogeton crispus*
Elodea	*Elodea canadensis*
Eelgrass	*Vallisneria americana*
Eurasian watermilfoil	*Myriophyllum spicatum*
Flatstem pondweed	*Potamogeton zosteriformis*
Floating Leaf pondweed	*Potamogeton natans*
Fries pondweed	*Potamogeton friesii*

Illinois pondweed	*Potamogeton illinoensis*
Large Leaf pondweed	*Potamogeton amplifolius*
Water lobelia	*Lobelia dortmanna*
Marigold	*Bidens beckii*
Nitella	*Nitella sp.*
Northern watermilfoil	*Myriophyllum sibiricum*
Phragmites	*Phragmites australis*
Pickerelweed	*Pontederia cordata*
Purple loosestrife	*Lythrum salicaria*
Reed Canary Grass	*Phalaris spp.*
Robbins'/Fern pondweed	*Potamogeton robbinsii*
Sago pondweed	*Stuckenia pectinata*
Sedge	*Juncus spp.*
Sheathed pondweed	*Stuckenia vaginata*
Spikerush	*Eleocharis acicularis*
Stiff pondweed	*Potamogeton strictifolius*
Thinleaf pondweed	*Potamogeton diversifolius*
Variable pondweed	*Potamogeton gramineus*
Water Stargrass	*Heteranthera dubia*
Whitestem pondweed	*Potamogeton praelongus*
White waterlily	*Nymphaea odorata*
Whorled watermilfoil	*Myriophyllum verticillatum*

Plant species from each designated location are presented in comparison tables below by number of years surveyed, four years to one year, not alphabetically. Milfoil distribution and density maps are located in Appendix A. This year AVAS maps include areas where Purple Loosestrife (PL) was observed represented by a single dot within the AVAS transects. Please note these are not exact locations of the species on the shoreline.

Four year surveys

3.1 Cedarville Bay (CDB [PI]) – 2013 to 2016

Twenty five species were identified from the point intercept survey in Cedarville Bay (Table 3.1). The dominant species observed this year include eel grass, chara and naiad while milfoil continues to decrease in density in the bay occurring in only 18 of the 146 points (Figure 3.1). The highest occurrence was eel grass which is problematic for boaters when it's flowering or inhabiting shallow areas. Narrowleaf cattail, another invasive species, was the same density as observed last year (less than 1% CC).

Table 3.1 Cedarville Bay Point Intercept Survey 2013-2016

Common Name	Scientific Name	2013 Percent of Points (146)	2014 Percent of Points (146)	2015 Percent of Points (113)	2016 Percent of Points (146)

Eelgrass	*Vallisneria americana*	52	66	58	55
Chara	*Chara sp.*	59	53	50	53
Naiad	*Najas flexilis*	30	39	67	51
Clasping-leaf pondweed	*Potamogeton richardsonii*	17	18	9	14
Eurasian watermilfoil	*Myriophyllum spicatum*	51	44	28	11
Robbins'/Fern pondweed	*Potamogeton robbinsii*	25	20	10	11
Illinois pondweed	*Potamogeton illinoensis*	16	12	16	10
Elodea	*Elodea canadensis*	28	15	9	9
Variable pondweed	*Potamogeton gramineus*	8	7	7	8
Large-leaf pondweed	*Potamogeton amplifolius*	12	14	4	8
Sheathed pondweed	*Stuckenia vaginata*	*	*	<1	8
Whorled watermilfoil	*Myriophyllum verticillatum*	*	*	<1	5
Nitella (common)	*Nitella sp.*	19	14	15	4
Flatstem pondweed	*Potamogeton zosteriformis*	6	1	9	4
Fries' pondweed	*Potamogeton friesii*	3	3	8	4
Water Stargrass	*Heteranthera dubia*	*	*	*	3
Marigold	*Bidens beckii*	2	5	2	2
Bulrush	*Scirpus sp.*	*	*	*	2
Blunt-leaf pondweed	*Potamogeton obtusifolius*	3	*	*	1
Burreed	*Sparganium sp.*	*	*	*	<1
Narrowleaf cattail	*Typha angustifolia*	*	*	<1	<1
Coontail	*Ceratophyllum demersum*	3	2	<1	<1
Floating-leaf pondweed	*Potamogeton natans*	*	*	*	<1
Needle spikerush	*Eleocharis acicularis*	*	*	*	<1
Thin-leaf pondweed	*Potamogeton pusillus*	*	1	<1	<1
Northern watermilfoil	*Myriophyllum sibiricum*	3	18	*	*
Stiff pondweed	*Potamogeton strictifolius*	<1	1	*	*
Alternate watermilfoil	*Myriophyllum alterniflorum*	<1	<1	*	*
Nitella (uncommon)	*Nitella sp.*	*	<1	*	*
Water lobelia	*Lobelia dortmanna*	<1	<1	*	*

**Species not found*

3.2 Hessel Harbor (HH [AVAS]) – 2013 to 2016**

This is being considered as a four year survey as the Hessel boat marina (AVAS transect 5, red box on Figure 3.2) was, in fact, surveyed all four years. In 2013, nine AVAS locations were created along the northern shoreline of Hessel Bay. The 2014 and 2015 surveys only concentrated on surveying the marina for invasive species while five AVAS transects (4-9) were completed in 2016.

Nineteen species were identified throughout the harbor, the most dominant still is chara (Table 3.2). Milfoil was observed to be increasing but still considered in low density. Curlyleaf pondweed, another invasive species, was observed in the marina but in low density (less than one percent). This invasive species can be just as problematic as EWM but it typically occur early in the season (May-June) prior to the onset of EWM.

Table 3.2 Hessel Harbor AVAS Comparison 2013-2016

Species	CC% 2013	CC% 2014	CC% 2015	CC% 2016
Chara	11.33	10.00	40.00	22.00
Eurasian watermilfoil	17.00	40.00	1.00	3.83
Clasping Leaf pondweed	0.11	1.00	*	1.67
Elodea	0.11	40.00	1.00	0.33
Eelgrass	1.33	1.00	1.00	0.33
Fries pondweed	*	*	1.00	0.33
Naiad	0.22	*	1.00	0.33
Bulrush	0.22	*	*	0.17
Buttercup	*	1.00	*	0.17
Coontail	*	*	*	0.17
Curlyleaf pondweed	*	*	*	0.17
Flatstem pondweed	0.11	10.00	*	0.17
Large Leaf pondweed	0.11	*	*	0.17
Nitella	*	*	*	0.17
Robbins/Fern pondweed	0.11	*	*	0.17
Stiff pondweed	*	*	*	0.17
Water Marigold	*	*	*	0.17
Sheathed pondweed	*	*	*	0.17
Whorled watermilfoil	1.11	*	*	0.17
Cattail	On shore	*	*	*
Northern watermilfoil	0.11	*	*	*
Thinleaf pondweed	0.11	1.00	*	*
Water Stargrass	0.11	*	*	*

** Species not found*

3.3 Islington Channel (IC [AVAS]) – 2013 to 2016

Twenty eight species were identified in Islington Channel, the highest diversity recorded over the four years, most of which were found to be occurring in low density (less than one percent) including EWM (Table 3.3). Although still in low density, EWM is on the rise according to the table. As observed in other survey areas, Chara is the dominant native species with 26.50% cumulative cover. This low growing, macroalgae species has been increasing over the last four years. Purple Loosestrife was identified in three locations within the channel (Figure 3.3).

Again, please note that these are not exact locations on the map but rather identified within the specific AVAS.

Table 3.3 Islington Channel AVAS Comparison 2013-2016

Species	CC% 2013	CC% 2014	CC% 2015	CC% 2016
Chara	8.96	16.23	17.39	26.50
Eelgrass	2.96	12.46	5.39	14.96
Cattail	2.73	*	0.87	11.96
Bulrush	21.62	*	13.00	11.12
Naiad	0.58	5.69	9.65	7.77
Variable pondweed	0.90	0.77	0.57	1.54
Clasping Leaf pondweed	0.58	1.77	0.48	1.12
Eurasian watermilfoil	27.81	0.77	0.17	0.77
Large Leaf pondweed	2.50	1.00	0.09	0.58
Nitella	0.23	1.54	0.26	0.58
Sheathed pondweed	*	*	0.04	0.58
Reed Canary Grass	1.58	*	*	0.50
Elodea	1.65	0.46	2.48	0.46
Flatstem pondweed	0.12	0.08	0.57	0.46
Floating-leaf pondweed	*	*	*	0.42
Purple Loosestrife	*	*	0.22	0.19
Illinois pondweed	2.19	5.62	0.13	0.12
Coontail	0.08	0.15	0.09	0.08
Phragmites	*	*	*	0.08
Pickerelweed	*	*	0.04	0.08
Pond lillies	*	*	*	0.08
Robbins/Fern pondweed	0.04	1.15	0.13	0.08
Sedge	*	*	*	0.08
Water Stargrass	0.08	*	0.04	0.08
Whorled watermilfoil	0.27	*	*	0.08
Bladderwort	*	*	*	0.04
Fries pondweed	0.46	0.23	0.22	0.04
Northern watermilfoil	0.46	0.08	*	0.04
Alternate watermifoil	0.04	*	*	*
Blunt pondweed	0.08	0.08	*	*
Marigold	0.08	0.23	0.17	*
Thinleaf pondweed	*	*	0.04	*
White waterlilly	*	*	0.04	*
Quillwort	*	0.08	*	*

*Species not found

3.4 Sheppards Bay (SHP [PI]) – 2013 to 2016

The first four point intercept locations were not accessible by boat; the area was consumed by bulrush. This area was not included in survey. One hundred and forty-three point intercept locations were surveyed. Milfoil was found in 22 of 143 points, an increase from last year (Figure 3.1). The overall plant diversity in the bay is decreasing (Table 3.4). Naiad, a low growing native species, was the dominant plant identified all throughout the bay again for a second year in a row. Purple Loosestrife was noted on the shoreline in five areas but not counted in the points as this survey only measures submersed species density at each point. These notations are visible on the Sheppard's Bay AVAS map, Figure 3.10. It was also noted that EWM had taken root on a rocky shoal off of Urie point. This area could be a good candidate for a fungal project.

Table 3.4 Sheppard's Bay Point Intercept Comparison 2013-2016

Common Name	Scientific Name	2013 Percent of Points (147)	2014 Percent of Points (147)	2015 Percent of Points (120)	2016 Percent of Points (143)
Naiad	*Najas flexilis*	41	48	70	71
Eelgrass	*Vallisneria americana*	48	45	49	43
Chara	*Chara sp.*	50	31	40	35
Variable pondweed	*Potamogeton gramineus*	12	9	8	22
Clasping-leaf pondweed	*Potamogeton richardsonii*	24	30	19	17
Eurasian watermilfoil	*Myriophyllum spicatum*	79	48	8	15
Robbins'/Fern pondweed	*Potamogeton robbinsii*	7	9	18	13
Fries' pondweed	*Potamogeton friesii*	<1	7	8	8
Illinois pondweed	*Potamogeton illinoensis*	7	14	7	8
Elodea	*Elodea canadensis*	7	2	6	8
Sheathed pondweed	*Potamogeton*	*	*	4	7
Flatstem pondweed	*Potamogeton zosteriformis*	5	*	3	6
Large-leaf pondweed	*Potamogeton amplifolius*	*	4	5	4
Marigold	*Bidens beckii*	<1	3	4	2
Nitella	*Nitella sp.*	1	10	10	2
Water Stargrass	*Heteranthera dubia*	3	*	*	1
Bulrush	*Scirpus sp.*	3	*	3	<1
Whorled watermilfoil	*Myriophyllum verticillatum*	3	*	2	<1
Coontail	*Ceratophyllum demersum*	1	1	3	*
Small pondweed	*Potamogeton*	*	*	2	*
Spikerush	*Eleocharis sp.*	*	*	<1	*
Stiff pondweed	*Potamogeton strictifolius*	<1	1	*	*
Blunt-leaf pondweed	*Potamogeton obtusifolius*	<1	<1	*	*

Floating-leaf pondweed	*Potamogeton natans*	*	<1	*	*
Northern watermilfoil	*Myriophyllum sibiricum*	*	<1	*	*
Yellow water-lily	*Nuphar lutea*	*	<1	*	*
Narrowleaf cattail	*Typha angustifolia*	<1	*	*	*
Thin-leaf pondweed	*Potamogeton pusillus*	1	*	*	*

**Species not found*

3.5 Smith's Bay (SM [AVAS]) – 2013 to 2016

A total of 18 species were identified, 16 native and 2 invasive, in 2016. The species of concern, EWM, was the lowest density observed over the four years at less than 1% cumulative cover (Table 3.5). Narrowleaf cattail was observed in the second transect (Figure 3.5) and is potentially inhabiting the southern portion of the bay near the weevil stocking site where a dense stand of cattails was observed but couldn't get close enough for a positive identification.

Table 3.5 Smith's Bay AVAS Comparison 2013-2016

Species	CC% 2013	CC% 2014	CC% 2015	CC% 2016
Naiad	0.67	3.67	12.00	17.78
Chara	16.89	0.17	10.50	16.11
Bulrush	11.22	13.50	12.00	12.44
Eelgrass	21.44	16.83	10.50	2.78
Burreed	*	*	*	1.22
Clasping Leaf pondweed	0.44	3.67	2.50	0.67
Eurasian watermilfoil	41.11	7.00	7.00	0.56
Flatstem pondweed	0.11	*	*	0.33
Sheathed pondweed	*	*	*	0.33
Variable pondweed	1.33	0.17	*	0.33
Elodea	0.33	2.00	0.50	0.22
Pickerelweed	0.11		*	0.22
Robbins/Fern pondweed	2.22	0.33	*	0.22
White waterlily	*	*	0.17	0.22
Narrowleaf cattail	*	*	*	0.11
Fries pondweed	*	*	2.33	0.11
Northern watermilfoil	4.78	0.17	*	0.11
Phragmites	*	*	*	0.11
Alternate watermilfoil	*	0.33	*	*
Floating Leaf pondweed	0.22	*	*	*
Large leaf pondweed	5.00	8.50	0.17	*
Nitella	*	*	0.17	*
Sago pondweed	0.11	*	*	*
Spadderdock	0.22	*	*	*
Whorled watermilfoil	1.67	0.17	*	*

Water Stargrass	1.67	0.17	*	*

*Species not found

Three year surveys

3.6 Cedarville Bay (CB [AVAS]) – 2014 to 2016

These three 1,000ft AVAS's start at the boat launch in Cedarville and moves eastward toward the marina (Figure 3.6). The diversity in the plant community is the highest recorded in 2016 over the three year period at 29 species (Table 3.6). However, the once monoculture of EWM is now a robust composition of Elodea, Flatstem pondweed and Coontail. It appears there may be some underlying water quality issues in this area contributing to the robust growth. All of which is very unlike what was observed in the rest of the bay in the point intercept survey. EWM was measured the same density in 2016 as 2015. Curlyleaf pondweed was observed in Pearson's Creek. Narrowleaf cattail was also identified near Pearson's Creek and along the shoreline in third AVAS transect. Purple Loosestrife was observed at the boat launch and within the wetland area near Pearson's Creek (Figure 3.6).

Table 3.6 Cedarville Bay AVAS Comparison 2014-2016

Species	CC% 2014	CC% 2015	CC% 2016
Elodea	30.00	53.67	30.00
Flatstem pondweed	0.67	0.67	30.00
Coontail	1.00	0.67	20.00
Eurasian watermilfoil	1.00	17.00	17.00
Eelgrass	17.00	1.00	13.33
Naiad	4.00	0.33	13.33
Narrowleaf cattail	*	26.67	4.00
Bulrush	*	0.33	3.67
Fries pondweed	0.67	14.00	1.00
Buttercup	*	*	0.67
Largeleaf pondweed	0.33	*	0.67
Pond lilies	*	*	0.67
Thinleaf pondweed	*	3.67	0.67
Variable pondweed	*	0.33	0.67
Arrowhead	*	*	0.33
Bladderwort	*	*	0.33
Burreed	*	*	0.33
Cattail	*	6.67	0.33
Chara	0.33	0.33	0.33
Curlyleaf pondweed	0.33	*	0.33
Floatingleaf pondweed	*	*	0.33
Illinois pondweed	3.33	3.33	0.33

Pickerelweed	*	*	0.33
Purple Loosestrife	*	*	0.33
Robbins pondweed	*	*	0.33
Sedge	*	*	0.33
Sheathed pondweed	*	*	0.33
Water Merigold	*	*	0.33
Whitestem pondweed	*	*	0.33
Blunt pondweed	0.67	*	*
Clasping leaf pondweed	0.67	*	*
Nitella	0.33	0.33	*
Whorled watermilfoil	*	*	*
White waterlily	*	0.67	*
Water Stargrass	*	0.67	*
Marigold	0.67	*	*

**Species not found*

3.7 East LaSalle Island (ELS [AVAS]) – 2014 to 2016

Milfoil was identified in all nine AVAS's along the eastern side of LaSalle Island for a total of 2.0% cumulative cover (Table and Figure 3.7). Narrowleaf cattail was observed along the shoreline in higher density at 2.56% CC. The densest submersed species in this area was naiad at 21.11% CC. Purple Loosestrife was identified in the 5th transect (Figure 3.7).

Table 3.7 East LaSalle Island AVAS Comparison 2014-2016

Species	CC% 2014	CC% 2015	CC% 2016
Naiad	0.44	4.78	21.11
Bulrush	*	28.89	17.89
Robbin's/Fern Pondweed	7.22	13.44	11.33
Chara	15.67	4.89	9.44
Eelgrass	10.22	7.22	8.89
Cattail	*	0.11	2.67
Narrowleaf cattail	*	*	2.56
Phragmites	*	1.22	2.56
Eurasian watermilfoil	13.56	5.00	2.00
Whorled watermilfoil	*	0.11	1.56
Clasping Leaf pondweed	1.44	0.33	0.78
Elodea	0.67	0.33	0.78
Flatstem pondweed	*	0.33	0.33
Sedge	*	*	0.33
Sheathed pondweed	*	*	0.33
Marigold	*	0.11	0.22

Alternate watermilfoil	2.22	0.11	0.11
Burreed	*	*	0.11
Buttercup	0.11	*	0.11
Fries pondweed	0.22	0.22	0.11
Purple loosestrife	*	0.11	0.11
Stiff pondweed	*	0.11	0.11
Curlyleaf pondweed	0.11	*	*
Coontail	*	0.11	*
Largeleaf pondweed	0.33	*	*
Lobelia	0.11	0.11	*
Northern watermilfoil	0.89	*	*
Nitella	0.11	0.56	*
Thinleaf pondweed	*	0.33	*
Variable pondweed	*	0.44	*
Water stargrass	*	0.11	*

**Species not found*

3.8 Hill's Channel (HC [AVAS]) – 2013, 2014 and 2016

EWM was identified in four of the nine AVAS transects at ratings of A for a cumulative cover of less than 1% (Figure 3.8). The overall species richness increased to 29 species (Table 3.8). For unknown reasons, Narrowleaf cattail was not measured in 2014. This invasive species was measured at the densest of species in the area at 20.25% CC.

Table 3.8 Hill's Channel AVAS Comparison 2013, 2014 and 2016

Species	CC% 2013	CC% 2014	CC% 2016
Narrow leaf Cattail	15.00	*	20.25
Bulrush	6.83	*	10.38
Naiad	3.83	20.00	7.75
Sedge	*	*	3.75
Chara	40.00	25.71	3.00
Variable pondweed	5.50	10.29	1.75
Cattail	*	*	1.50
Nitella	0.17	0.29	1.38
Pickerelweed	0.17	*	1.38
Robbins/Fern pondweed	0.50	3.00	1.38
Clasping Leaf pondweed	0.83	7.86	1.00
Eelgrass	8.67	3.29	0.75
Eurasian watermilfoil	16.83	2.00	0.50
Bladderwort	*	*	0.38
Fries pondweed	0.17	*	0.38

Floatingleaf pondweed	*	*	0.38
Lillies	*	*	0.38
Large Leaf pondweed	3.50	18.71	0.38
Sheathed pondweed	*	*	0.38
Whorled watermilfoil	0.33	0.14	0.38
Alternate watermilfoil	1.83	*	0.25
Native phragmites	*	*	0.25
Elodea	0.83	0.14	0.25
Water marigold	*	*	0.25
Blunt pondweed	0.33	0.14	0.13
Flatstem pondweed	0.17	*	0.13
Lobelia	*	0.14	0.13
Northern watermilfoil	1.83	0.29	0.13
Spikerush	0.17	*	0.13
Illinios pondweed	0.17	0.29	*
Pipewort	0.33	*	*
Stiff pondweed	0.17	*	*

**Species not found*

3.9 North LaSalle Island (NLS [AVAS]) – 2014 to 2016

Milfoil increased from 2015 to 2016 from less than 1% CC to over 3% CC (Figure and Table 3.9). Narrowleaf cattail was identified for the first time along the northern shoreline of LaSalle Island in 2016 (transects 2 and 4). Naiad and Eelgrass were the dominant submersed species recorded in the four AVAS's. Additionally, purple loosestrife was not observed in 2016 as it was the prior year.

Table 3.9. North LaSalle Island AVAS Comparison 2014-2016

Species	CC% 2014	CC% 2015	CC% 2016
Naiad	0.75	25.00	40.00
Eelgrass	32.5	5.50	25.00
Bulrush	*	15.00	15.00
Cattail	*	*	5.00
Narrowleaf cattail	*	*	5.00
Eurasian watermilfoil	15.25	0.75	3.25
Chara	0.5	0.75	0.50
Fries pondweed	0.5	0.25	0.50
Illinois pondweed	13	*	0.50
Large Leaf pondweed	15	0.75	0.50
Northern watermilfoil	0.25	*	0.50
Robbins/Fern pondweed	0.5	*	0.50
Water stargrass	*	*	0.50

Clasping Leaf pondweed	3	5.00	0.25
Elodea	*	0.25	0.25
Phragmites	*	0.25	0.25
Sedge	*	*	0.25
Variable pondweed	*	0.75	0.25
Flatstem pondweed	0.5	*	*
Lobelia	*	0.50	*
Marigold	*	0.25	*
Nitella	*	1.00	*
Purple loosestrife	*	0.25	*

**Species not found*

3.10 Sheppard's Bay (SHP [AVAS]) – 2014 to 2016

A navigation lane was dredged in Sheppard's Bay at the end of 2013. ES started monitoring the changes to the plant community in the lane from 2014 to 2016. This year it was noted that milfoil was starting to come back in the navigation lane but was increasing in density closer to shore (Figure 3.10). Naiad was the dominant submersed species observed in the lane (Table 3.10). Purple loosestrife locations are represented on the AVAS map from both surveys; PI and AVAS (Figure 3.10).

Table 3.10 Sheppard's Bay AVAS Comparison 2014-2016

Species	CC% 2014	CC% 2015	CC% 2016
Naiad	16.45	8.27	41.18
Eelgrass	6.18	5.09	11.09
Chara	8.55	2.55	3.82
Clasping Leaf pondweed	5.82	1.27	2.18
Illinois pondweed	0.45	0.09	2.00
Eurasian watermilfoil	2.64	1.49	1.64
Robbins/Fern pondweed	2.18	2.00	0.36
Elodea	0.36	0.36	0.27
Fries pondweed	1.00	0.45	0.27
Nitella	0.64	0.36	0.27
Bullrush	*	*	0.18
Largeleaf pondweed	*	0.27	0.18
Purple loosestrife	*	*	0.18
Flatstem pondweed	0.91	*	0.09
Sheathed pondweed	*	*	0.09
Variable pondweed	0.45	0.18	0.09
Whitestem pondweed	*	*	0.09
Whorled watermilfoil	*	*	0.09
Northern watermilfoil	0.27	*	*

Marigold	0.18	0.45	*
Water stargrass	0.09	*	*

*Species not found

Two year surveys

3.11 Cedarville Bay (CVB [AVAS]) – 2013 and 2016

A single AVAS along the southeast shore of LaSalle Island contained thirteen species: a decrease in diversity from 2013 (Figure and Table 3.11). Sparse milfoil was identified throughout the 1,000 ft transect with a rating of A; a drastic reduction from D in 2013. Chara was the densest species recorded at 40% CC.

Table 3.11 Cedarville Bay AVAS Comparison 2013 and 2016

Species	CC% 2013	CC% 2016
Chara	10.00	40.00
Bulrush	On shore	10.00
Naiad	1.00	10.00
Robbins/Fern pondweed	10.00	10.00
Alternate watermilfoil	1.00	1.00
Clasping Leaf pondweed	1.00	1.00
Eelgrass	10.00	1.00
Eurasian watermilfoil	40.00	1.00
Flatstem pondweed	1.00	1.00
Fries pondweed	1.00	1.00
Large Leaf pondweed	1.00	1.00
Whorled watermilfoil	10.00	1.00
Sheathed pondweed	*	1.00
Water Stargrass	1.00	*
Pipewort	1.00	*
Cattail	On shore	*
Northern watermilfoil	1.00	*
Phragmites	On shore	*
Reed Canary Grass	On shore	*
Spikerush	1.00	*
Variable pondweed	10.00	*
Variable pondweed	10.00	*

*Species not found

3.12 Government Bay (GVT [AVAS]) – 2013 and 2016

In 2013, EWM had a cumulative cover of 30% and decreased to less than 1% by 2016 in Government Bay. Bulrush and Chara were the densest species recorded in 2016 as in 2013.

Table 3.12 Government Bay AVAS Comparison 2013 and 2016

Species	CC% 2013	CC% 2016
Bulrush	20.25	13.00
Chara	20.50	12.75
Sedge	*	3.00
Phragmites	on shore	2.75
Eurasian watermilfoil	30.00	0.75
Naiad	0.25	0.75
Whorled watermilfoil	0.75	0.75
Clasping Leaf pondweed	0.25	0.50
Elodea	0.25	0.50
Eelgrass	10.25	0.50
Robbins/Fern pondweed	0.25	0.50
Blunt pondweed	0.25	0.25
Buttercup	0.25	0.25
Fries pondweed	0.50	0.25
Water Stargrass	0.25	0.25
Thin leaf pondweed	*	0.25
Flatstem pondweed	*	0.25
Sheathed pondweed	*	0.25
Alternate watermilfoil	0.25	*
Nitella	0.50	*
Northern watermilfoil	0.50	*
Reed Canary Grass	on shore	*
Variable pondweed	0.50	*

**Species not found*

3.13 Hessel Bay (HB [AVAS]) – 2013 and 2016

The ten AVAS's in Hessel Bay are located along the northeastern shore of Marquette Island (Figure 3.13). A total of 16 species were identified along the shoreline this year including Narrowleaf cattail (3%CC) and Eurasian watermilfoil (>1%CC) (Table 3.13). As observed in several other bays, Chara was the dominant submersed species.

Table 3.13 Hessel Bay AVAS Comparison 2013 and 2016

Species	CC% 2013	CC% 2016
Chara	54.00	64.00
Bulrush	0.10	27.00
Burreed	*	3.00
Narrowleaf cattail	*	3.00
Robbins/Fern pondweed	3.40	1.70
Eelgrass	2.50	1.40
Eurasian watermilfoil	53.00	0.70

Clasping Leaf pondweed	4.30	0.50
Naiad	1.20	0.50
Alternate watermilfoil	0.10	0.20
Large Leaf pondweed	12.20	0.20
Elodea	0.40	0.10
Northern watermilfoil	0.20	0.10
Phragmites	On shore	0.10
Variable pondweed	0.30	0.10
Whorled watermilfoil	6.50	0.10
Flatstem pondweed	0.50	*
Reed canary grass	On shore	*

**Species not found*

3.14 Middle Entrance (ME [AVAS]) – 2013 and 2016

Milfoil slightly increased by 3 percent when comparing 2013 to 2016 (Figure and Table 3.14). Eighteen species were identified, an increase in diversity from 2013, most of which were recorded at less than 1% CC. Chara was the dominant species recorded however it was found in less density than found in 2013.

Table 3.14 Middle Entrance AVAS Comparison 2013 and 2016

Species	CC% 2013	CC% 2016
Chara	40.00	4.00
Eurasian watermilfoil	0.67	3.67
Bullrush	3.67	1.00
Clasping Leaf pondweed	1.00	0.67
Fries pondweed	0.33	0.67
Sedge	*	0.67
Variable pondweed	0.67	0.67
Whorled watermilfoil	1.00	0.67
Alternate watermilfoil	*	0.33
Buttercup	*	0.33
Elodea	0.67	0.33
Eelgrass	0.67	0.33
Flatstem pondweed	0.67	0.33
Floatingleaf pondweed	*	0.33
Naiad	1.00	0.33
Nitella	*	0.33
Northern watermilfoil	*	0.33
Robbins/Fern pondweed	0.33	0.33

**Species not found*

3.15 Musky Bay (MSK [AVAS]) – 2013 and 2016

Purple Loosestrife was identified for the first time this year in the small bay south of Pleasant Point (Transect 7) in Musky Bay (Figure 3.15). Narrowleaf Cattail and Reed canary grass was also observed in the last transect, 15, located on the western shore of LaSalle Island. Milfoil was noted to have decreased in abundance. Both Bullrush (emergent) and Chara (submerserd) were equal in density (11.0%CC) (Table 3.15).

Table 3.15 Musky Bay AVAS Comparison 2013 and 2016

Species	CC% 2013	CC% 2016
Bulrush	17.73	11.00
Chara	30.73	11.00
Naiad	4.47	2.56
Eurasian watermilfoil	15.47	1.81
Eelgrass	2.60	1.69
Elodea	0.13	0.81
Clasping Leaf pondweed	2.40	0.50
Variable pondweed	0.33	0.38
Flatstem pondweed	0.87	0.31
Sedge	*	0.25
Fries pondweed	0.07	0.19
Sheathed pondweed	*	0.19
Large Leaf pondweed	7.67	0.13
Nitella	*	0.13
Narrowleaf cattail	*	0.13
Phragmites	*	0.13
Purple Loosestrife	*	0.13
Robbins/Fern pondweed	1.33	0.13
Burreed	*	0.06
Northern watermilfoil	*	0.06
Reed Canary Grass	on shore	0.06
Whorled watermilfoil	0.40	0.06
Alternate watermilfoil	0.07	*
Buttercup/White water buttercup	0.07	*
Water stargrass	0.07	*

**Species not found*

3.16 Snow's Channel (SNO [AVAS]) – 2013 and 2016

Purple Loosestrife was identified in at least 14 areas (AVAS transects) of Snow's Channel (Figure 3.16), an increase from 2013 (Table 3.16). Two new invasive species were discovered in 2016; Narrowleaf cattail and Reed canary grass. Milfoil, on a positive note, decreased

drastically throughout the channel from 42% CC to less than 1% CC. Naiad, also known as Bushy pondweed, was the most abundant species is the channel.

Table 3.16 Snow's Channel AVAS Comparison 2013 and 2016

Species	CC% 2013	CC% 2016
Naiad	2.23	15.50
Bulrush	10.40	7.43
Chara	21.40	6.33
Eelgrass	7.33	6.00
Clasping Leaf pondweed	0.73	0.60
Eurasian watermilfoil	42.00	0.55
Robbins/Fern pondweed	0.23	0.50
Purple Loosestrife	0.05	0.35
Burreed	*	0.25
Marigold	0.05	0.25
Narrowleaf cattail	*	0.25
Nitella	*	0.25
Sheathed pondweed	*	0.25
Large Leaf pondweed	3.13	0.23
Elodea	0.45	0.18
Flatstem pondweed	0.80	0.18
Variable pondweed	0.35	0.15
Fries pondweed	*	0.10
Water Stargrass	0.70	0.10
Floating Leaf pondweed	0.03	0.05
Northern watermilfoil	0.05	0.05
Sedge	*	0.05
Lobelia	0.03	0.03
Native cattail	*	0.03
Pickerel weed	*	0.03
Pond lillies	*	0.03
Reed Canary Grass	*	0.03
Cattail	0.50	*
Coontail	0.03	*
Phragmites	0.03	*
Thinleaf pondweed	0.05	*
Whorled watermilfoil	0.58	*

**Species not found*

3.17 Wilderness Bay (WDS [AVAS]) – 2013 and 2016

Very sparse EWM and Narrow leaf cattail was observed in Wilderness Bay (Figure and Table 3.17). Eighteen of the nineteen species identified were measured to be less than 1% CC in the bay.

Table 3.17 Wilderness Bay AVAS Comparison 2013 and 2016

Species	CC% 2013	CC% 2016
Bulrush	*	4.58
Chara	43.50	0.26
Eurasian watermilfoil	10.75	0.26
Phragmites	*	0.26
Clasping Leaf pondweed	2.55	0.21
Sago pondweed	0.05	0.21
Alternate watermilfoil	4.50	0.11
Eelgrass	0.70	0.11
Flatstem pondweed	0.30	0.11
Cattail	*	0.11
Northern watermilfoil	0.55	0.11
Robbins/Fern pondweed	1.15	0.11
Variable pondweed	6.80	0.11
Whorled watermilfoil	5.65	0.11
Elodea	1.25	0.05
Narrow-leaf Cattail	*	0.05
Fries Pondweed	*	0.05
Spikerush	0.10	0.05
Sheathed pondweed	*	0.05
Thinleaf pondweed	6.00	*

**Species not found*

One year Surveys

3.18 MillPond (MP [AVAS]) – 2016

The whole surface area of Millpond was surveyed for invasive species identifying milfoil and Narrowleaf cattail in low densities (Figure and Table 3.18). A total of 11 species were identified in the pond.

Table 3.18 MillPond AVAS 2016

Species	CC% 2016
Chara	2.11

Clasping Leaf pondweed	0.53
Cattail	0.53
Pond lilies	0.53
Eelgrass	0.05
Elodea	0.05
Eurasian watermilfoil	0.05
Narrow-leaf Cattail	0.05
Pickerelweed	0.05
Robbins/Fern pondweed	0.05
Naiad	0.05

4.0 Weevil Population Survey

The Milfoil Solutions® program was started in 2007 with much success and implemented again in 2011 and 2012. Since stocking over 100,000 weevils, EnviroScience biologists have been back nine non-consecutive years to monitor the success performing a follow-up survey around the same timeframe, mid-late August, each of those years (Table 4.0).

Table 4.0 Weevil Schedule 2007-2016

Bay	Year	Survey Dates	Sites – established and/or stocked	Number of Weevils Stocked
Cedarville Bay	2007	Initial: 6/21 Follow-up: 8/7	S1,S2, MA	15,500
	2008	Follow-up: 8/6	Survey	0
	2009	Follow-up:8/11	Survey	0
	2011	Initial:8/5 Follow-up:9/12	S3, MB	15,000
	2012	Initial: 6/27 Follow-up:8/30	S2, S3	12,000
	2013	Follow-up: 8/6	Survey	0
	2014	Follow-up: 8/12	Survey	0
	2015	Follow-up: 8/26	Survey	0
	2016	Follow-up: 8/24	Survey	0
Sheppard's Bay	2011	Initial:8/5 Follow-up:9/12	S1, MA	30,000
	2012	Initial: 6/27 Follow-up: 8/30	S1	14,000
	2013	Follow-up: 8/6	Survey	0
	2014	Follow-up: 8/12	Survey	0
	2015	Follow-up: 8/26	Survey	0
	2016	Follow-up: 8/25	Survey	0
Smith's Bay	2011	Initial:8/5 Follow-up:9/12	S1, MA	10,000
	2012	Initial: 6/27 Follow-up: 8/30	S1	5,000
	2013	Follow-up: 8/6	Survey	0
	2014	Follow-up: 8/12	Survey	0
	2015	Follow-up: 8/26	Survey	0
	2016	Follow-up: 8/25	Survey	0

4.1 Cedarville Bay

Eurasian watermilfoil was virtually absent in Cedarville Bay yet another year. As mentioned in the methods, efforts to collect stems were made by rake tosses from the boat. Five to thirty stems were found from three locations; S3, MA and MB. The 30 stems from S3 were found closer to the navigation channel where milfoil increased in density. Biologists decided to swim through the shallow area of S1 to search for milfoil as bulrush increased in density extending towards the channel making it unnavigable by boat; no milfoil was found. Fifteen rake tosses were made from Shoberg's property to the channel in S2 collecting only native species. Native species observed while swimming or on the rake tows included: chara, naiad, eel grass, flatstem pondweed, whorled watermilfoil, northern watermilfoil, claspingleaf pondweed, Illinois pondweed and bulrush.

The few stems collected were analyzed for weevil life stages at the ES lab and identifying larvae, pupal chambers and adults in 2 of the 3 sites: S3 and MA (Table 4.1.a). The table below compares the late season surveys weevil population counts. The highest population for S3 was recorded in 2016, identifying 3 weevil life stages. Density measurements were not collected in 2016 as efforts were focused on collecting stems for the population study (Table 4.1.b).

Table 4.1.a Late Season Weevil Population Density in Cedarville Bay

Site	Parameter measured	8/7/07	8/6/08	8/11/09	8/5/11	9/12/11	8/30/12	8/6/13	8/12/14	8/26/15	8/24/16
S1	Total weevils Total stems **Avg. weevils/stem**	11.00 30.00 **0.37**	9.00 30.00 **0.30**	21.00 30.00 **0.70**	8.00 30.00 **0.27**	1.00 30.00 **0.03**	2.00 30.00 **0.67**	36.00 30.00 **1.20**	50.00 30.00 **1.67**	**	**
S2	Total weevils Total stems **Avg. weevils/stem**	7.00 30.00 **0.23**	0.00 28.00 **0.00**	11.00 30.00 **0.37**	0.00 10.00 **0.00**	0.00 29.00 **0.00**	2.00 30.00 **0.67**	25.00 30.00 **0.83**	13.00 30.00 **0.43**	**	**
S3	Total weevils Total stems **Avg. weevils/stem**	*	*	*	0.00 30.00 **0.00**	0.00 30.00 **0.00**	0.00 30.00 **0.00**	1.00 30.00 **0.03**	1.00 30.00 **0.03**	**	3.00 30.00 **0.10**
MA	Total weevils Total stems **Avg. weevils/stem**	9.00 30.00 **0.30**	1.00 28.00 **0.036**	8.00 30.00 **0.27**	3.00 30.00 **0.10**	0.00 29.00 **0.00**	1.00 30.00 **0.03**	16.00 30.00 **0.53**	2.00 27.00 **0.07**	0.00 17.00 **0.00**	2.00 5.00 **0.40**
MB	Total weevils Total stems **Avg. weevils/stem**	*	*	*	*	0.00 30.00 **0.00**	0.00 30.00 **0.00**	0.00 30.00 **0.00**	0.00 29.00 **0.00**	**	0.00 10.00 **0.00**

** = site not established, ** = EWM not present or occurring at density too low to survey*

Table 4.1.b Average Density of EWM (stems/m^2) in Cedarville Bay

Site	8/7/07	8/6/08	8/11/09	8/5/11	9/12/11	8/30/12	8/6/13	8/12/14	8/26/15	8/24/16
S1	211.11	11.11	25.89	51.9	<10	120.37	15.87	75.93	**	**
S2	166.67	40.00	0.00	<10	<10	174.07	20.37	22.22	**	**
S3	*	*	*	77.8	163.0	88.89	70.37	75.93	**	**
MA	270.00	133.33	74.11	66.7	63.0	125.93	38.89	12.96	**	**
MB	*	*	*	*	144.4	81.48	42.59	79.37	**	**

** = site not established, ** = EWM not present or occurring at density too low to survey*

4.2 Sheppard's Bay

Sixteen rake tosses were made in the large stocking area of Sheppard's Bay, S1, in attempt to locate milfoil; native species were only collected. A total of 13 stems were collected in the monitoring site, MA, after an attempt of 15 rake tosses. Laboratory analysis of those stems revealed six weevil life stages, the highest population recorded since stocking in 2011 (Table 4.2.a). Just like that in Cedarville Bay, the milfoil density was too low for accurate measurements.

Table 4.2.a Weevil Population Density in Sheppard's Bay

Site	Parameter measured	8/5/11	9/12/11	8/30/12	8/6/13	8/12/14	8/26/15	8/25/16
S1	Total weevils Total stems **Avg. weevils/stem**	0.00 30.00 **0.00**	0.00 60.00 **0.00**	2.00 58.00 **0.07**	0.00 30.00 **0.00**	**	**	**
MA	Total weevils Total stems **Avg. weevils/stem**	5.00 30.00 **0.17**	0.00 30.00 **0.00**	1.00 30.00 **0.03**	8.00 30.00 **0.27**	0.00 30.00 **0.00**	0.00 27.00 **0.00**	6.00 13.00 **0.46**

*** = EWM not present or occurring at density too low to survey*

Table 4.2.b Average Density of EWM (stems/m^2) in Sheppard's Bay

Site	8/5/11	9/12/11	8/30/12	8/6/13	8/12/14	8/26/15	8/25/16
S1	74.1	211.1	195.30	55.56	**	**	**
MA	37.0	31.5	183.33	64.81	35.19	1.85	**

***=EWM not present or occurring at density too low to survey*

4.3 Smith's Bay

Damage indicative of weevils was noted on sparse milfoil while swimming within S1. Lab analysis revealed the highest weevil population recorded within the six years at .70 weevils per stem (Table 4.3.a). Milfoil made up 10% of the plant community and stem density was measured at 5.6 stems/m^2 (Table 4.3.b). Another observation made in the stocking site which has been observed in the past were an abundance of red water mites. This is only mentioned due to them being carnivorous on macro-invertebrates which could have a direct impact on weevil larvae.

EnviroScience biologist swam all along the shoreline to the monitoring area (MA). Sparse milfoil was noted closer to shore but not in the monitoring site; no density measurements were collected. Twenty random stems were collected for the weevil population analysis finding three life stages for an average .15 weevils/stem.

Table 4.3.a Weevil Population Density in Smith's Bay

Site	Parameter measured	8/5/11	9/12/11	8/30/12	8/6/13	8/12/14	8/26/15	8/25/16
S1	Total weevils Total stems **Avg. weevils/stem**	5.00 30.00 **0.17**	2.00 30.00 **0.07**	1.00 60.00 **0.02**	6.00 30.00 **0.20**	12.00 30.00 **0.40**	13.00 28.00 **0.46**	14.00 20.00 **0.70**
MA	Total weevils Total stems **Avg. weevils/stem**	*	0.00 30.00 **0.00**	0.00 30.00 **0.00**	6.00 29.00 **0.21**	3.00 29.00 **0.10**	0.00 30.00 **0.00**	3.00 20.00 **0.15**

** = site not established, ** = EWM not present or occurring at density too low to survey*

Table 4.3.b Average Density of EWM (stems/m^2) in Smith's Bay

Site	8/5/11	9/12/11	8/30/12	8/6/13	8/12/14	8/26/15	8/25/16
S1	137.0	113.9	235.19	19.05	33.33	16.67	5.60
MA	*	85.2	83.33	64.81	14.81	7.41	**

** = site not established, ** = EWM not present or occurring at density too low to survey*

5.0 Plant and Weevil Discussion

A diverse plant community of 43 species was identified throughout 24 bays of LCI in 2013. Since that initial survey, the densities of these species has shifted and changed in several bays from dense monocultures of EWM to layers of low growing, more desirable native species such as chara and naiad.

The 2016 survey found that those desirable native submersed plant community continues to outcompete Eurasian watermilfoil as well as emergent species are invading and moving into new territories of LCI. Although milfoil is still in low density throughout the eighteen areas surveyed, it is slowly on the rise creeping up around boat docks and marinas. The western shore of Sheppard's Bay, for instance, was the densest milfoil measured. In the bay, beds of milfoil were observed off Connor's Point, a rocky shoal off Urie Point and at Jerry's boat dock just to name a few. While the milfoil in Sheppard's Bay is on the comeback, it's still declining in Cedarville Bay. The densest area within Cedarville Bay was measured at the public boat launch eastward to the town marina with densities ranging from 1-60% cumulative cover (CB AVAS, Figure 3.6).

A few of the other non-native, problematic species were discovered in higher density and in new bays in 2016. Purple Loosestrife was found in several areas along the shoreline of Snows Channel, Cedarville Bay, Sheppards Bay and Islington Channel. New infestations included Musky Bay and East LaSalle Island. It was noted to be present in the 2015 survey along North LaSalle Island but not in 2016. Two species of cattail were observed emerging from the shoreline of several bays in the LCI; the native species (*T. latifolia*) and narrow-leaved cattail (*T. angustifolia*). However, together they can hybridize to form (T. glauca). Positive identification can prove to be difficult performing the current sampling procedures from a boat however, they

are morphologically distinguishable. The easiest way to differentiate the hybrid is by the flowering parts; the staminate and pistilate spikes which are separated by a half inch gap whereas the narrow-leaved flowering parts are separated by a few centimeters (Minnesota Bureau of Water and Soil Resource. Cattail Comparison: Broad leaf vs. Narrow leaf vs. Hybrid Cattails. 2008).

Reed Canary grass is considered non-native however through genetic testing, alien and native varieties have been documented. Native populations have been documented in Northern Michigan while invasive, alien populations that are problematic have been found in Southern Michigan (A. A. Reznicek, E. G. Voss, & B. S. Walters, February 2011, University of Michigan, *Michigan Flora Online*). The population within LCI does not demonstrate the invasive tendencies like that of an exotic or alien species.

Another observation made during the survey was the decrease in or lack of rare or special characteristic species such as Mare's tail, Water marigold and bladderwort to name a few. It is possible that these sensitive species exist in low densities and were not captured with the current sampling techniques used or have been out competed by other native species.

The most impressive change of the milfoil over the last 4 years has been documented in Cedarville and Sheppard's Bays, two weevil stocking locations. These changes can be seen from the Point Intercept survey in Figure 3.1. The third stocking location in Smith's Bay also revealed sparse milfoil in 2016. Even with the lack of milfoil, weevils were found in all three bays in 2016.

Whether the lack of milfoil is weevil related, seasonal variation, just a natural cycle of the plant or all of the above; milfoil will inevitably continue to increase in density within LCI. One mild winter or early spring is all it would take to jump start the growth patterns of milfoil to overtake the native species such as chara. If these unfavorable circumstances do occur, ES biologists hope for a gradual increase to allow the weevil population a chance to 'catch up' to hopefully keep the growth in check.

6.0 Literature Cited

Madsen, J. 1999. Point Intercept and Line Intercept Methods for Aquatic Plant Management. Aquatic Plant Control Technical Note. MI-02.

Michigan Flora Online. A. A. Reznicek, E. G. Voss, & B. S. Walters. February 2011. University of Michigan. Web. November, 2016. http://michiganflora.net.

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