

# Lake Eden 2023 Pre-Treatment Eurasian Water Milfoil Inventory

June 19, 2023



### 1. Introduction

In June of 2023, Arrowwood Environmental was retained by the Lake Eden Association to map Eurasian water milfoil (EWM) in Lake Eden, Vermont. The purpose of the inventory was to create a map of EWM in the lake for use in targeting control efforts. This brief report summarizes the methods and findings of that inventory.

### 2. Methods

The study area for the inventory consisted of the entire waterbody of Lake Eden as defined by the shoreline derived from the Vermont Hydrography Dataset (VHD). Two different methods were used to inventory for the presence of invasive species: 1) Visual Littoral Surveys; 2) Underwater SCUBA Surveys. The methodology used for each of these survey types is outlined below.

### a. Visual Littoral Survey

The entire perimeter of the lake was circumnavigated in a motorboat and the littoral zone was visually surveyed for the presence EWM. Water visibility allowed for the survey of areas 8 feet deep and less with this method. In some cases, vigorous plants of EWM could be detected in 10' deep water. The map in Appendix 2 shows the areas that were surveyed using this method.

### b. Underwater SCUBA Surveys

Underwater SCUBA Surveys were conducted in high priority areas where Visual Littoral Surveys were deemed insufficient for detecting EWM. These areas were chosen based on their proximity to known locations of EWM and areas that provided suitable habitat for EWM. These areas were surveyed by the diver either being towed behind a motorboat using a planer board or by swimming compassed-based transects through the area (or a combination of the two methods). Underwater SCUBA Surveys were conducted in four areas as shown on the map in Appendix 2: 1) Public boat launch; 2) Along the north shore south of the boat launch; 3) Area near the public beach and; 4) Boy Scout camp.



### c. Mapping EWM Occurrences

When EWM was detected, a GPS point was taken along with a count of the number of plants present, area occupied by the plants and the water depth. In three cases, the population of EWM was better mapped using boundaries. In these circumstances, GPS points were taken to define the edges of the EWM population, and these converted to polygons as shown in the maps in Appendix 2. For the Underwater surveys where the diver was towed behind the motorboat, the locations of EWM were marked using marker buoys and data collection occurred from the boat once the survey was completed. During underwater transects, data was collected by the field assistant in a kayak.

### 3. Results

The locations of EWM in the lake are shown on the maps in Appendix 2. The Tables in Appendix 1 lists each location along with number of plants, area occupied by the occurrence and water depth. In addition to these occurrences, 5 individual EWM plants were removed during the Underwater SCUBA Survey at the public beach area. Though widespread EWM control was beyond the scope of this inventory, these plants were removed because they were somewhat isolated and may have been difficult to locate by the DASH crew.

Every effort was made to detect all of the EWM in the lake. However, due to the size of the lake and the limited underwater visibility, some EWM may have been missed. The area in the vicinity of the public beach, in particular, is quite large and should be scanned by the DASH crew for EWM occurrences that may have been missed by the current inventory. As shown in the map in Appendix 2, no EWM plants were documented in the southwestern end of the lake. However, 12 fragments of EWM were found (and removed) floating in this area. Given wind and water currents, this area should be monitored later in the season for any EWM that may become established from fragments.



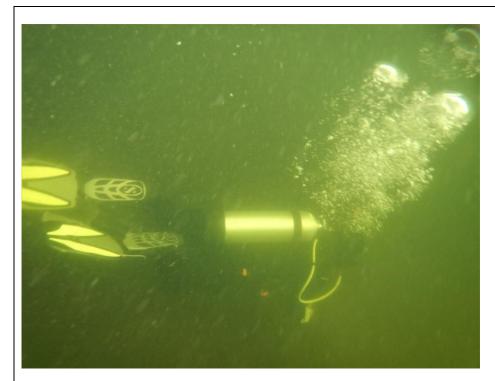


EWM near Boy Scout camp 6/15/2023



EWM near public boat launch 6/12/2023





Underwater SCUBA Survey 6/15/2023



EWM flowering near public beach 6/15/2023



# Appendix 1

## **Table of EWM Occurrences**



3         1         2         44.717361         -72.504003           3         1         2         44.717361         -72.504003           5         2         2         44.717566         -72.502907           3         2         10         44.717506         -72.502471           3         1         2         44.717506         -72.495809           3         1         2         44.727449         -72.495402           4         1         2         44.72829         -72.495402           3         1         2         44.72829         -72.495402           3         1         2         44.728279         -72.495402           3         1         2         44.728277         -72.495402           3         1         2         44.728277         -72.495409           4         1         2         44.728025         -72.495409           4         1         2         44.728325         -72.495809           6         1         2         44.728325         -72.495809           6         1         2         44.728325         -72.495891           10         1         2         4	Depth (ft)	Plant Count	Diameter (ft)	Lat	Long
5         2         2         44.717551         -72.502907           3         2         10         44.717506         -72.502471           3         1         2         14.727449         -72.494886           2         2         5         44.727649         -72.495099           3         1         2         44.728029         -72.495162           4         1         2         44.728472         -72.495402           3         1         2         44.728472         -72.495402           3         1         2         44.728472         -72.495716           6         2         2         44.728402         -72.497309           4         1         2         44.72866         -72.495916           6         1         2         44.728055         -72.496899           6         1         2         44.728325         -72.496899           6         1         2         44.728327         -72.495828           10         1         2         44.72837         -72.4959501           6         1         2         44.728323         -72.501622           9         1         2	3	1	2	44.715906	-72.509998
3         2         10         44.717506         -72.502471           3         1         2         44.727469         -72.49886           2         2         5         44.727669         -72.495162           4         1         2         44.728029         -72.495162           4         1         2         44.72829         -72.495711           6         2         2         44.728472         -72.495711           6         2         2         44.72666         -72.497511           6         2         2         44.72602         -72.501612           6         1         2         44.72602         -72.501612           6         1         2         44.72835         -72.495961           6         1         2         44.726773         -72.495961           6         1         2         44.726773         -72.495961           10         1         2         44.72673         -72.49591           6         1         2         44.72673         -72.49592           10         1         2         44.726412         -72.50668           6         1         2         44.72643<	3	1	2	44.717361	-72.504003
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10         1         2         44.728046         -72.495377           12         1         2         44.728187         -72.49581           12         1         2         44.728266         -72.495839           12         1         2         44.728094         -72.496311           4         2         2         44.719279         -72.50806           4         2         2         44.719307         -72.508086           8         1         20         44.719287         -72.508463           7.5         1         2         44.719054         -72.500865           11         1         2         44.719287         -72.500865           11         1         2         44.719287         -72.500865           11         1         2         44.719287         -72.500865           11         1         2         44.719287         -72.500865           11         1         2         44.719287         -72.500865           11         1         2         44.719287         -72.50065           11         1         2         44.719288         -72.50017           8         1         10					
12         1         2         44.728187         -72.49581           12         1         2         44.728266         -72.495839           12         1         2         44.728094         -72.496311           4         2         2         44.719279         -72.50806           4         2         2         44.719307         -72.508086           8         1         20         44.719287         -72.508463           7.5         1         2         44.719054         -72.510065           11         1         2         44.71928         -72.510065           11         1         2         44.719128         -72.510001           10         1         2         44.719128         -72.500176           8         1         10         44.720981         -72.500144           8         1         2         44.721127         -72.500547           2         1         2         44.721127         -72.500547           2         1         2         44.72126         -72.50057           10         1         10         44.721232         -72.50057           0         1         10					
12         1         2         44.728266         -72.495839           12         1         2         44.728094         -72.496311           4         2         2         44.719279         -72.50806           4         2         2         44.719307         -72.508086           8         1         20         44.719287         -72.508463           7.5         1         2         44.719054         -72.510065           11         1         2         44.719054         -72.510001           10         1         2         44.719128         -72.500176           8         1         10         44.720981         -72.500144           8         1         2         44.721127         -72.500144           8         1         2         44.721127         -72.500547           2         1         2         44.721127         -72.500547           2         1         2         44.721127         -72.500547           10         1         10         44.72126         -72.50057           10         1         10         44.72126         -72.500547           2         2         44.721027 <td></td> <td></td> <td></td> <td></td> <td></td>					
12         1         2         44.728094         -72.496311           4         2         2         44.719279         -72.50806           4         2         2         44.719307         -72.508086           8         1         20         44.719287         -72.508463           7.5         1         2         44.719054         -72.510065           11         1         2         44.71928         -72.510001           10         1         2         44.719128         -72.5008176           8         1         10         44.720981         -72.500144           8         1         2         44.721127         -72.500547           2         1         2         44.72126         -72.500547           2         1         2         44.72126         -72.500547           10         1         10         44.72126         -72.50057           10         1         10         44.721232         -72.50057           10         1         10         44.721232         -72.500189           4         5         10         44.719599         -72.500189           4         5         10					
4         2         2         44.719279         -72.50806           4         2         2         44.719307         -72.508086           8         1         20         44.719287         -72.508463           7.5         1         2         44.719054         -72.510065           11         1         2         44.718829         -72.510001           10         1         2         44.719128         -72.508176           8         1         10         44.720981         -72.500144           8         1         2         44.721127         -72.500547           2         1         2         44.72126         -72.500547           2         1         2         44.72126         -72.50057           10         1         10         44.72132         -72.50057           10         1         10         44.72132         -72.500745           0         1         10         44.72164         -72.495029           6         2         2         44.721027         -72.500189           4         5         10         44.718988         -72.502312           9         3         30					
4         2         2         44.719307         -72.508086           8         1         20         44.719287         -72.508463           7.5         1         2         44.719054         -72.510065           11         1         2         44.718829         -72.510001           10         1         2         44.719128         -72.508176           8         1         10         44.720981         -72.500547           2         1         2         44.721127         -72.500547           2         1         2         44.72126         -72.500547           2         1         2         44.72126         -72.500547           10         1         10         44.721232         -72.50057           10         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721027         -72.500189           4         5         10         44.718988         -72.500219           9         3         30         44.718988         -72.500221           40         2         6					
8         1         20         44.719287         -72.508463           7.5         1         2         44.719054         -72.510065           11         1         2         44.718829         -72.510001           10         1         2         44.719128         -72.508176           8         1         10         44.720981         -72.500144           8         1         2         44.721127         -72.500547           2         1         2         44.72126         -72.500547           2         1         2         44.72126         -72.50057           10         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721032         -72.500745           0         1         10         44.721032         -72.500189           4         5         10         44.718988         -72.500189           4         5         10         44.718988         -72.509251           9         2         10					
7.5         1         2         44.719054         -72.510065           11         1         2         44.718829         -72.510001           10         1         2         44.719128         -72.508176           8         1         10         44.720981         -72.500144           8         1         2         44.721127         -72.500547           2         1         2         44.72126         -72.50057           10         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500189           4         5         10         44.717599         -72.500212           9         3         30         44.71888         -72.502312           9         2         10         44.71886         -72.509224           40         2         6					
11         1         2         44.718829         -72.510001           10         1         2         44.719128         -72.508176           8         1         10         44.720981         -72.500144           8         1         2         44.721127         -72.500547           2         1         2         44.72126         -72.50057           10         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500745           0         1         10         44.721232         -72.500189           4         5         10         44.715999         -72.500189           4         5         10         44.718988         -72.500212           9         3         30         44.71886         -72.500297           9         2         10         44.720387         -72.499613           10         5         5					
10         1         2         44.719128         -72.508176           8         1         10         44.720981         -72.500144           8         1         2         44.721127         -72.500547           2         1         2         44.72126         -72.500547           10         1         10         44.721232         -72.500745           0         1         10         44.721322         -72.500745           0         1         10         44.721027         -72.500745           0         1         10         44.721027         -72.500189           6         2         2         44.721027         -72.500189           4         5         10         44.717599         -72.502312           9         3         30         44.71888         -72.502312           9         2         10         44.71886         -72.509275           9         2         10         44.71886         -72.50022           40         2         6         44.720387         -72.499613           10         5         5         44.720566         -72.499695           5         14         10					
8       1       10       44.720981       -72.500144         8       1       2       44.721127       -72.500547         2       1       2       44.72126       -72.50057         10       1       10       44.721232       -72.500745         0       1       10       44.727614       -72.495029         6       2       2       44.721027       -72.500189         4       5       10       44.717599       -72.502312         9       3       30       44.718988       -72.509975         9       2       10       44.71886       -72.509975         9       2       10       44.71886       -72.50022         40       2       6       44.720387       -72.499613         10       5       5       44.720472       -72.499828         5       2       30       44.720566       -72.499695         5       14       10       44.717557       -72.502627         9       13       5       44.724316       -72.500827         8.5       10       2       44.719283       -72.507471         10       7       2       44.719289					
8       1       2       44.721127       -72.500547         2       1       2       44.72126       -72.50057         10       1       10       44.721232       -72.500745         0       1       10       44.72164       -72.495029         6       2       2       44.721027       -72.500189         4       5       10       44.71599       -72.502312         9       3       30       44.718988       -72.509975         9       2       10       44.71886       -72.51022         40       2       6       44.720387       -72.499613         10       5       5       44.720472       -72.499828         5       2       30       44.720566       -72.499695         5       14       10       44.71557       -72.502627         9       13       5       44.724316       -72.500827         8.5       10       2       44.719283       -72.507471         10       7       2       44.719289       -72.508975         10       2       2       44.719289       -72.508412         6       4       20       44.720652					
2       1       2       44.72126       -72.50057         10       1       10       44.721232       -72.500745         0       1       10       44.727614       -72.495029         6       2       2       44.721027       -72.500189         4       5       10       44.717599       -72.502312         9       3       30       44.718988       -72.509975         9       2       10       44.71886       -72.51022         40       2       6       44.720387       -72.499613         10       5       5       44.720472       -72.499828         5       2       30       44.720566       -72.499695         5       14       10       44.717557       -72.502627         9       13       5       44.724316       -72.500827         8.5       10       2       44.719283       -72.507471         10       7       2       44.719289       -72.508975         10       2       2       44.719289       -72.508412         6       4       20       44.720652       -72.499762         10       5       2       44.720385 <td></td> <td></td> <td></td> <td></td> <td></td>					
10       1       10       44.721232       -72.500745         0       1       10       44.727614       -72.495029         6       2       2       44.721027       -72.500189         4       5       10       44.717599       -72.502312         9       3       30       44.718988       -72.509975         9       2       10       44.71886       -72.51022         40       2       6       44.720387       -72.499613         10       5       5       44.720472       -72.499828         5       2       30       44.720566       -72.499695         5       14       10       44.717557       -72.502627         9       13       5       44.724316       -72.500827         8.5       10       2       44.719283       -72.508975         10       2       2       44.719289       -72.508975         10       2       2       44.719187       -72.508412         6       4       20       44.720652       -72.499762         10       5       2       44.720385       -72.499779					
0       1       10       44.727614       -72.495029         6       2       2       44.721027       -72.500189         4       5       10       44.717599       -72.502312         9       3       30       44.718988       -72.509975         9       2       10       44.71886       -72.51022         40       2       6       44.720387       -72.499613         10       5       5       44.720472       -72.499828         5       2       30       44.720566       -72.499695         5       14       10       44.717557       -72.502627         9       13       5       44.724316       -72.500827         8.5       10       2       44.719283       -72.507471         10       7       2       44.719289       -72.508975         10       2       2       44.719289       -72.509224         20       6       2       44.719187       -72.508412         6       4       20       44.720652       -72.499762         10       5       2       44.720385       -72.499779					
6       2       2       44.721027       -72.500189         4       5       10       44.717599       -72.502312         9       3       30       44.718988       -72.509975         9       2       10       44.71886       -72.51022         40       2       6       44.720387       -72.499613         10       5       5       44.720472       -72.499828         5       2       30       44.720566       -72.499695         5       14       10       44.717557       -72.502627         9       13       5       44.724316       -72.500827         8.5       10       2       44.719283       -72.507471         10       7       2       44.719289       -72.508975         10       2       2       44.719289       -72.509224         20       6       2       44.719187       -72.508412         6       4       20       44.720652       -72.499762         10       5       2       44.720385       -72.499779					
4       5       10       44.717599       -72.502312         9       3       30       44.718988       -72.509975         9       2       10       44.71886       -72.51022         40       2       6       44.720387       -72.499613         10       5       5       44.720472       -72.499828         5       2       30       44.720566       -72.499695         5       14       10       44.717557       -72.502627         9       13       5       44.724316       -72.500827         8.5       10       2       44.719283       -72.507471         10       7       2       44.719289       -72.508975         10       2       2       44.719289       -72.509224         20       6       2       44.719187       -72.508412         6       4       20       44.720652       -72.499762         10       5       2       44.720385       -72.499779					
9       3       30       44.718988       -72.509975         9       2       10       44.71886       -72.51022         40       2       6       44.720387       -72.499613         10       5       5       44.720472       -72.499828         5       2       30       44.720566       -72.499695         5       14       10       44.717557       -72.502627         9       13       5       44.724316       -72.500827         8.5       10       2       44.719283       -72.507471         10       7       2       44.719259       -72.508975         10       2       2       44.719289       -72.509224         20       6       2       44.719187       -72.508412         6       4       20       44.720652       -72.499762         10       5       2       44.720385       -72.499779					
9       2       10       44.71886       -72.51022         40       2       6       44.720387       -72.499613         10       5       5       44.720472       -72.499828         5       2       30       44.720566       -72.499695         5       14       10       44.717557       -72.502627         9       13       5       44.724316       -72.500827         8.5       10       2       44.719283       -72.507471         10       7       2       44.719259       -72.508975         10       2       2       44.719289       -72.509224         20       6       2       44.719187       -72.508412         6       4       20       44.720652       -72.499762         10       5       2       44.720385       -72.499779	4		10	44.717599	
40       2       6       44.720387       -72.499613         10       5       5       44.720472       -72.499828         5       2       30       44.720566       -72.499695         5       14       10       44.717557       -72.502627         9       13       5       44.724316       -72.500827         8.5       10       2       44.719283       -72.507471         10       7       2       44.719259       -72.508975         10       2       2       44.719289       -72.509224         20       6       2       44.719187       -72.508412         6       4       20       44.720652       -72.499762         10       5       2       44.720385       -72.499779		3	30		-72.509975
10     5     5     44.720472     -72.499828       5     2     30     44.720566     -72.499695       5     14     10     44.717557     -72.502627       9     13     5     44.724316     -72.500827       8.5     10     2     44.719283     -72.507471       10     7     2     44.719259     -72.508975       10     2     2     44.719289     -72.509224       20     6     2     44.719187     -72.508412       6     4     20     44.720652     -72.499762       10     5     2     44.720385     -72.499779	9		10	44.71886	-72.51022
5     2     30     44.720566     -72.499695       5     14     10     44.717557     -72.502627       9     13     5     44.724316     -72.500827       8.5     10     2     44.719283     -72.507471       10     7     2     44.719259     -72.508975       10     2     2     44.719289     -72.509224       20     6     2     44.719187     -72.508412       6     4     20     44.720652     -72.499762       10     5     2     44.720385     -72.499779	40	1	6	44.720387	-72.499613
5     14     10     44.717557     -72.502627       9     13     5     44.724316     -72.500827       8.5     10     2     44.719283     -72.507471       10     7     2     44.719259     -72.508975       10     2     2     44.719289     -72.509224       20     6     2     44.719187     -72.508412       6     4     20     44.720652     -72.499762       10     5     2     44.720385     -72.499779		5	5	44.720472	-72.499828
9     13     5     44.724316     -72.500827       8.5     10     2     44.719283     -72.507471       10     7     2     44.719259     -72.508975       10     2     2     44.719289     -72.509224       20     6     2     44.719187     -72.508412       6     4     20     44.720652     -72.499762       10     5     2     44.720385     -72.499779	5	2	30	44.720566	-72.499695
8.5     10     2     44.719283     -72.507471       10     7     2     44.719259     -72.508975       10     2     2     44.719289     -72.509224       20     6     2     44.719187     -72.508412       6     4     20     44.720652     -72.499762       10     5     2     44.720385     -72.499779		14		44.717557	-72.502627
10     7     2     44.719259     -72.508975       10     2     2     44.719289     -72.509224       20     6     2     44.719187     -72.508412       6     4     20     44.720652     -72.499762       10     5     2     44.720385     -72.499779	9	13	5	44.724316	-72.500827
10     2     2     44.719289     -72.509224       20     6     2     44.719187     -72.508412       6     4     20     44.720652     -72.499762       10     5     2     44.720385     -72.499779	8.5	10	2	44.719283	-72.507471
20     6     2     44.719187     -72.508412       6     4     20     44.720652     -72.499762       10     5     2     44.720385     -72.499779	10	7	2	44.719259	-72.508975
6     4     20     44.720652     -72.499762       10     5     2     44.720385     -72.499779	10	2	2	44.719289	-72.509224
10 5 2 44.720385 -72.499779	20	6	2	44.719187	-72.508412
	6	4	20	44.720652	-72.499762
10 16 20 44.720998 -72.500324	10	5	2	44.720385	-72.499779
	10	16	20	44.720998	-72.500324



Depth (ft)	Plant Count	Diameter (ft)	Lat	Long
8	7	10	44.720921	-72.500155
12	3	10	44.728085	-72.496125
6	2	2	44.721221	-72.500775
11	6	NA	44.721129	-72.500585
10	22	NA	44.719084	-72.508306
10	60	NA	44.720246	-72.499739

# EWM polygons

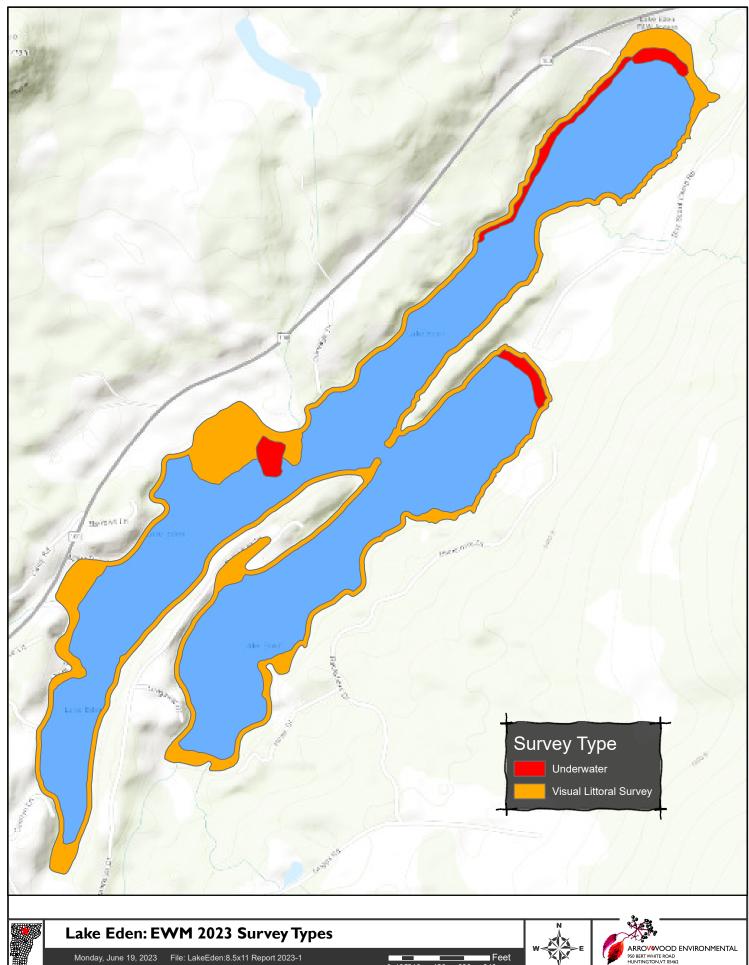
Site Name	Depth (ft)	Plant Count	Diameter (ft)	Lat	Long
Α	2	59	5	44.72852	-72.495418
В	10	50% cover	2	44.718829	-72.507541
С	3	26	5	44.721143	-72.500275



# Appendix 2

# **Maps of Survey Areas and EWM Occurrences**

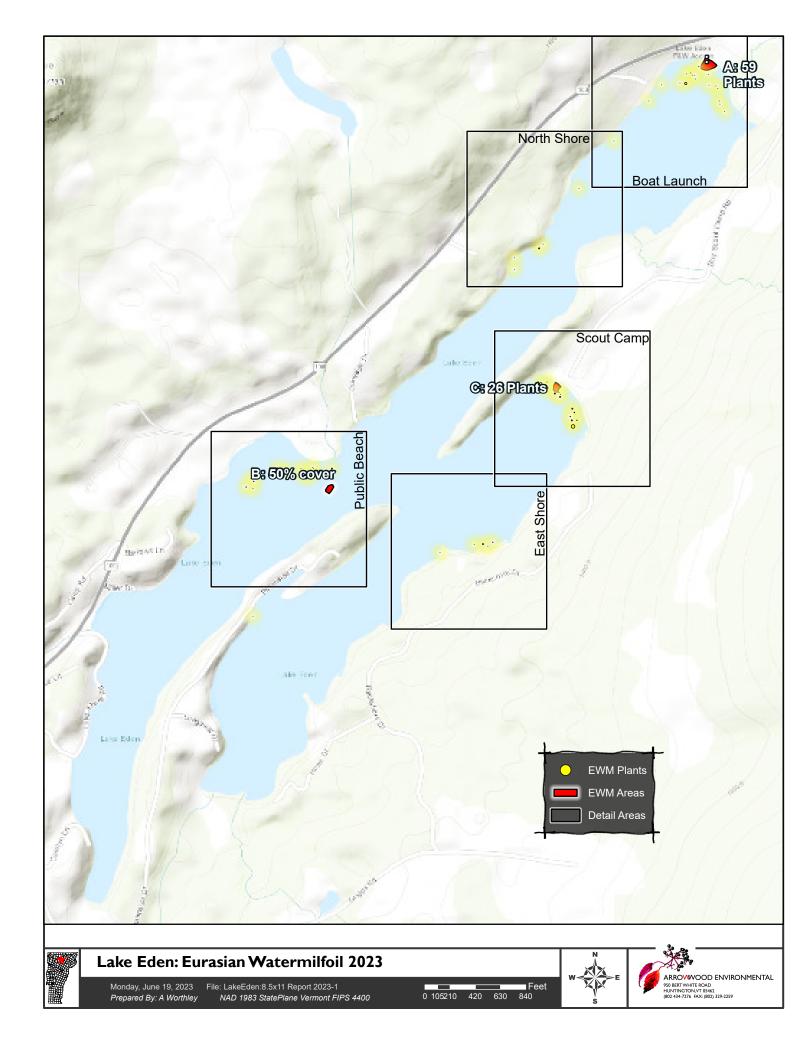


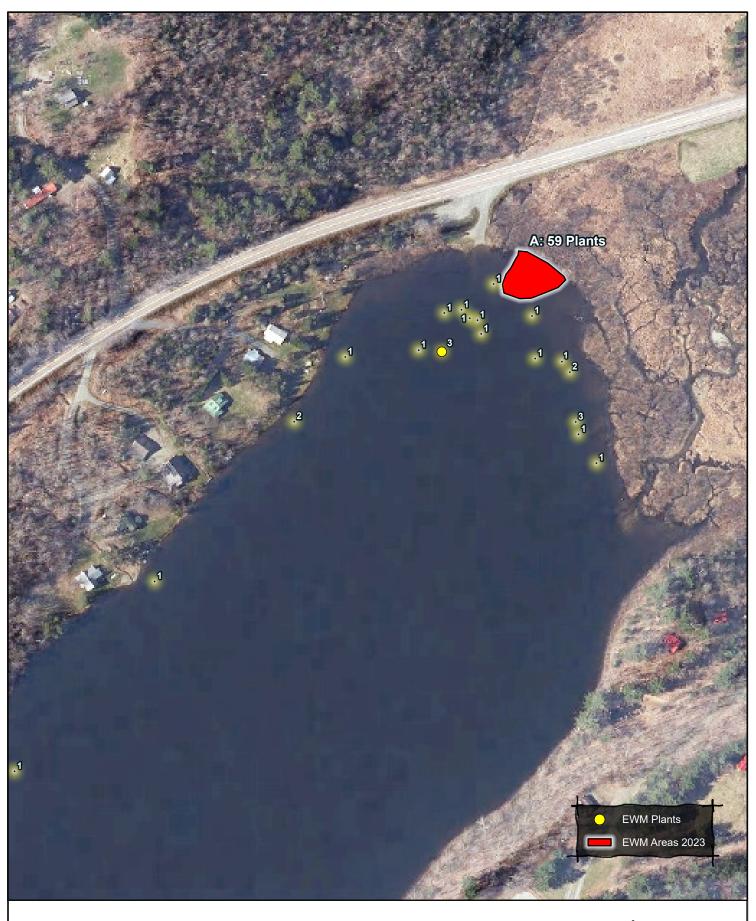










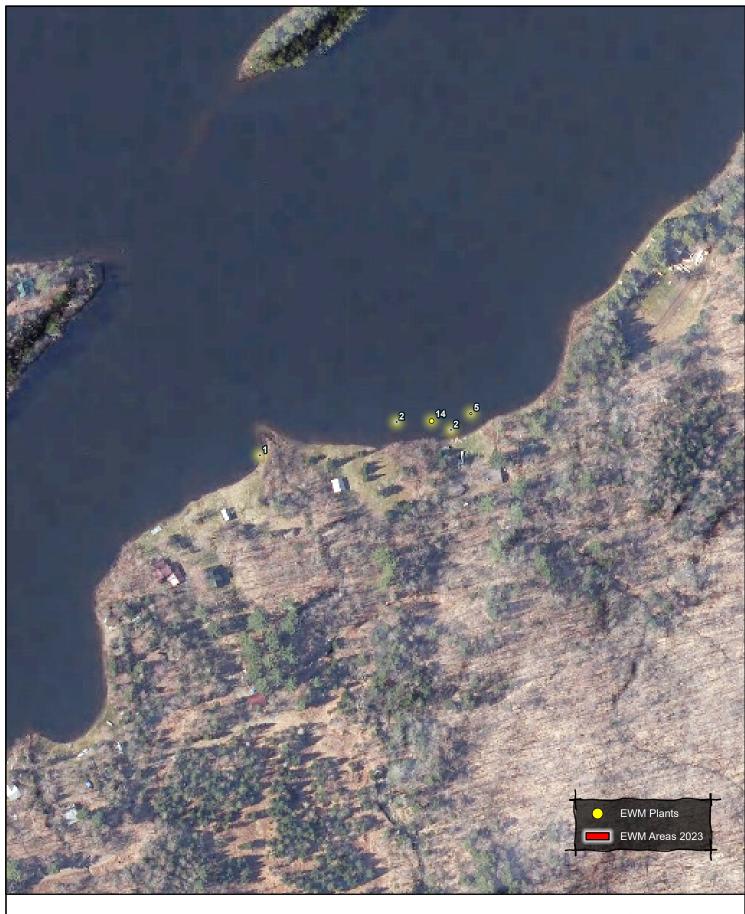




Lake Eden: EWM 2023 DETAIL: Boat Launch





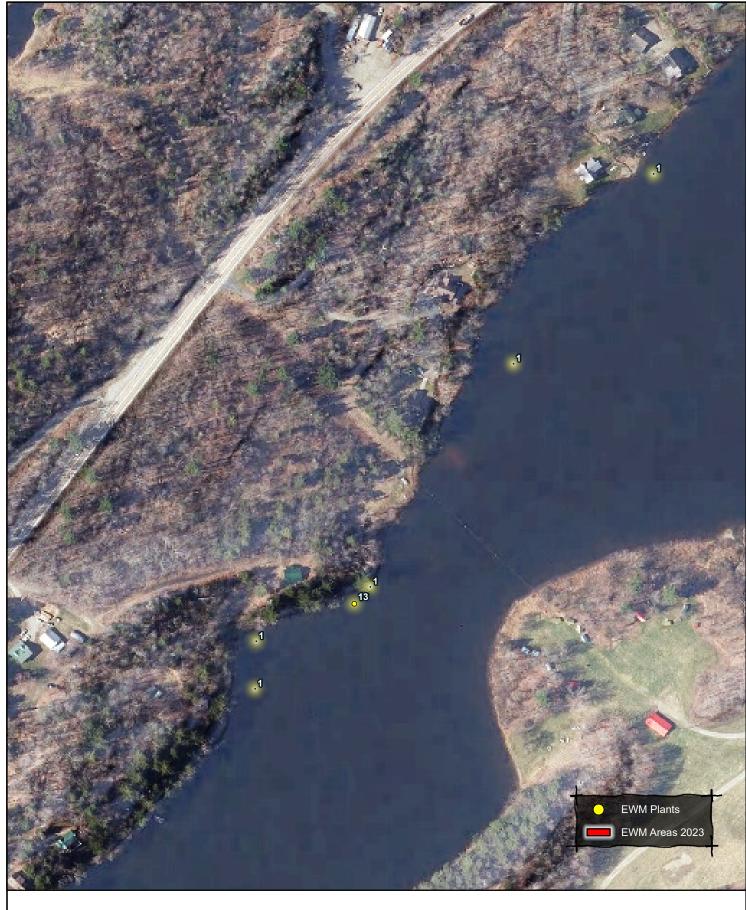




Lake Eden: EWM 2023 DETAIL: East Shore









Lake Eden: EWM 2023 DETAIL: North Shore









Lake Eden: EWM 2023 DETAIL: Public Beach

Monday, June 19, 2023 File: LakeEden:8.5x11 Report 2023-2
Prepared By: A Worthley NAD 1983 StatePlane Vermont FIPS 4400



Feet 0 25 50 100 150 200







Lake Eden: EWM 2023 DETAIL: Scout Camp





