2012 Progress Report of the Milfoil Solution® Program in

Blue Lake

Prepared for:

The Blue Lake Improvement Association

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I. Introduction

Eurasian watermilfoil (*Myriophyllum spicatum*, hereafter referred to as milfoil or EWM) is an exotic aquatic species that tolerates a wide range of growing conditions and out-competes native vegetation. Monocultures of milfoil limit recreational use, reduce biodiversity, and can cause detrimental changes to water temperature and dissolved oxygen in severe infestations. EnviroScience implemented a **Milfoil Solution®** program in 2010 using the native milfoil weevil to suppress milfoil growth at the request of the Blue Lake Improvement Association.

The North American beetle, the milfoil weevil (*Euhrychiopsis lecontei)*, has been augmented in Blue Lake, Multnomah County, Oregon. This weevil is a specialist herbivore of milfoil and damages the plant in multiple ways. The most significant impact is caused by weevil larvae as they damage the meristem, or growing tip, and burrow through the stem. Nutrient flow in the plant is disrupted and the stem loses buoyancy and collapses in the water column. A cascading effect pulls neighboring plants lower into the water column and the rate of photosynthesis is significantly reduced in these stems.

The following is a project outline of **Milfoil Solution®** at Blue Lake:

Year	Survey Dates	Sites Established	Number of Weevils Stocked
2010	Initial: 8/14 Follow-up: 9/27	S1, S2, M1	12,000
2011	Initial: 7/14 Follow-up: 9/7	***	20,000*
2012	Final Follow-up:7/23	***	***

** 8,000 weevils were stocked in addition to the contracted amount of 12,000 at no extra cost due to an excess in the culturing facility and the time-sensitive nature of live organisms.*

II. Survey Methods

An initial survey is performed prior to weevil stocking and a follow-up survey is conducted six to eight weeks later. These surveys are integral in monitoring changes that occur in both the augmented weevil population and the health of the milfoil over the course of the program in order to make informed management decisions. Qualitative observations in these surveys include the overall density and health of milfoil, identification of native plant species present, and the presence of weevils and weevil-induced damage. Quantitative measurements include milfoil density and weevil population density. Milfoil density is determined by randomly collecting stems throughout the milfoil bed using a quadrat. This sample is then converted to the number of stems per square meter (stems/m^2). Weevil population density (number of weevils per stem) is determined through lab analysis of stems sampled from three transect lines at each site. Identical survey methods are implemented for the final follow-up survey.

III. 2010 and 2011 Summary

EnviroScience biologists established two stocking sites in Blue Lake in 2010 (S1 and S2) (Figure 1). 6,000 weevils were stocked in each site for a total of 12,000. A monitoring site (M1) was established to compare conditions throughout the duration of the project. Prior to stocking weevils, an initial survey was performed at all three sites, gathering both qualitative and quantitative data to provide baseline information. All three sites contained little native plant diversity, with dense beds of EWM comprising most of the plant community. Only one adult weevil was found in 2010 and little weevil-induced damage was observed, indicating a small existing population. In 2011 20,000 weevils were stocked at S1 and S2 (10,000 at each site). An increase in the weevil population was observed from 2010 to 2011 after just one season of augmentation.

IV. 2012 Follow-up Survey

S1 – This bed of milfoil was patchy to moderately dense from the central area to the east side (towards the channel). Most stems were low growing and damaged. Multiple weevils were observed during the survey and during lab analysis (Table 1).

S2 –This bed of milfoil contains relatively sparse clusters of stems containing extensive weevil-induced damage. An adult weevil was observed during the survey and many weevil life stages were identified during stem sample analysis in the lab. While the milfoil at this site is sparse and damaged, outer lying beds were observed to the west of the stocking zone.

M1 – Moderately dense milfoil composes the majority of the plant community at this site. Milfoil here is noticeably healthier than at the stocking sites. A small weevil presence was detected from the analysis of samples.

In addition to Eurasian watermilfoil, plant species observed in the survey sites in 2012 included Curly leaf pondweed (*Potamogeton crispus*), Elodea (*Elodea canadensis*), Nitella (*Nitella spp.*), Sago pondweed (*P. pectinatus*), Small pondweed (*P. capillaceus*), Water Lily (*Nymphaea spp.*), Flat-stem pondweed (*P. zosteriformis*), and Chara (*Chara spp.*).

V. Discussion

Based on positive results from the 2012 survey, it appears that the Milfoil Solution® program at Blue Lake has significantly reduced the milfoil infestation after just two years of stocking (Table 2). Signs of milfoil suppression include reduction in density of the milfoil, maintenance of the stems below the lake surface at a non-nuisance level, and open areas within the stocking site.

Stem samples from the stocking sites included weevil life stages and exhibited indicators unique to a weevil population such as holes in the stems, damage to the growing tip (meristem), and extensively damaged areas where larvae have burrowed down the stems. Since few weevils were found prior to stocking, this indicates that the weevil population is successfully overwintering and returning to the lake. The weevil population at the untreated monitoring site (M1) increased in 2011, but a decrease was noted in 2012. This may be explained by the increase in stem density at this site.

The measured stem density of milfoil has decreased at both stocking sites (Table 2) and is expected to continue this trend as the weevil population grows. Many large, open areas were occupied by native aquatic plant species. Over the course of the program, areas of milfoil infestation have transitioned to a more natural distribution that supports a healthier ecosystem while improving recreational and aesthetic value.

IV. Future Recommendations

It is the recommendation of EnviroScience that annual monitoring is implemented as part of the milfoil management program when considering factors such as seasonal variability and the ability of milfoil to grow much faster than native species. Should the milfoil infestation rebound in the near future, a supplemental weevil stocking event should occur to deter future growth.

Please contact EnviroScience at (800) 940-4025 or slomske@enviroscienceinc.com with questions regarding this report.

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Table 1. Weevil population analysis (weevils/stem), 2010-2012.

Site	Parameter measured	August 14, 2010	September 27, 2010	July 14, 2011	September 7, 2011	July 23, 2012
S1	**Total weevils**	0.00	0.00	1.00	9.00	3.00
	Total stems	27.00	30.00	30.00	30.00	28.00
	Avg. weevils/stem	**0.00**	**0.00**	0.03	**0.30**	**0.11**
S2	**Total weevils**	1.00	0.00	3.00	9.00	12.00
	Total stems	30.00	30.00	30.00	30.00	30.00
	Avg. weevils/stem	**0.03**	**0.00**	0.10	**0.30**	**0.40**
M1	**Total weevils**	0.00	0.00	2.00	30.00	1.00
	Total stems	30.00	30.00	30.00	30.00	30.00
	Avg. weevils/stem	**0.00**	**0.00**	**0.07**	**1.00**	**0.03**

Table 2. Densities of Eurasian watermilfoil (stems/m^2), 2010-2012.

Site	August 14, 2010	September 27, 2010	July 14, 2011	September 7, 2011	July 23, 2012
S1	114.4	91.7	307.4	96.3	36.1
S2	111.1	102.8	107.4	100.0	44.4
M1	125.0	129.7	188.9	107.4	150.0

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