We Energies
Eurasian Water Milfoil -
2010 Management Plan Summary

In 2007, We Energies began implementation of a long-term management program for studying the effectiveness of various control methods and implementation of these methods. An experimental project utilizing manual, chemical, and biological controls was conducted in 2007. Manual (hand pulling) controls were found to be ineffective, while chemical controls were found to be relatively effective after a single treatment. Biological controls were implemented on three reservoirs: Brule, Lower Paint, and Twin Falls. Positive trends were immediately observed in both Lower Paint and in Brule. These included a sharp drop in the cover of Eurasian water milfoil, an increase in native diversity and cover, and evidence of successfully reproducing native milfoil weevils (*Euhrychiopsis lecontei)*. While conducting the weevil release, indigenous populations of the native weevils were observed at both Brule and Lower Paint. Conversely, no weevils were observed in or around the release site at Twin Falls pre or post-release, which occurred in Badwater Lake.

Cowboy Lake in the Kingsford Reservoir exhibited similar characteristics to Badwater Lake during both the 2006 and 2007 seasons. Both water bodies contained the largest extent of Eurasian water milfoil growth as well as the highest densities. Based on the apparent lack of weevils in Badwater Lake, we suspected that one of two factors could be playing a role in why Eurasian water milfoil is growing at such high distribution and densities in these two lakes. We suspected that either significant predation was occurring or weevil reproduction was oppressed by the presence of a hybrid milfoil strain.

The results from 2007 led to the development of a multi-faceted management program. Implementation began in 2008 and has continued trough 2010. With the discovery of indigenous weevil populations at two reservoirs and the apparent lack of weevils at Twin Falls, the 2008 and 2009 activities have been focused on evaluating the extent to which indigenous populations are present in the system. We've also studied how other factors could be affecting the weevil reproduction potential. Work over the past three seasons has focused on the following objectives:

- characterizing the indigenous weevil population throughout the system (2008-10)
- determining whether successful weevil reproduction could occur on known hybrid strains of Eurasian water milfoil (2008)
- evaluating the extent to which weevil predation is occurring: in Twin Falls (i.e. Badwater Lake) and Kingsford (i.e. Cowboy Lake) both 2008-09; Big Quinnesec Falls (2009); Lower Paint and Brule (2010)
- collect baseline water quality measurements at sample locations in all reservoirs (2008-10)
- supplementing indigenous weevil populations with additional weevils, and evaluate the resulting affects (2007-10)

Indigenous weevil populations were found in each of the nine reservoirs studied in 2008. The nine reservoirs were selected as they are the only ones with Eurasian water milfoil present. Half of the reservoirs were resampled in 2009. All nine reservoirs were resampled in 2010. Correlations are developing between weevil populations and increasing/decreasing trends in Eurasian water milfoil spatial distribution and density. Weevil populations varied from one reservoir to another, with the highest populations generally occurring in reservoirs with either fewer stands of milfoil or the lowest average densities. Where Eurasian water milfoil is on an increasing trend, weevil populations are tending to decline.

Attached is a summary report from EnviroScience, Inc. describing the methods and summarizing the results from the weevil population surveys conducted in 2008-2010, the fish predation study, and the weevil release work.

We Energies is currently developing the management program to be carried out in 2010. Facets of this plan include the following items:

- Replication of plan methods implemented from 2008 through 2010 to continue developing an understanding of indigenous populations, predation on these populations, and the affects indigenous populations are having,
- Conducting additional supplemental weevil releases,
- Monitoring of the affects of prior weevil releases, and
- Cooperating with an independent study being run by the Dickinson County Conservation District. The objective of this study is to evaluate Eurasian water milfoil and hybrid forms through a genetic analysis. Preliminary results from the 2010 genetics work reveal that a majority of the invasive milfoil occurring in the Menominee system are hybrid milfoils. Analyses of these results are currently occurring. Additional genetic sampling and analysis are planned from 2011.

2010 Progress Report of Milfoil Biological Control Research for the
Menominee River

Prepared for:

WE Energies
333 W. Everett St.
Milwaukee, WI 53203

Prepared by:

EnviroScience, Inc.,
3781 Darrow Road, Stow, Ohio 44224
(800) 940-4025 · www.enviroscienceinc.com

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EnviroScience, Inc
3781 Darrow Road, Stow, OH 44224
(800) 940-4025 Fax: (330)688-3858.
www.envirosciencein c.com

INTRODUCTION

Since 2008 EnviroScience has been contracted to further investigate the milfoil weevil (*Euhrychiopsis lecontei*) and its potential to control Eurasian watermilfoil (*Myriophyllum spicatum*) (EWM) within the Menominee River watershed. Fish predation, weevil distribution, and the weevil's ability to utilize hybrid milfoil have been the main focus of the investigation.

1.0 WEEVIL DISTRIBUTION METHODS

The distribution study has been consistently performed during the second week of July for the past three years. In 2008, all nine reservoirs were surveyed as a base for the study. It was decided to survey only half the reservoirs in 2009. Based on the drastic changes observed over the two years, all nine reservoirs were surveyed in 2010.

Stems of EWM were collected along the same transects taken in 2008. This was achieved by collecting pairs of plants along a transect line running perpendicular to shore and swimming through selected beds of EWM. The tops of two randomly selected plants were removed at five evenly spaced intervals, for a total of ten plants along each line. Plants were shipped overnight EnviroScience's Ohio lab after collection for assessment of all weevil life stages.

Water quality measurements were taken at each transect, measuring pH, temperature, dissolved oxygen (DO), and conductivity using a YSI 556 MPS multi-parameter water quality monitoring device. All measurements were taken at the surface.

1.1 WEEVIL DISTRIBUTION RESULTS

1.1.1 Big Quinnesec Reservoir

On July 7, 2010, a total of 65 weevils were found on 59 stems collected from 6 of the 7 transects in Big Quinnesec Reservoir, which is comparatively similar to the 2009 results (Figure 1-1). EWM was not collected along transect 5 (T5), native plants were observed

Figure 1-1. WE Energies Big Quinnesec Hydro Project. 2008, 2009, & 2010 Weevil Distribution Survey.

Survey Transect

BQF_pts (WE Energies)

BQF_poly (WE Energies)

510 255 0 510 Meters

1,500 750 0 1,500 Feet

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2006 NAIP imagery courtesy of USDA. 2007 vegetation points and polygons appear as provided by WE Energies.

throughout the bay. The lowest weevil densities were found along T1 and T4 which has been a gradual decrease over the last three seasons (Table 1-1). Compared to 2009, the weevil population is increasing in T2, T3, T6 and T7. In regards to the area of T2, EWM was replaced by northern watermilfoil in 2009 but was observed to be moving back in sporadically close to shore. On a positive note, 7 weevils were found on the 9 stems collected.

During the 2010 survey the temperature at each area was recorded at its highest value to date while the Dissolved Oxygen (DO) was significantly lower. No true correlation with weevils and water quality can be made at this time.

Table 1-1 2008 (Gray), 2009 (White) and 2010 (Yellow) Stem Analysis and Water Quality Data at Each Transect in Big Quinnesec Reservoir

	Water Quality				Stem Counts			Weevil Count	
Transect	Cond	Temp	pH	DO	Stems	Meristems	Ave. Meristem/ Stem	Total Weevils	Ave. Weevils/ Stem
1	0.162	22.78	8.31	7.54	10	25	2.5	14	1.40
1	0.205	22.96	8.25	9.56	10	8	0.8	10	1.00
1	0.180	24.44	7.90	6.61	10	27	2.7	3	0.30
2	0.161	23.25	8.09	8.33	9	26	2.9	23	2.56
2	0.196	22.97	8.37	9.69	-	-	-	-	-
2	0.183	25.48	7.97	7.02	9	11	1.2	7	0.80
3	0.162	23.14	8.06	7.86	10	23	2.3	30	3.00
3	0.205	23.68	8.78	11.90	10	14	1.4	4	0.40
3	0.182	25.81	8.45	8.45	10	15	1.5	13	1.30
4	0.159	22.50	8.14	7.53	10	30	3.0	49	4.90
4	0.191	23.08	8.38	9.12	10	23	2.3	10	1.00
4	0.179	24.16	7.98	5.98	10	14	1.4	3	0.30
5	0.162	22.86	8.04	7.58	10	18	1.8	11	1.10
5	0.205	23.00	8.29	9.16	10	22	2.2	15	1.50
5	0.180	25.00	8.29	6.98	-	-	-	-	-
6	0.164	23.32	8.14	8.70	10	23	2.3	17	1.70
6	0.208	23.45	8.41	9.20	10	15	1.5	7	0.70
6	0.182	25.74	8.27	7.31	10	15	1.5	15	1.50
7	0.163	23.33	8.12	9.11	10	28	2.8	27	2.70

7	0.187	23.56	8.41	10.70	10	15	1.5	15	1.50
7	0.182	25.74	8.41	7.82	10	25	2.5	24	2.40
				2008 TOTAL	**69**	**173**	**2.5**	**171**	**2.48**
				2009 TOTAL	**60**	**97**	**1.6**	**61**	**1.02**
				2010 TOTAL	**59**	**107**	**1.8**	**65**	**1.10**

1.1.2 Kingsford Reservoir

The EWM appeared dense in a majority of the transect locations during the 2009 population study. This year the milfoil was considered to be sparse to moderately dense within the river channel and Cowboy Lake. On July 10, 2010, 146 stems of EWM were collected along the same 15 transect locations used in 2008 and 2009 (Figure 1-2). The overall population increased from 2009 but was still lower than in 2008. Lab analysis revealed weevil life stages from every location sampled with the exception of T15 in Cowboy Lake (Table 1-2). The surface temperature readings were closer to what was recorded in 2008.

Table 1-2 2008 (Gray)**,** 2009 (White) and 2010 (Yellow) Stem Analysis and Water Quality Data at Each Transect in Kingsford Reservoir

	Water Quality				Stem Counts			Weevil Count	
Transect	Cond	Temp	pH	DO	Stems	Meristems	Ave. Meristem/ Stem	Total Weevils	Ave. Weevils/ Stem
1	0.165	25.61	8.24	7.60	10	25	2.5	48	4.80
1	0.192	21.94	8.49	9.36	10	7	0.7	2	0.20
1	0.190	27.07	8.65	8.90	10	18	1.8	19	1.90
2	0.161	24.40	7.90	7.44	10	30	3.0	51	5.10
2	0.188	21.36	8.32	9.07	10	7	0.7	2	0.20
2	0.181	25.45	8.09	7.19	10	25	2.5	31	3.10
3	0.165	25.66	7.99	7.16	10	21	2.1	29	2.90
3	0.177	21.36	8.21	8.92	10	6	0.6	2	0.20
3	0.188	26.00	8.30	7.68	10	27	2.7	20	2.00
4	0.165	25.54	7.92	7.40	10	26	2.6	26	2.60
4	0.191	21.49	8.24	8.97	10	6	0.6	1	0.10
4	0.186	26.13	8.32	7.78	9	19	2.1	25	2.80
5	0.164	25.37	8.09	9.43	9	15	1.7	24	2.67
5	0.192	21.44	8.27	8.87	10	25	2.5	11	1.10

5	0.192	27.87	8.91	-	10	21	2.1	5	0.50
6	0.169	25.02	7.81	12.60	10	19	1.9	29	2.90
6	0.193	21.99	8.27	9.29	10	23	2.3	24	2.40
6	0.174	25.62	8.15	7.34	10	14	1.4	24	2.40
7	0.192	30.15	8.38	9.65	10	22	2.2	26	2.40
7	0.195	22.28	8.30	9.15	10	26	2.6	3	0.30
7	0.191	29.72	9.32	11.37	10	21	2.1	12	1.20
8	0.172	27.01	8.35	9.83	10	18	1.8	6	0.60
8	0.196	21.80	8.25	9.00	10	16	1.6	4	0.40
8	0.193	29.43	9.27	9.47	9	13	1.4	3	0.30
9	0.186	28.19	8.19	8.58	10	15	1.5	36	3.60
9	0.196	21.63	8.19	8.89	10	22	2.2	2	0.20
9	0.191	27.71	8.85	8.74	9	24	2.7	17	1.89
10	0.175	28.62	8.17	8.50	9	14	1.6	17	1.89
10	0.203	22.84	8.46	9.67	10	23	2.3	2	0.20
10	0.192	28.21	8.37	7.70	10	20	2.0	28	2.80
11	0.174	29.52	8.69	8.92	10	15	1.5	16	1.60
11	0.196	22.88	8.50	9.62	10	13	1.3	4	0.40
11	0.190	28.00	8.51	7.98	9	18	2.0	13	1.40
12	0.170	28.34	8.75	9.03	10	22	2.2	0	0.00
12	0.188	22.91	8.81	9.73	10	18	1.8	3	0.30
12	0.185	27.74	8.86	8.11	10	24	2.4	7	0.70
13	0.171	28.25	8.73	9.17	10	19	1.9	11	1.10
13	0.189	23.07	8.79	8.76	10	5	0.5	0	0.00
13	0.191	28.70	8.86	8.11	10	27	2.7	6	0.60
14	0.166	27.13	8.85	9.51	9	18	2.0	3	0.30
14	0.187	22.27	8.80	10.01	10	2	0.2	0	0.00
14	0.189	28.31	8.95	7.84	10	28	2.8	1	0.10
15	0.172	28.94	8.83	9.35	10	14	1.4	3	0.30
15	0.184	22.38	8.82	10.19	10	17	1.7	2	0.20
15	0.183	27.97	9.04	8.71	10	23	2.3	0	0.00
				2008 TOTAL	**147**	**293**	**2.0**	**329**	**2.24**
				2009 TOTAL	**150**	**216**	**1.4**	**62**	**0.41**
				2010 TOTAL	**146**	**322**	**2.2**	**211**	**1.45**

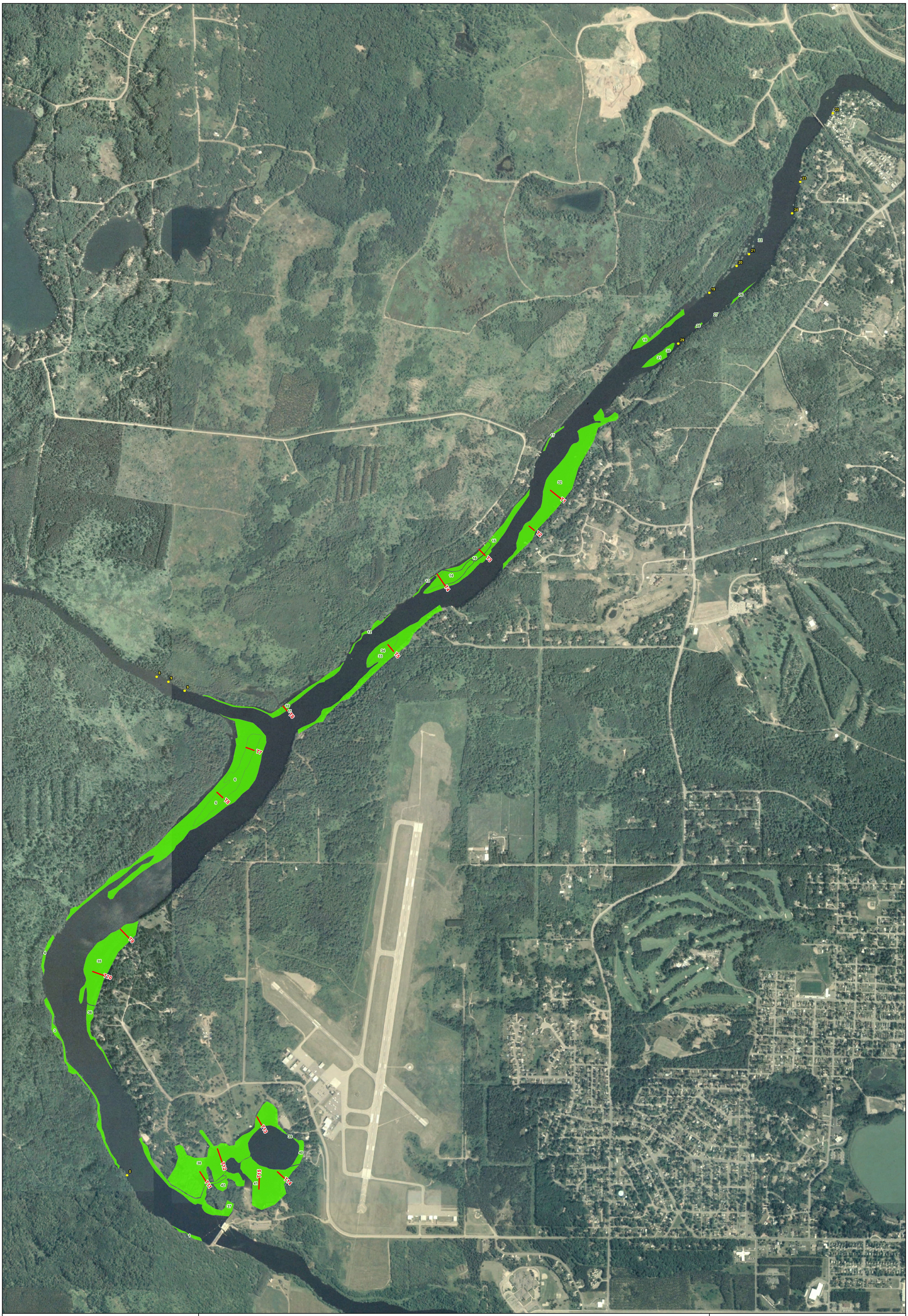

Figure 2-02. WE Energies KingsfordHydro Project. 2008 & 2010 Weevil Distribution Survey.

Survey Transect

KFH_pts (WE Energies)

KFH_poly (WE Energies)

500 250 0 500 Meters

1,500 750 0 1,500 Feet

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2006 NAIP imagery courtesy of USDA. 2007 vegetation points and polygons appear as provided by WE Energies.

1.1.3 Michigamme Falls Reservoir

On July 11, 2010, a total of 168 stems were collected from 18 of the 21 transects in Michigamme Falls Reservoir; stems were not collected at transects 7, 17 and 21 (Figure 1-3). Lab analysis showed weevil life stages present from every location stems were collected as well as an increase to the overall population from 2009 to 2010 with the exception of T18 (Table 1-3). The lowest population was found in T18 while the highest was in the area of T4 and T6. Interestingly, it was noted in the field that the milfoil beds along the western shore (T 1-10) were heavily damaged by weevils while minimal damage was found within the beds along the northern and eastern shore. Although the weevil population decreased drastically in 2009 to 0.27 weevils/stem it increased this year to1.30 weevils/stem.

As seen in the previous reservoirs, the surface temperature increased while the DO decreased from 2009 to 2010.

Table 1-3 2008 (Gray), 2009 (White) and 2010 (Yellow) Stem Analysis and Water Quality Data at Each Transect in Michigamme Falls Reservoir

	Water Quality				Stem Counts			Weevil Count	
Transect	Cond	Temp	pH	DO	Stems	Meristems	Ave. Meristem/ Stem	Total Weevils	Ave. Weevils/ Stem
1	0.094	22.70	8.37	8.45	10	18	1.8	27	2.70
1	0.113	19.31	8.12	8.97	10	7	0.7	1	0.10
1	0.118	22.29	7.88	6.02	9	14	1.6	9	1.00
2	0.094	22.60	8.19	8.48	10	11	1.1	2	0.20
2	0.113	19.64	8.01	9.44	10	6	0.6	1	0.10
2	0.123	22.56	7.69	6.25	10	17	1.7	10	1.00
3	0.093	22.59	8.01	8.02	10	13	1.3	13	1.30
3	0.111	19.22	7.97	9.51	10	11	1.1	1	0.10
3	0.123	22.55	7.69	6.51	10	23	2.3	7	0.70
4	0.093	22.46	7.89	7.78	10	13	1.3	4	0.40
4	0.113	19.60	7.97	9.47	10	25	2.5	2	0.20
4	0.123	22.53	7.64	6.30	10	22	2.2	23	2.30
5	0.092	22.04	7.92	7.98	9	11	1.2	5	0.56
5	0.113	19.88	7.90	9.33	10	18	1.8	3	0.30

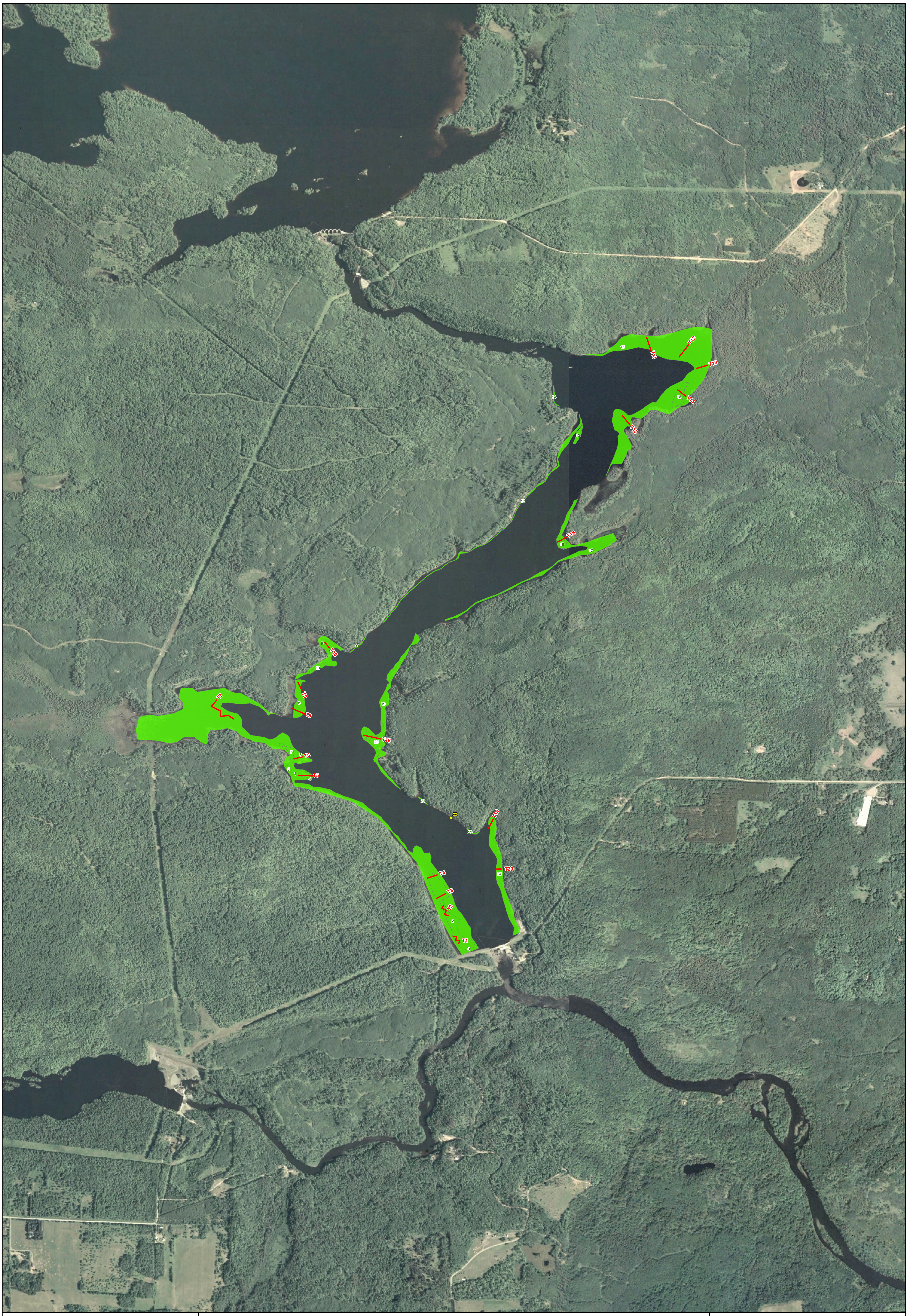

Figure 1-3. WE Energies Michigamme Falls Hydro Project. 2010 Weevil Distribution Survey.

Survey Transect

MCH_pts (WE Energies)

MCH_poly (WE Energies)

500 250 0 500 Meters

1,500 750 0 1,500 Feet

N

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2006 NAIP imagery courtesy of USDA. 2007 vegetation points and polygons appear as provided by WE Energies.