

Successful Operational Use of Renovate OTF for Selective Control of *Myriophyllum spicatum* (Eurasian watermilfoil) in Three New York Lakes: Saratoga, Lamoka, Waneta

Authors:

Mark Heilman, Ph.D., SePRO Corporation

Marc Bellaud, Aquatic Control Technology

Glenn Sullivan, Allied Biological

Northeast Aquatic Plant Management Society

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Successful Operational Use of Renovate OTF for Selective Control of *Myriophyllum spicatum* (Eurasian watermilfoil) in Three New York Lakes: Saratoga, Lamoka, Waneta

Overview:

Background on Renovate

Renovate OTF: granular v. liquid

Management Results:

Saratoga Lake

Lamoka and Waneta Lakes



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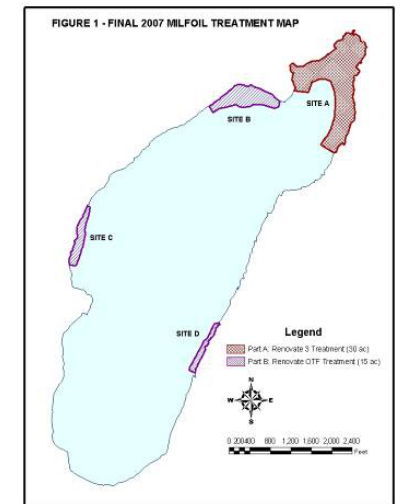
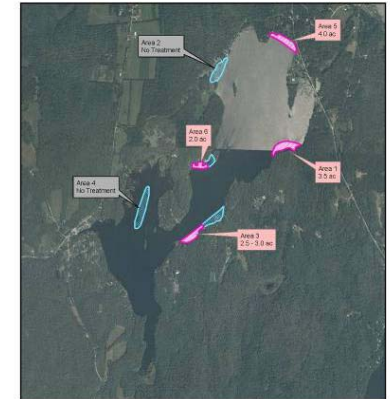
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Renovate* Use History in Northern US

- EPA label in 2002
- Significant adoption for Eurasian watermilfoil (EWM) control in Midwest
- MA GEIS in 2004, NY SEIS/SLN in 2007
- NE US – Prior to 2008, use evaluated operationally primarily in Vermont
- 2007: Introduction of Renovate OTF
- 2008: First operational use of Renovate herbicide in New York.

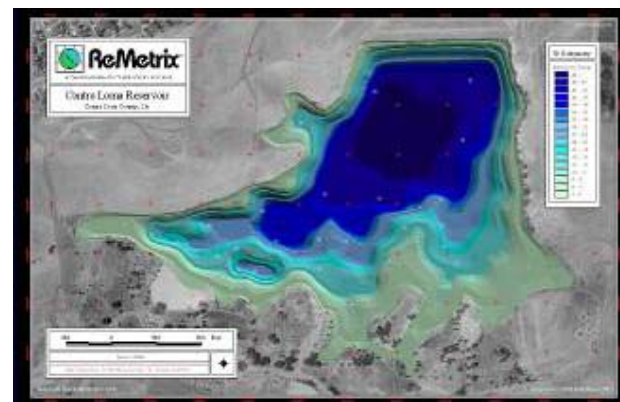


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Renovate* OTF

On Target Formulation

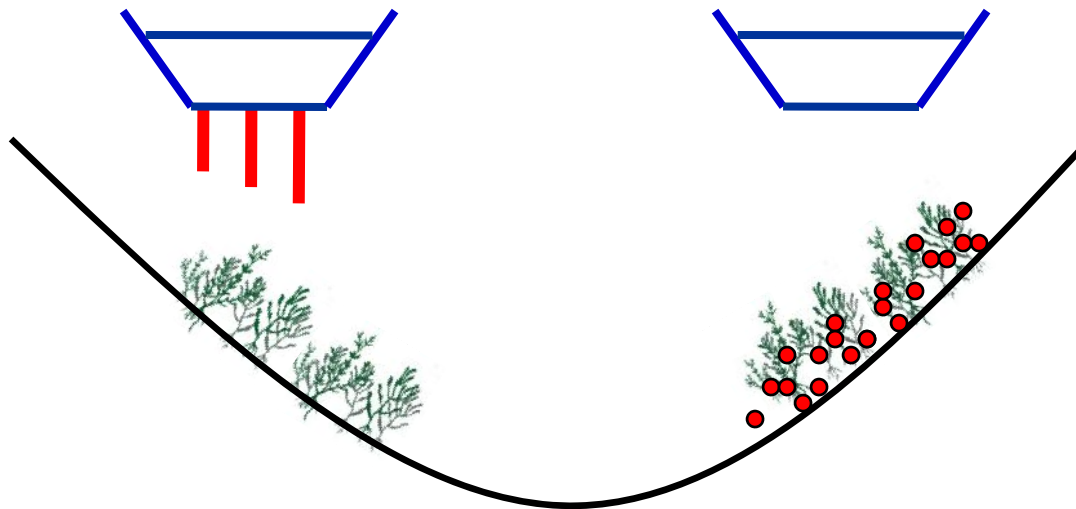
- Development Concept: A dry carrier for Renovate 3...10% ae triclopyr
- Delivers Renovate to target broadleaf weeds
- Maximizes herbicide concentration during critical exposure period (24 hrs)
- Improved efficacy in flowing water or in areas with tremendous potential for dilution
- Improved efficacy for spot treatment sites in larger lakes (i.e. shorelines, cove/bays, dock/marina areas)
- Improved economics



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Renovate* OTF

On Target Formulation



Advantages of granule vs. liquid...



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2008 Field Study

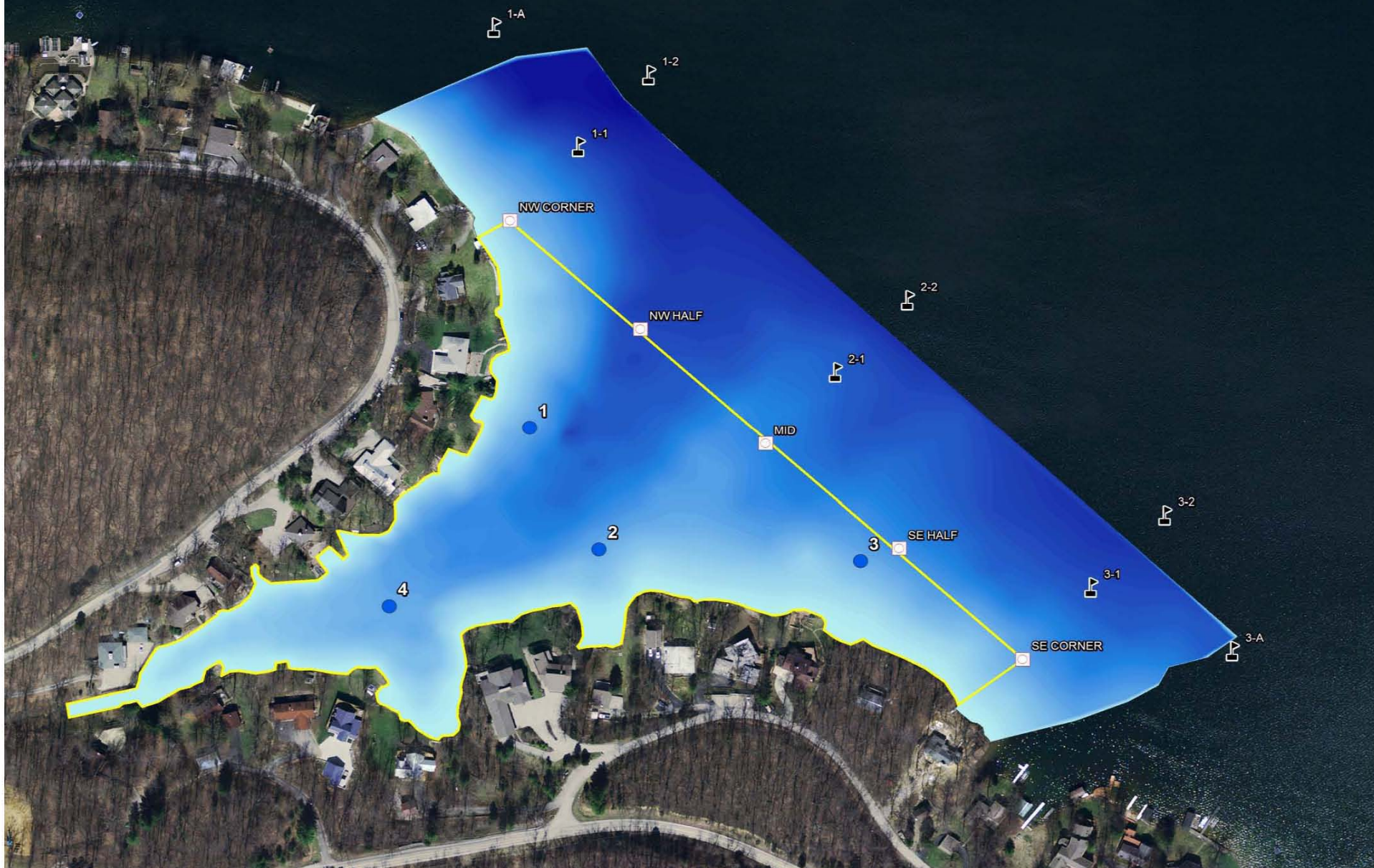
Objective: Compare liquid vs. granule formulation technology dissipation and vertical distribution of residues.

- **Simultaneous** deep water injection (40 foot hoses) vs. broadcast granule application
 - Liquid – Rhodamine WT dye
 - Granule – Renovate OTF
 - No thermocline
 - Limited plant density (<1 foot tall)



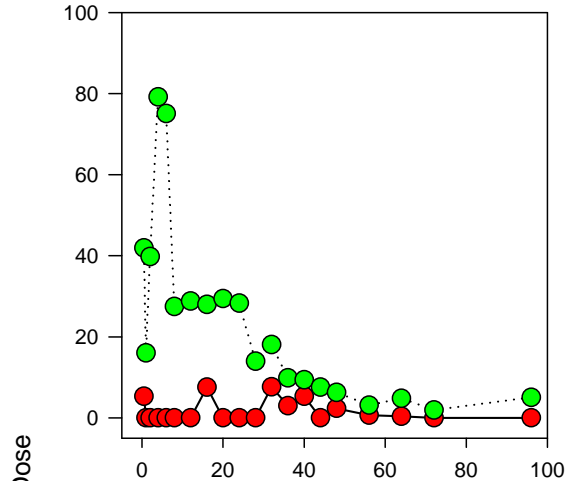
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Sampling Schedule: 0, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 56, 64, 72, and 96 Hours After Treatment

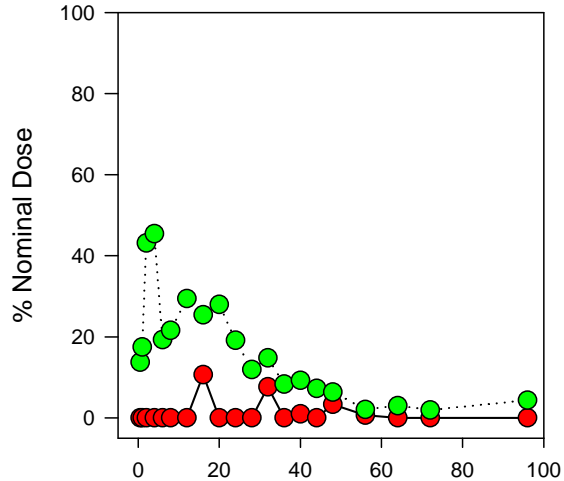


—●— DYE
 ...●... OTF

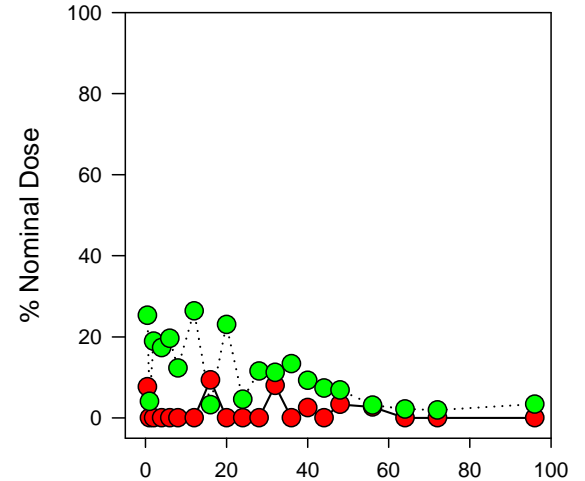
Station 3 - 0.5 feet



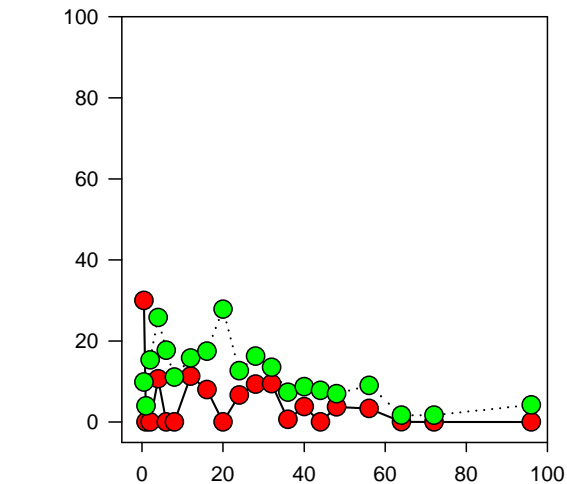
Station 3 - 1.0 feet



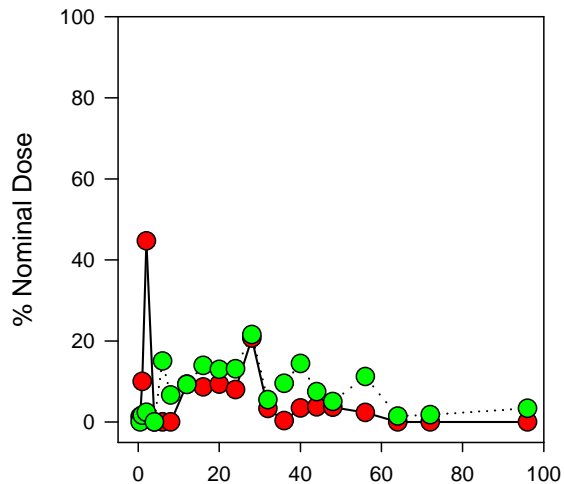
Station 3 - 2.0 feet



Station 3 - 4 feet



Station 3 - 8 feet



Hours after treatment

•OTF residues higher in **93%** of all samples

•As % of target dose, granule averaged 8.9x higher than liquid

SePRO Formulation Technology Dissipation Study Summary



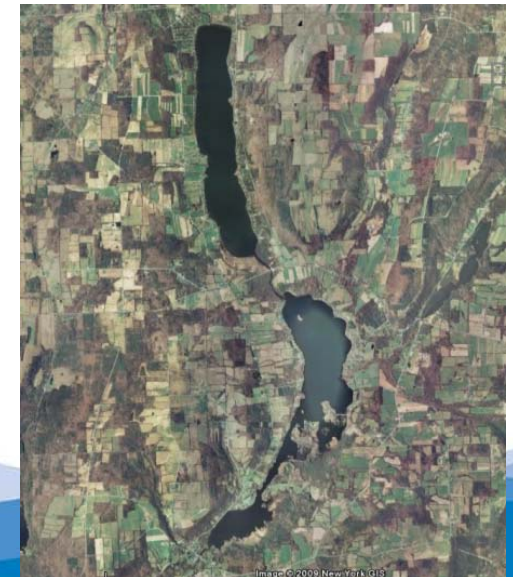
- OTF residues higher in **80%** of all samples
 - As % of dose applied, granules 4x greater than liquid
- Significantly higher residues in “deeper” water following OTF application
- Dissipation dramatically affected by edge effect and other internal currents
- Exposures maintained with OTF



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2008 Renovate OTF: New York

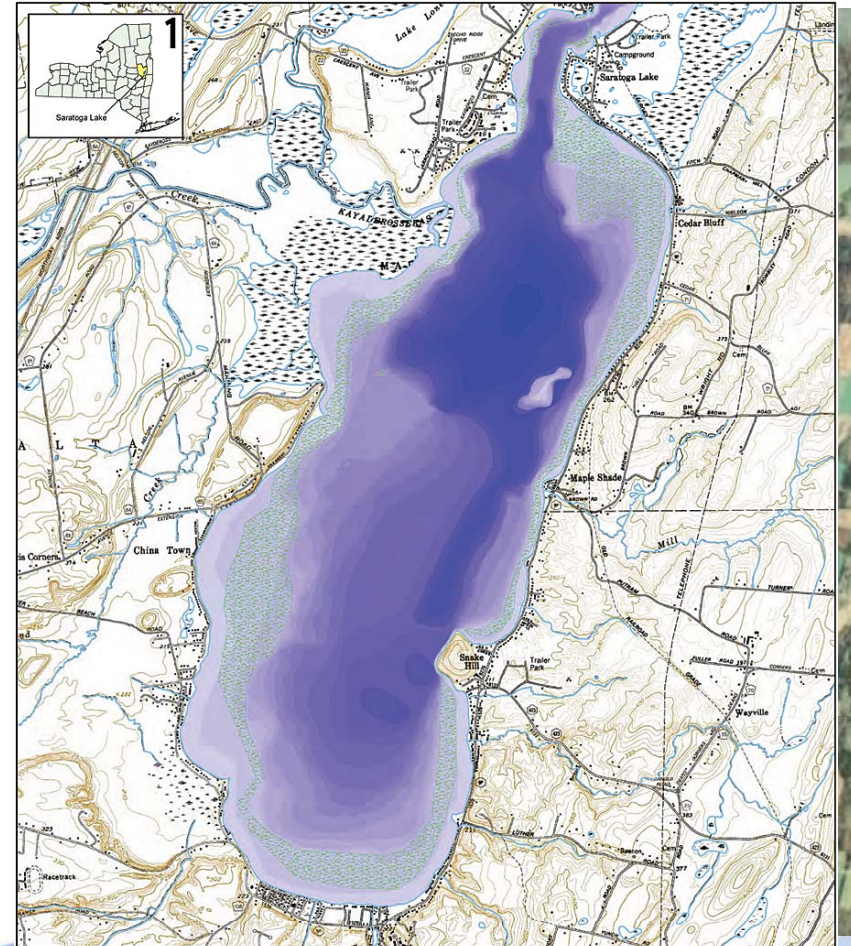
- Three major treatments permitted in '08
- All funded in part by Aquatic Invasive Species Eradication Grants from NYSDEC
- Saratoga Lake
 - Aquatic Control Technology
 - Saratoga Lake Protection and Improvement District and Saratoga Lake Association
 - The LA Group
 - Darrin Fresh Water Institute
 - SUNY Cobleskill
- Lamoka and Waneta Lakes
 - Allied Biological
 - Lamoka-Waneta Lakes Association
 - Cornell University
 - SUNY Brockport



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Saratoga Lake

- 3,762 acres
- Mean depth ~25 feet
- Eutrophic with excellent fishery
- Abundant, diverse macrophyte community
- Eurasian milfoil found in 1970's and became dominant with major habitat/water-use impacts

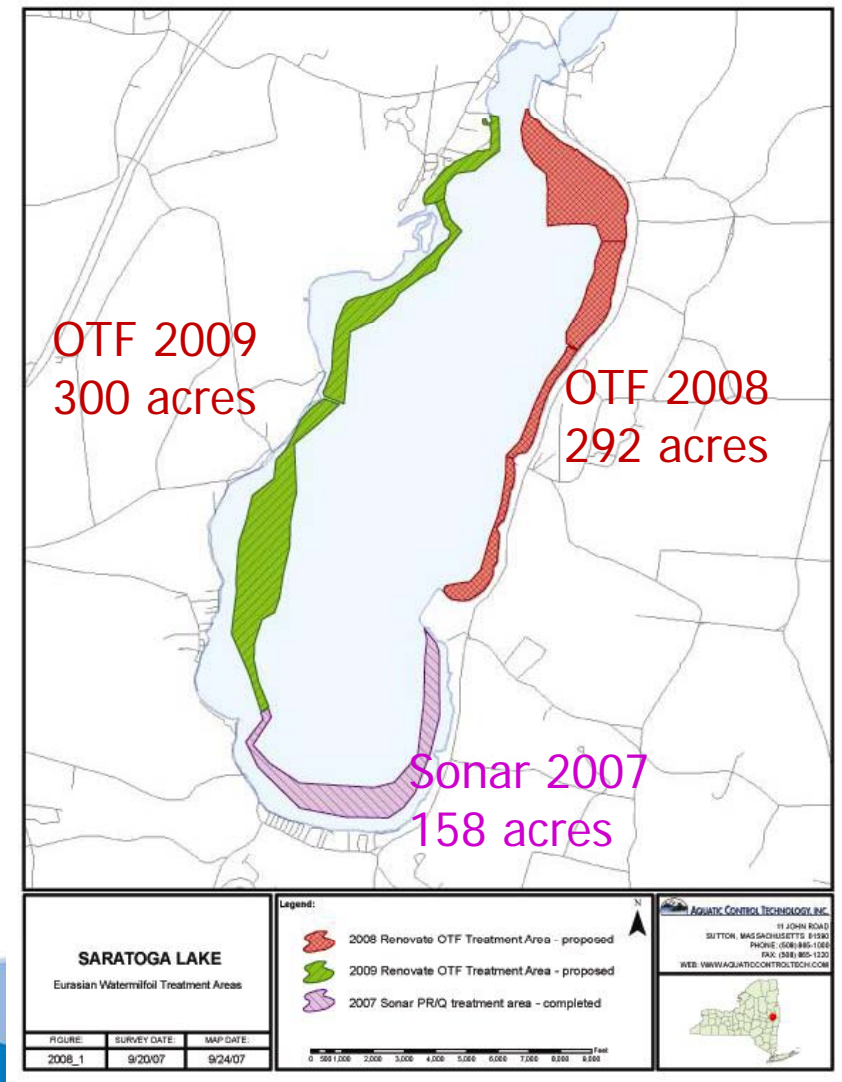


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Saratoga Lake

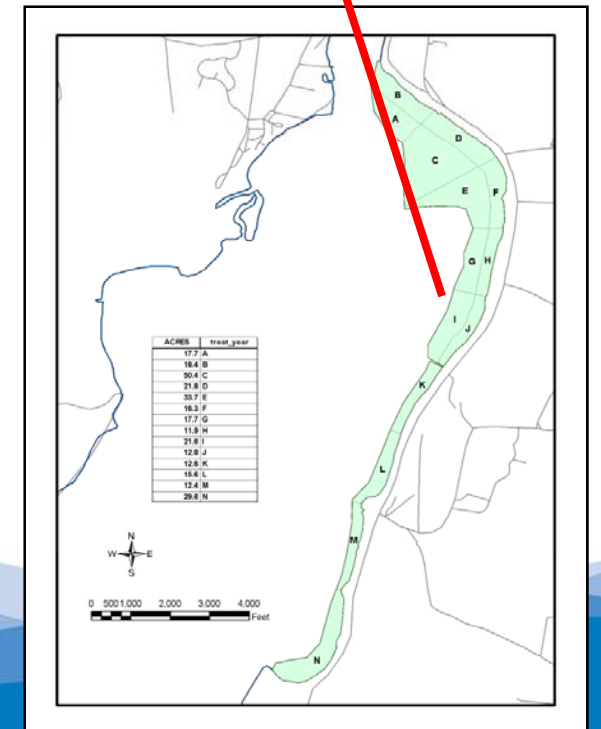
- Recent Milfoil Management History
 - Harvesting program '86 to present
 - Milfoil weevils introduced in late 90's
 - Sonar (fluridone) evaluations in 2000 and 2003
 - Sonar treatment of southern bay in 2007
- Renovate OTF in '08-'09



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Saratoga Lake 2008 OTF Treatment

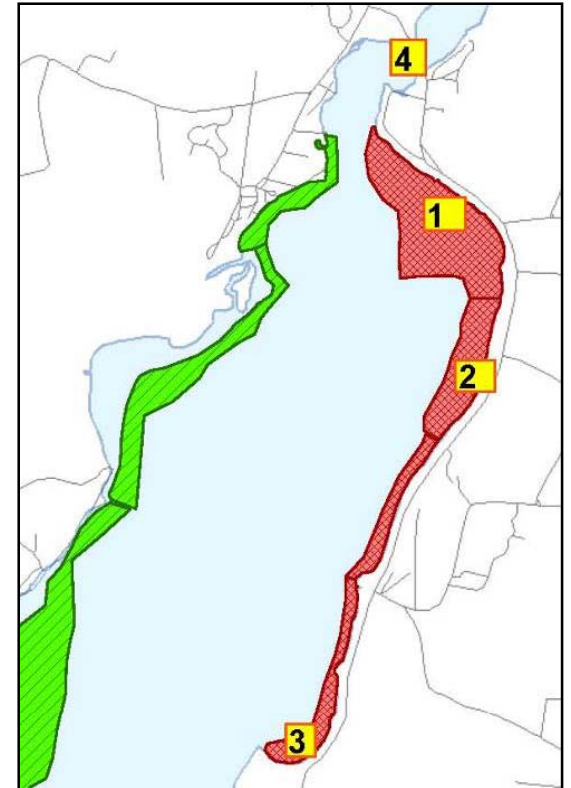
- May 27-30 by ACT
- Target dose: 2.0 – 2.25 ppm
- 66,920 lbs of OTF applied
- Eduction system utilized



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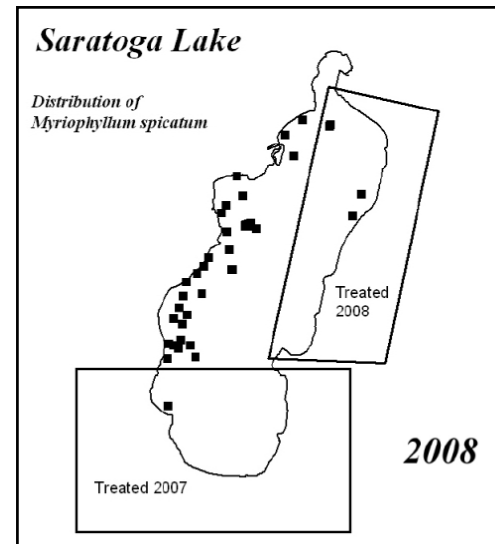
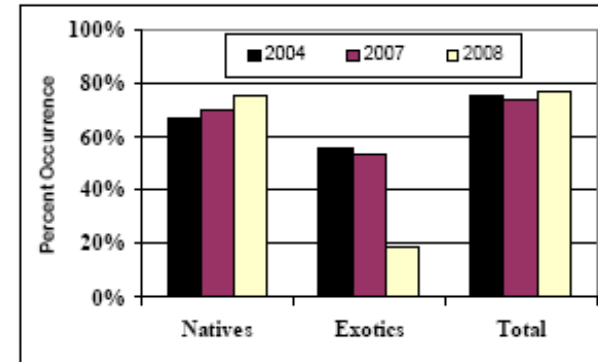
Saratoga Lake: '08 OTF Results

- Herbicide Monitoring using FastEST for Renovate (triclopyr)
- On 6/19—22 Days after start of treatment (5/27)—herbicide levels had declined below 1 ppb.
- Water quality maintained after treatment.
 - Visibility greater than 10 feet
- Qualitative site assessment on July 11 (6 WAT)
 - no viable EWM in OTF treatment area...strong growth of natives
 - 4-5' sparse growth along western untreated shore...some apparent herbicide symptoms
- August 6 (10 WAT) – snorkel survey
 - Very isolated milfoil finds in treated zone amidst dense native vegetation
 - Healthy milfoil growth along western shore still not topped-out



Saratoga Lake: '08 OTF Results

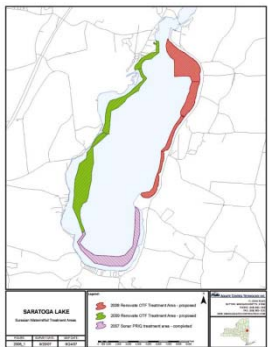
- Full Vegetation Assessment via point-intercept rake toss method per NYSDEC Tier III
- 80-m grid = 324 sample sites
- Comparable surveys in 2004 & 2007
 - Untreated
 - Sonar-treated ('07)
 - Renovate OTF-treated ('08)
 - Historical ('04)
 - EWM and Native Responses



From Eichler and Boylen 2008 (DFWI)

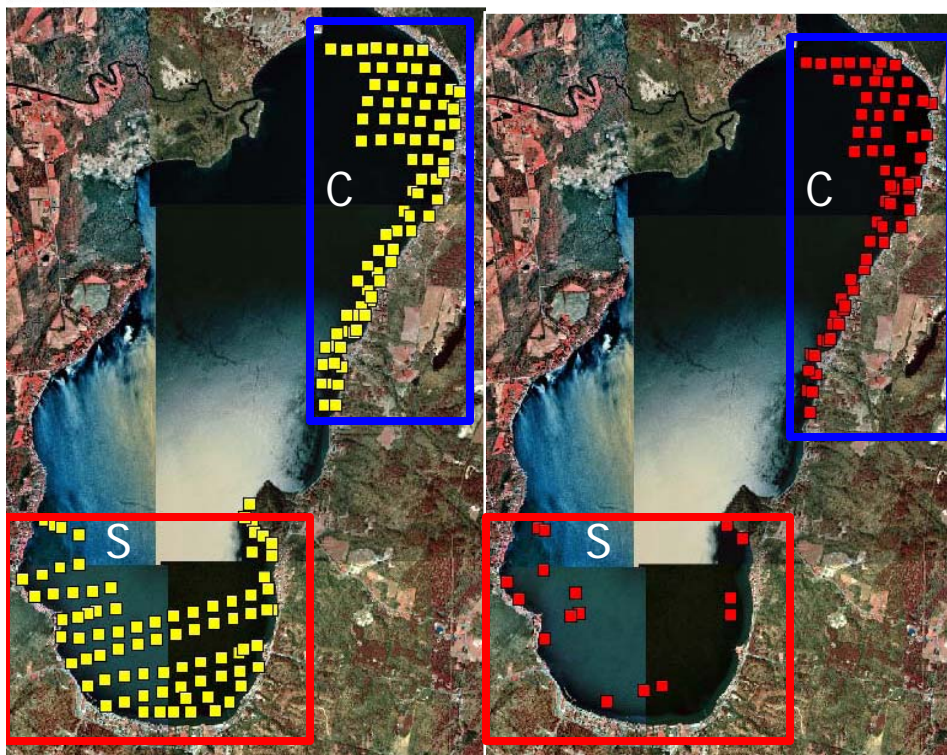


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EWM Distribution in Saratoga Lake: 2007 - 2008

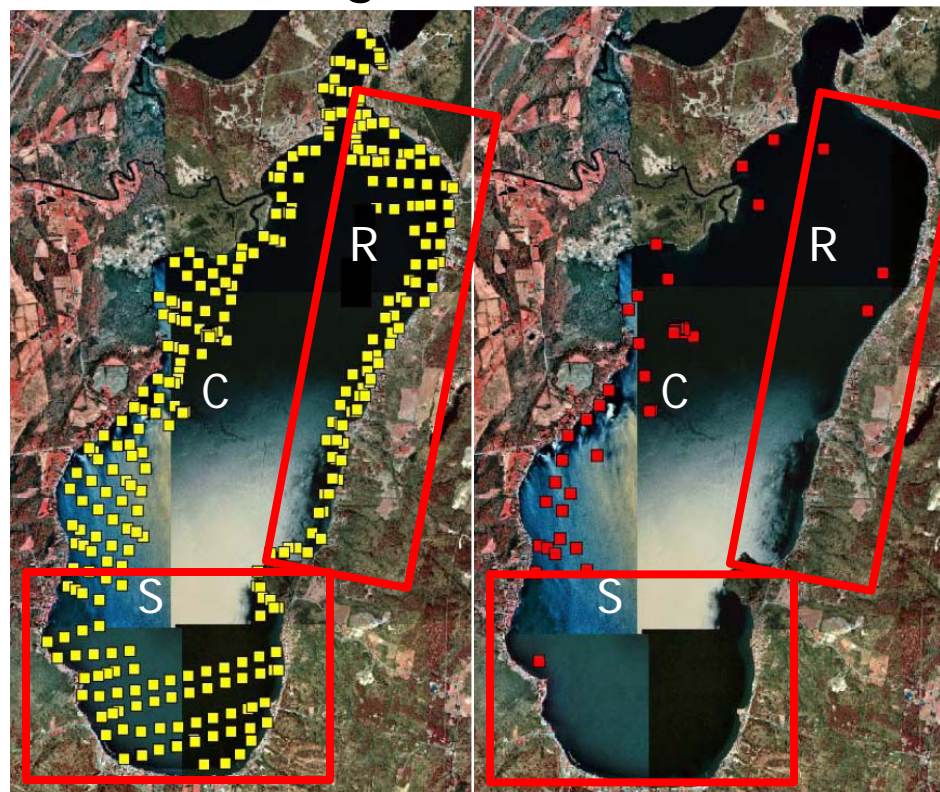
August 2007



160 total sites

EWM 80% - OTF zone
EWM 20% - Sonar zone

August 2008



324 total sites

EWM 2% - OTF
EWM 1% - Sonar
EWM 26% - UNT



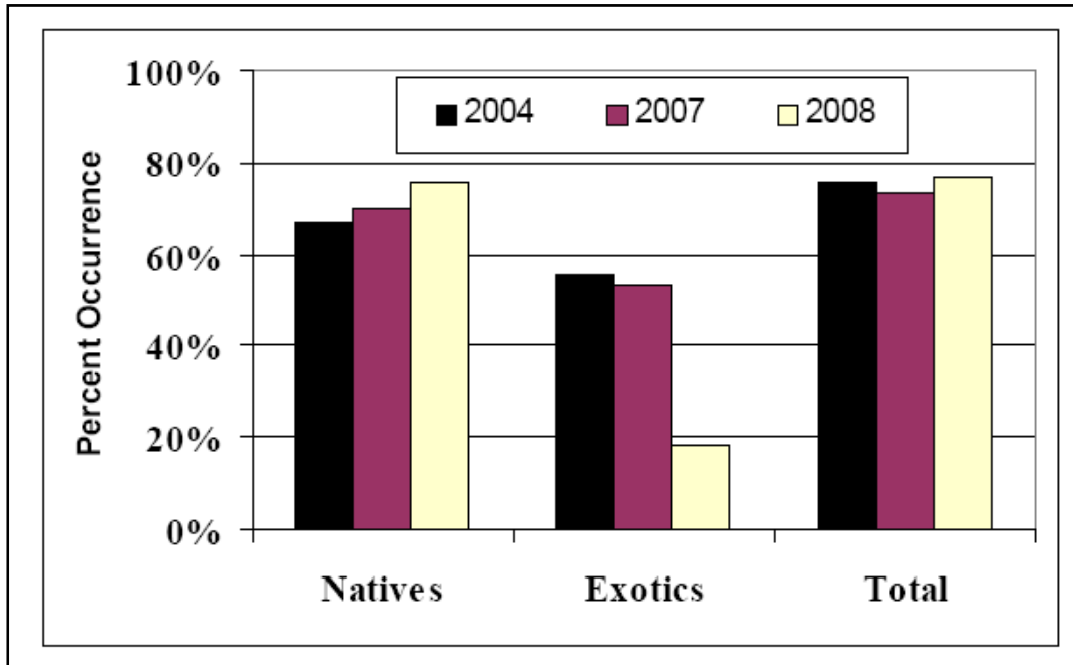
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From Eichler and Boylen 2008 (DFWI)

Table 3. Percent frequency of occurrence of aquatic plant species in Saratoga Lake.

<i>Species</i>	All	Control	Treated
<i>Myriophyllum spicatum</i>	13.0%	25.9%	3.2%
<i>Ceratophyllum demersum</i>	59.0%	61.9%	56.8%
<i>Zosterella dubia</i>	23.1%	23.0%	23.2%
<i>Vallisneria americana</i>	30.6%	29.5%	31.4%
<i>Najas guadalupensis</i>	30.9%	38.8%	24.9%
<i>Elodea canadensis</i>	25.3%	29.5%	22.2%
<i>Chara/Nitella</i>	6.8%	1.4%	10.8%
<i>Potamogeton zosteriformes</i>	14.5%	15.1%	14.1%
<i>Najas flexilis</i>	8.6%	2.9%	13.0%
<i>Potamogeton perfoliatus</i>	5.9%	0.7%	9.7%
<i>Lemna trisulca</i>	2.2%	5.0%	0.0%
<i>Megalodonta beckii</i>	0.9%	1.4%	0.5%
<i>Potamogeton illinoensis</i>	4.0%	4.3%	3.8%
<i>Potamogeton praelongus</i>	2.8%	2.2%	3.2%
<i>Potamogeton crispus</i>	5.6%	1.4%	8.6%
<i>Potamogeton pusillus</i>	8.6%	6.5%	10.3%
<i>Potamogeton gramineus</i>	0.3%	0.0%	0.5%
<i>Nuphar luteum</i>	0.6%	1.4%	0.0%
<i>Potamogeton amplifolius</i>	1.2%	2.9%	0.0%
<i>Stuckenia pectinata</i>	2.5%	1.4%	3.2%
<i>Nymphaea odorata</i>	0.6%	0.7%	0.5%
<i>Potamogeton robbinsii</i>	0.3%	0.7%	0.0%

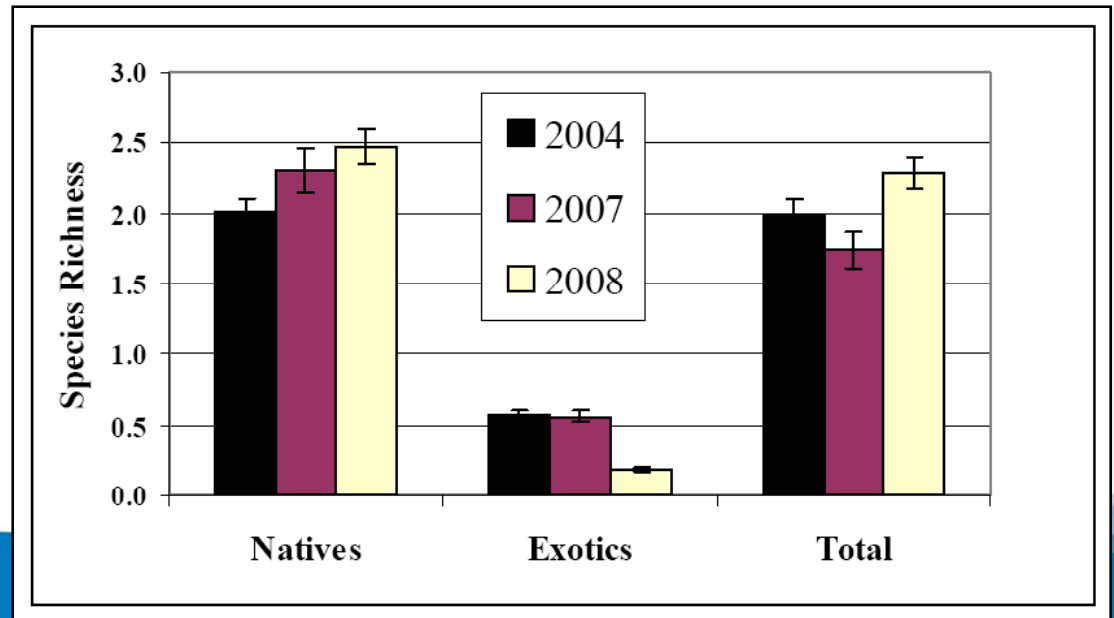
OTF and Sonar



Frequency of Occurrence

Species Richness

Natives v. Exotics
in Saratoga Lake:
2004, 2007, 2008



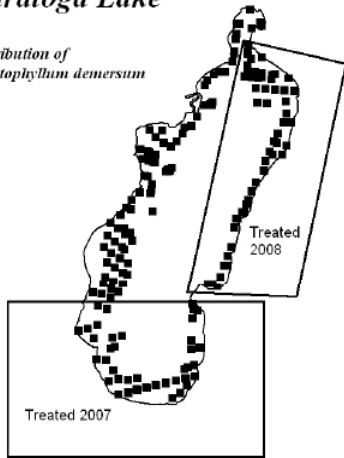
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From Eichler and Boylen 2008 (DFWI)

C. demersum

Saratoga Lake

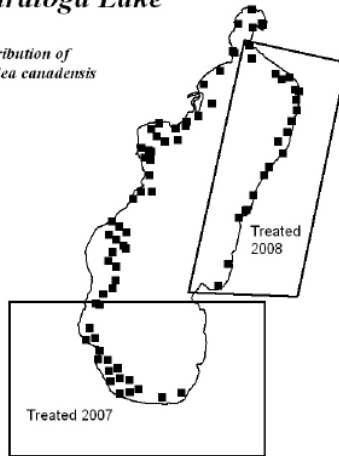
Distribution of *Ceratophyllum demersum*



E. canadensis

Saratoga Lake

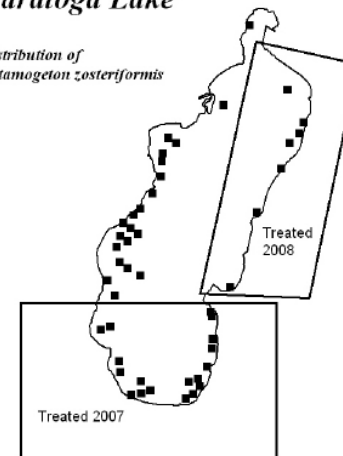
Distribution of *Elodea canadensis*



P. zosteriformis

Saratoga Lake

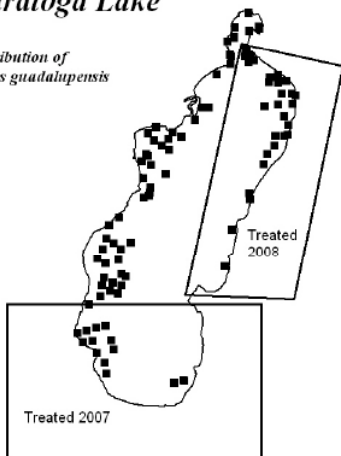
Distribution of *Potamogeton zosteriformis*



N. guadalupensis

Saratoga Lake

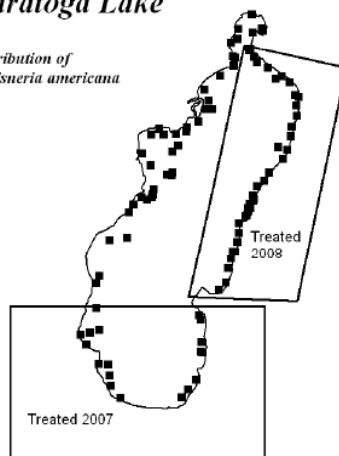
Distribution of *Najas guadalupensis*



V. americana

Saratoga Lake

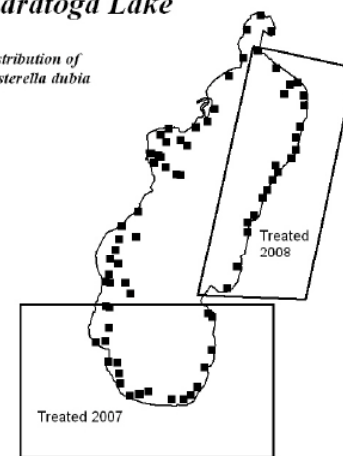
Distribution of *Vallisneria americana*



Z. dubia

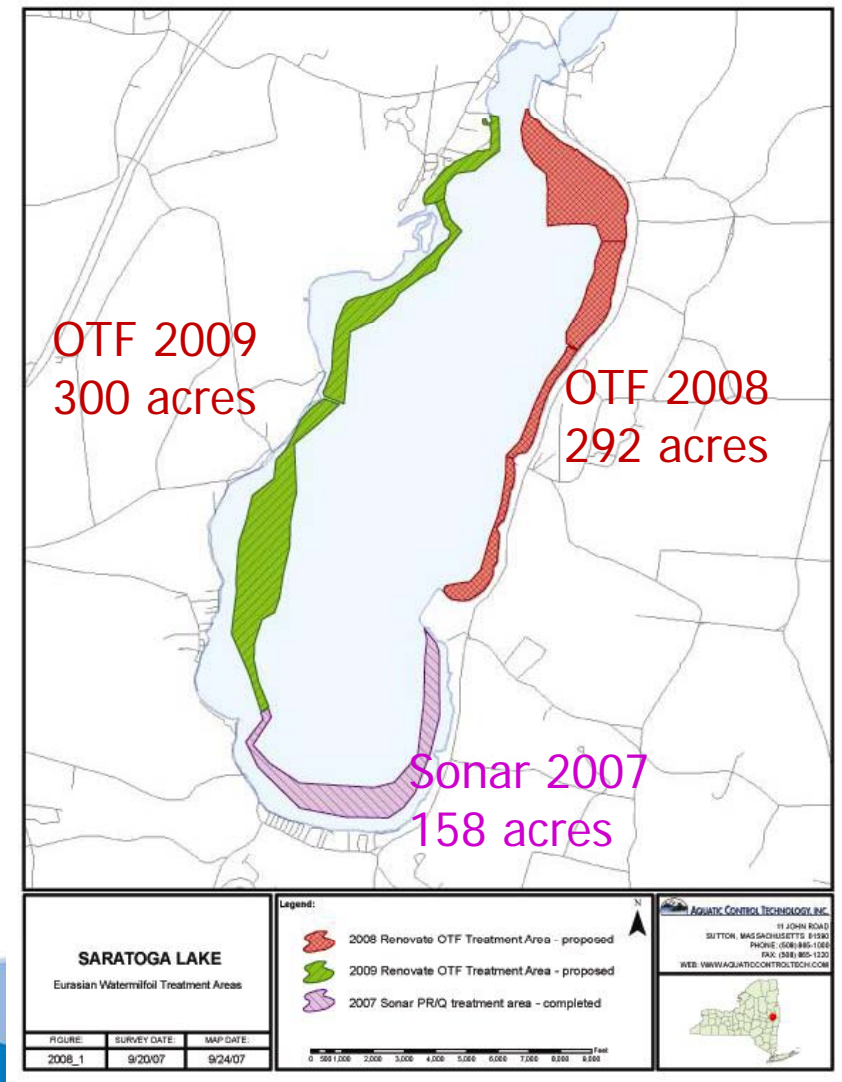
Saratoga Lake

Distribution of *Zosterella dubia*



Saratoga Lake: Summary

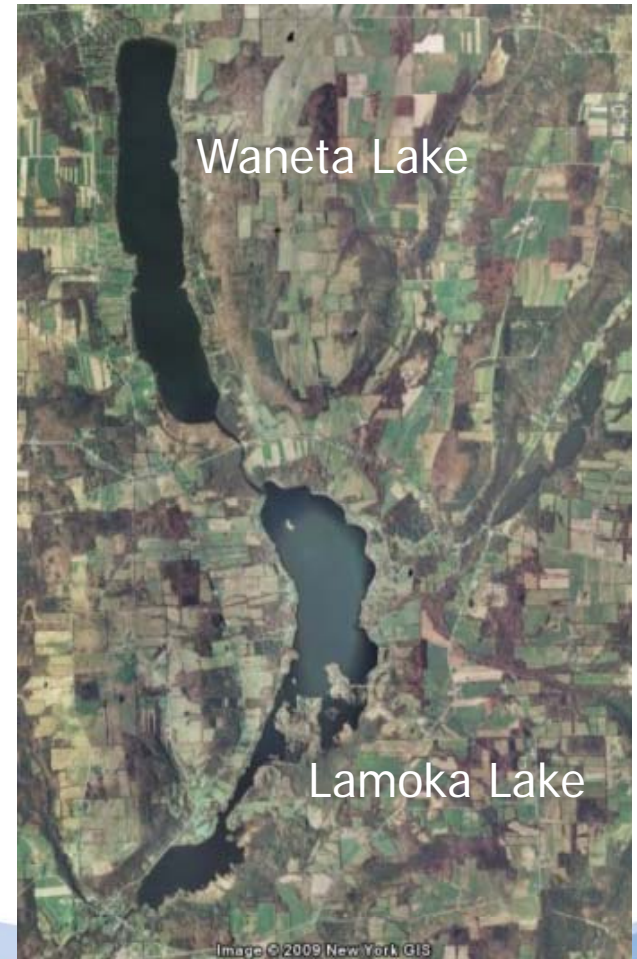
- 2008 Renovate OTF treatment provided excellent selective control of EWM in target zone.
- 2007 Sonar treatment shows good performance 1 YAT.
- Native abundance and diversity has increased
- Further progress should be made with '09 OTF.



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Lamoka and Waneta Lakes

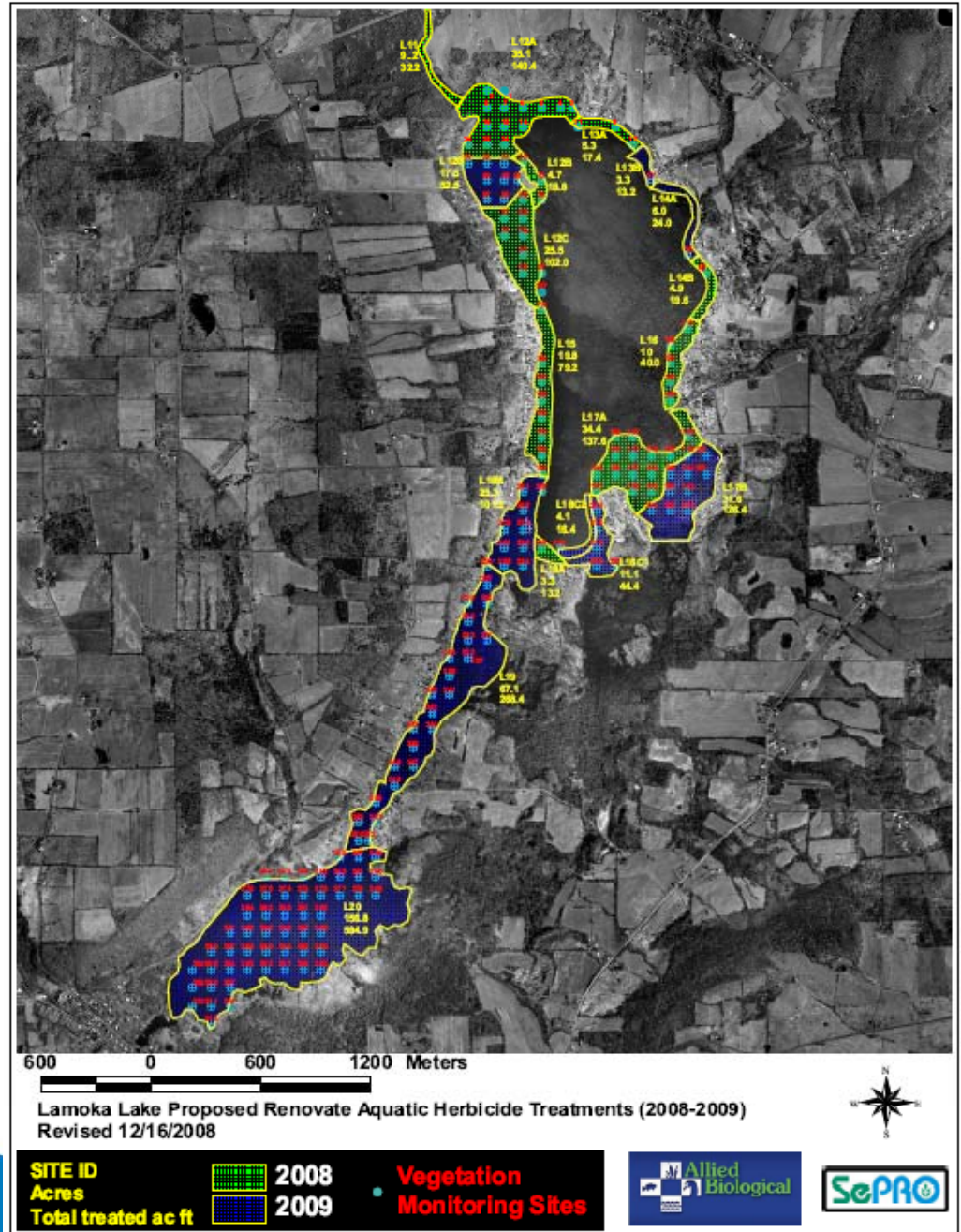
- Adjacent lakes in south-central New York
- Lamoka Lake
 - 826 acres, mean depth = 20 feet
- Waneta Lake
 - 781 acres, mean depth = 15 feet
- Eutrophic...Secchi = 4-4.5 feet
- EWM introduced ~mid 1980's
- 2-Year Plan for EWM control



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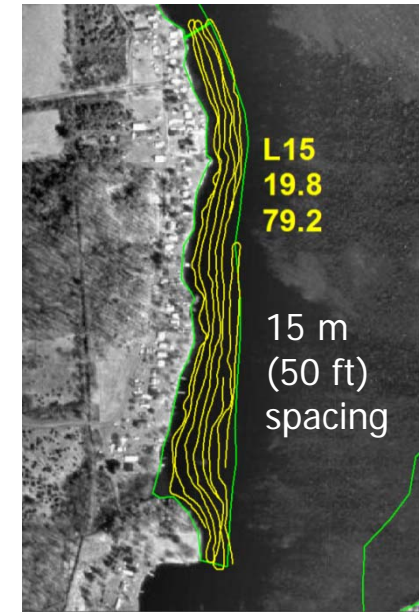
Lamoka Renovate 2008

- 152 acres treated in northern basin
- OTF
 - 24,460 lbs – 108 A
- 1.5 – 2.25 ppm target rates



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Lamoka - Waneta Renovate 2008



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Lamoka – Waneta

Vegetation Assessment 2000-2008

- Initial surveys of both lakes by US Army Corps of Engineers (Dr. John Madsen) in 2000
 - GPS Point-intercept approach using rake collection and representative biomass collection
 - Waneta – 50% of littoral sites with EWM
 - Lamoka – 77% of littoral sites with EWM
- Waneta (Sonar): 2003, 2004, 2005 Surveys by Cornell University (Dr. Robert Johnson)
- Lamoka and Waneta: 2006, 2008 again by Cornell...some additional sites requested by DEC and LWLA

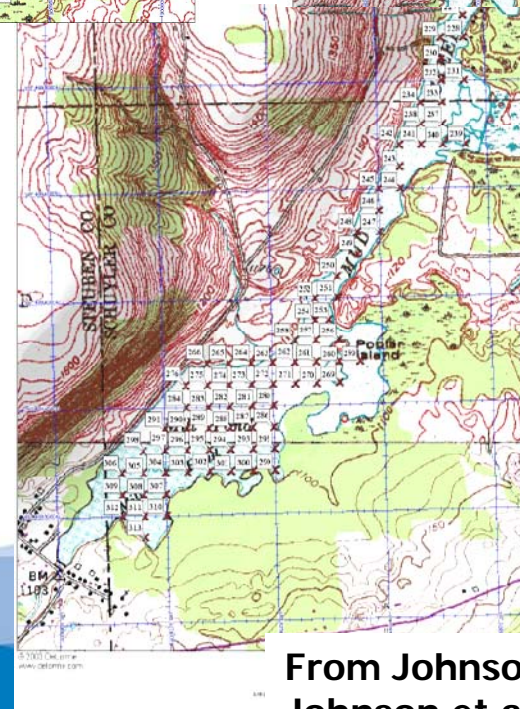
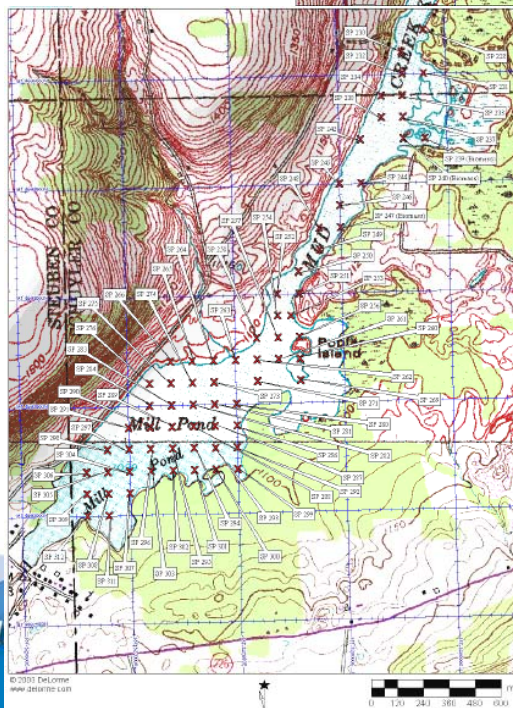
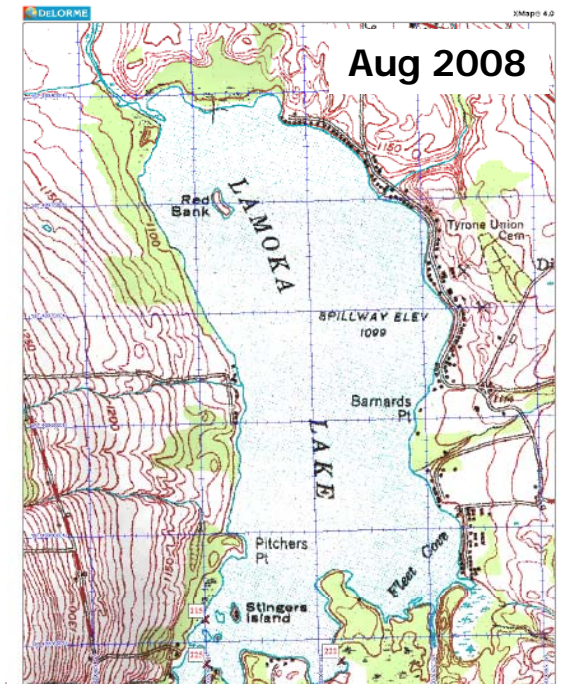
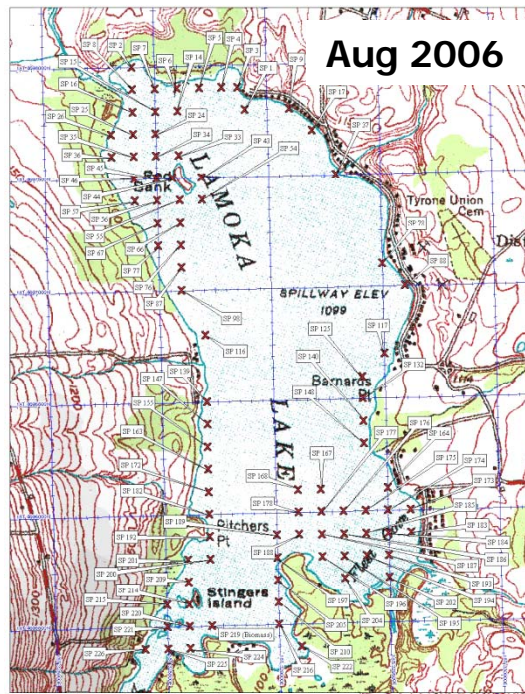


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EWM Distribution Lamoka Lake 2006 v. 2008

North Basin Treatment Areas

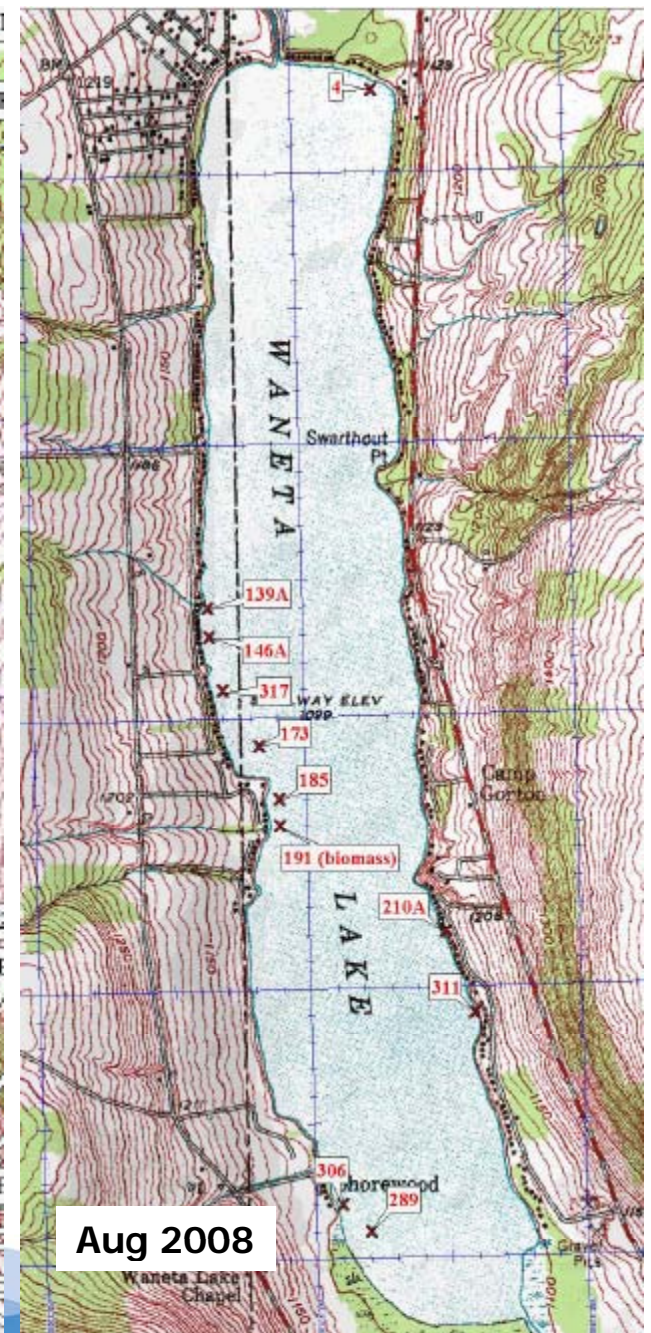
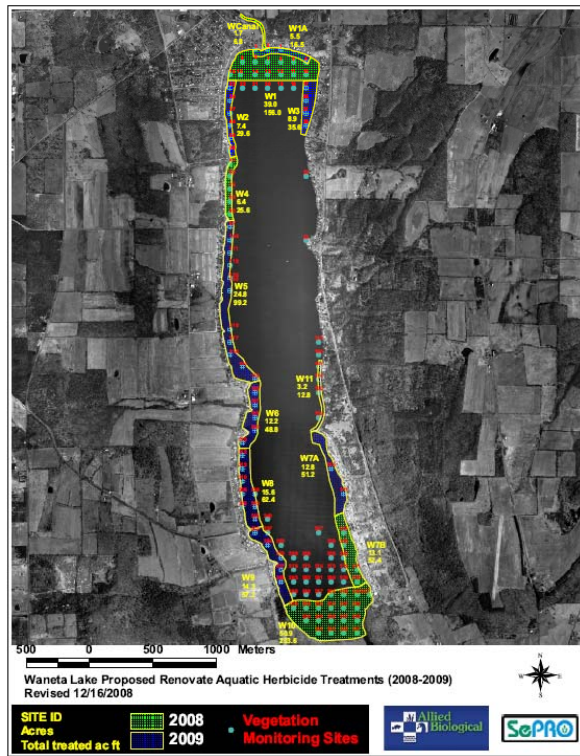
- 70 sampling sites
- 2006: 64 sites with EWM
- 2008: No EWM detected
- Snorkel Survey 8/4 found isolated decaying root crowns



EWM Distribution Waneta Lake 2006 v. 2008

EWM Lake-Wide

2008: 7 of 138 sites (5%)
 only 1 site in treated areas
 2006: 50 of 120 sites (42%)



From Johnson & Keith 2006
 Johnson et al. 2008 (Cornell)

Waneta Lake Species Occurrences Original 102 sites

Native species per site

2000: 1.37

2003: 0.79

2004: 0.58

2005: 0.60

2006: 0.91

2008: 3.49

Scientific Name	Common Name	2006		2008	
		Littoral Zone (in 2000)		Littoral Zone (in 2000)	
		FREQ	%	FREQ	%
<i>Ceratophyllum demersum</i>	coontail	12	12	40	39
<i>Chara</i> sp.	chara	13	13	29	28
<i>Elodea canadensis</i>	elodea	2	2	79	77
<i>Fontanalis</i> sp.	water moss	0	0	0	0
<i>Lemna minor</i>	duckweed	0	0	0	0
<i>Lemna trisulca</i>	star duckweed	0	0	4	4
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	50	49	5	5
<i>Najas flexilis</i>	bushy naiad	16	16	30	29
<i>Najas guadalupensis</i>	southern naiad	11	11	99	97
<i>Najas minor</i>	minor naiad	5	5	16	16
<i>Nitella flexilis</i>	stonewort	0	0	1	1
<i>Nitellopsis obtusa</i>	starry stonewort	0	0	1	1
<i>Nuphar advena</i>	yellow water lily	0	0	0	0
<i>Nymphaea odorata</i>	white water lily	1	1	1	1
<i>Potamogeton amplifolius</i>	wideleaf pondweed	0	0	0	0
<i>Potamogeton crispus</i>	curly-leaf pondweed	19	19	43	42
<i>Potamogeton diversifolius</i>	water-thread pondweed	0	0	0	0
<i>Potamogeton foliosus</i>	leafy pondweed	27	26	10	10
<i>Potamogeton praelongus</i>	tall pondweed	0	0	0	0
<i>Potamogeton pusillus</i>	small pondweed	0	0	38	37
<i>Potamogeton robbinsii</i>	Robbin's pondweed	0	0	5	5
<i>Potamogeton zosteriformis</i>	flatstem pondweed	1	1	0	0
<i>Ranunculus trichophyllus</i>	water buttercup	0	0	3	3
<i>Stuckenia pectinata</i>	sago pondweed	1	1	0	0
<i>Vallisneria americana</i>	water celery	8	8	16	16
<i>Zosterella dubia</i>	water stargrass	1	1	1	1
Total occurrences, at all SP's, of all species		167		421	



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From Johnson et al. 2008 (Cornell)

Lamoka Lake Species Occurrences Original 169 sites

Native species per site
 2000: 2.79
 2006: 5.56
 2008: 5.36

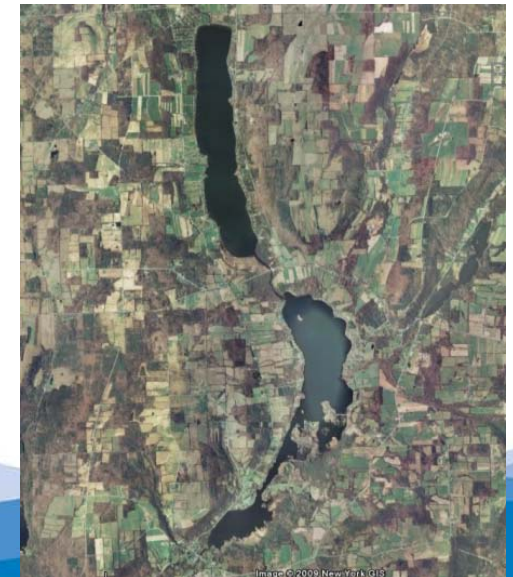
Scientific Name	Common Name	2006		2008	
		Littoral Zone (in 2000)		Littoral Zone (in 2000)	
		FREQ	%	FREQ	%
<i>Azolla caroliniana</i>	Carolina mosquito fern	0	0	4	2
<i>Brasenia schreberi</i>	water shield	2	1	2	1
<i>Ceratophyllum demersum</i>	coontail, hornwort	140	83	152	90
<i>Chara vulgaris</i>	chara, muskgrass	16	9	10	6
<i>Elodea canadensis</i>	elodea	106	63	107	63
<i>Lemna minor</i>	small duckweed	77	46	20	12
<i>Lemna trisulca</i>	star duckweed	52	31	65	38
<i>Megalodonta beckettii</i>	water marigold	8	5	6	4
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	153	91	67	40
<i>Najas flexilis</i>	bushy naiad	7	4	3	2
<i>Najas guadalupensis</i>	southern naiad	66	39	79	47
<i>Nitella flexilis</i>	nitella, stonewort	0	0	9	5
<i>Nuphar advena</i>	yellow water lily	23	14	31	18
<i>Nymphaea odorata</i>	white water lily	28	17	12	7
<i>Potamogeton amplifolius</i>	large-leaf pondweed	20	12	37	22
<i>Potamogeton crispus</i>	curly-leaf pondweed	18	11	41	24
<i>Potamogeton foliosus</i>	leafy pondweed	2	1	0	0
<i>Potamogeton hillii</i>	Hill's pondweed	3	2	0	0
<i>Potamogeton</i> ????	? hybrid ?	0	0	1	1
<i>Potamogeton nodosus</i>	long-leaf pondweed	0	0	1	1
<i>Potamogeton pusillus</i>	small pondweed	1	1	3	2
<i>Potamogeton praelongus</i>	white-stem pondweed	0	0	0	0
<i>Potamogeton robbinsii</i>	Robbin's pondweed	81	48	107	63
<i>Potamogeton zosteriformis</i>	flat-stem pondweed	55	33	53	31
<i>Polygonum amphibium</i>	water smartweed	3	2	4	2
<i>Ranunculus trichophyllus</i>	water buttercup	50	30	48	28
<i>Stuckenia pectinata</i>	sago pondweed	1	1	1	1
<i>Spirodela polyrhiza</i>	great duckweed	48	28	22	13
<i>Typha latifolia</i>	broad-leaved cattail	4	2	1	1
<i>Utricularia sp.</i>	bladderwort	11	7	34	20
<i>Vallisneria americana</i>	eel grass, wild celery	52	31	51	30
<i>Wolffia columbiana</i>	common watermeal	33	20	10	6
<i>Zanichellia palustris</i>	horned pondweed	0	0	0	0
<i>Zosterella dubia</i>	water stargrass	50	30	32	19
Total species occurrence for all SPs		1110		1013	



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Renovate OTF Use for EWM

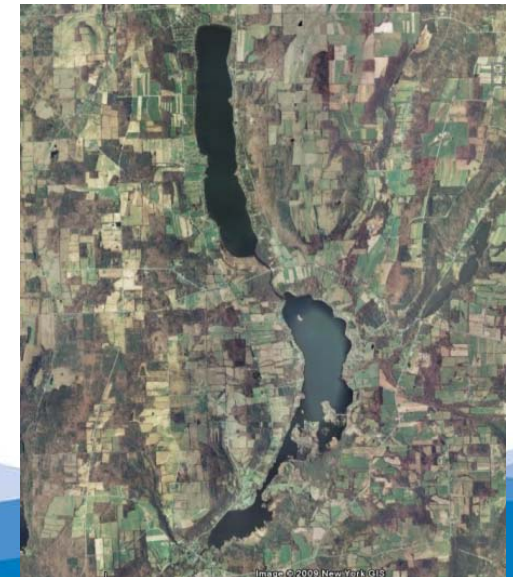
- Future Operational Considerations:
 - Dissipation pattern of large treatments, irrigation restrictions, and duration of control
 - Site-specific recommendations for optimal selectivity on potentially sensitive, non-target aquatic plants
 - Integration with other herbicides for enhanced spectrum of exotic weed control



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Summary

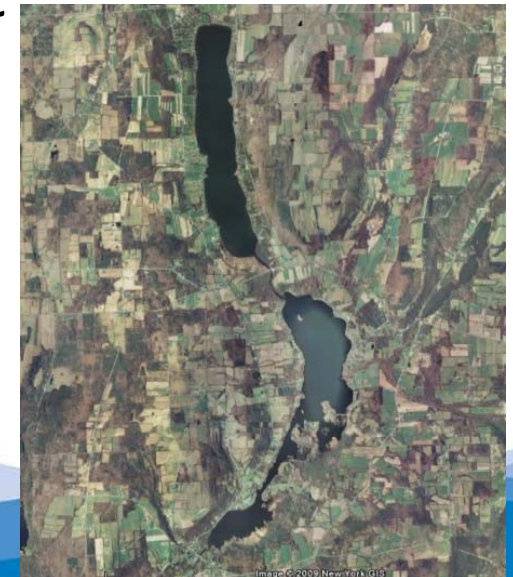
- Highly successful, selective control of EWM was observed in all three NY lakes in 2008.
- Granular OTF formulation has unique dissipation characteristics favorable for shoreline treatments.
- Selectivity and performance of Renovate OTF in two years of operational use confirm fit for EWM management in the NE US.



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