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INTERIM REPORT FOR RESTORATION OF THE WEST COVE OF WHITMAN'S POND 1999-2000

WEYMOUTH, MASSACHUSETTS

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ACKNOWLEDGEMENTS

Ocean Arks International would like to thank the following individuals for their assistance in this project:

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EXECUTIVE SUMMARY

The bioremediation of the West Cove of Whitman's Pond commenced on May 18th, 2000 and concluded on December 5th. During that time, the Restorer clearly reduced the growth of Millfoil within a zone of impact that reached approximately 100 feet from the treatment raft. This is believed to be the result of a reduction in available nitrogen caused by the Restorers aggressive nitrification bioreactor.

Bottom sediment digestion is also suggested by data trends from testing in autumn 1999 and 2000. While no statistically valid conclusions can be drawn from the limited number of samples, it does appear that the organic portion of the sediments was reduced within the Restorers zone of impact.

Wildlife flourished around the Restorer, although this had some negative impacts on the establishment of healthy, mature plants. Operators used several replanting strategies to counter aggressive grazing by herons, geese and swans. Eventually a physical barrier proved most effective. The operational plan for 2001 includes the installation of bird netting above both the internal attached growth media reactors and the perimeter plant rafts. Biological strategies include planting less palatable species on the outer perimeter, with the more succulent and palatable young shoots farther from the reach of long-necked fowl.

It was regrettable that the heavy grazing also damaged the aesthetic qualities of the Restorer. Despite some excellent root growth below the plant rafts, the top growth looked rather anemic throughout the summer. Ocean Arks International had hoped to participate in a media event with the Town and the Whitman's Pond Committee, but the Restorer never quite looked up to the occasion. The 2001 operational plan calls for a concerted effort to establish some flowering bulbs on the Restorer for some early summer color. While bulbs produce less treatment surface than many native wetland species, they do contribute to a celebratory atmosphere for the public and the non-technical press.

It is the hope of Ocean Arks International that the most damaging sources of pollution into the West Cove have been controlled, and that the Restorer has indeed turned the corner on the rehabilitation of this lovely body of water. Continued operation and monitoring in 2001 should advance the understanding of the cove's recovery, with the long-term goal of naturally restoring a sustainable ecology.

1. INTRODUCTION

1.1 History

Local residents tell of a time a century ago when the West Cove basin was an apple orchard. When a dam was installed on Whitman's Pond early last century, it turned West Cove into a lovely pond, with 9 to 10 feet of water in the center.

Several decades of sewage seepage, storm overflows and excessive fertilization of surrounding properties have caused a dramatic decline in the water quality and recreational potential of the West Cove of Whitman's Pond. High nutrient levels, decreased water circulation and high water temperatures, caused by thermal stratification, denied sufficient oxygen to the subsurface environment, accelerating the accumulation of organic sediments. Accumulated deep sediments have reduced the water volume and decreased the depth of the water column significantly. This has caused increased temperatures and a proliferation of nuisance aquatic plants. Aquatic life has suffered a reduction in species diversity and populations, such that only the hardiest species can be found during the summer months.

Aquatic Weed.

In short, West Cove was on an accelerated trajectory to becoming a marsh through the process of eutrophication. For example, build-up of aquatic weeds and organic sediments render the western corner of the pond impassable by watercraft.

Over the past decade a variety of chemical herbicides were used in attempts to eliminate or control aquatic weeds in the pond. These efforts proved unsuccessful in the long term as they killed beneficial species such as water lilies, yet had no lasting impact on the aquatic weed populations of Purple Loosestrife.

Aluminum salts in the form of Aluminum Sulfate, or Alum, were spread in the pond in hopes of sealing the sediments. Aluminum is often used to bind soluble phosphorus in sediments rendering it biologically unavailable. In this way, the plant life would be denied this primary plant nutrient. No recent water chemistry has been available for Ocean Arks International's analysis, but the effort clearly failed to have a long-term impact on the nuisance plant species.

1.2 Timeline

In April of 1999 the Town of Weymouth issued a Request for Proposal for the bioremediation of the West Cove of Whitman's Pond. On 25 August, 1999 a contract was awarded to Ocean Arks International (OAI) for a four-phase program that included:

Phase 1:
- survey and map the location of existing plant species
- set marker buoys on a grid pattern and take sediment depth measurements

Phase 2:
- construction and installation of a floating Restorer
- on-shore installation of electrical equipment and aeration blowers
- limited rehabilitation of the South Cove Restorer

Phase 3
- operational oversight of the Restorer through the 2000 growing season
- plant maintenance, the addition of new species, and replacement plants
- bioaugmentation with BactaPur™ bacterial formulations
- distribution of micronutrient minerals

Phase 4
- operational oversight of the Restorer through the 2001 growing season
- plant maintenance, the addition of new species, and replacement plants
- bioaugmentation with BactaPur™ bacterial formulations
- distribution of micronutrient minerals

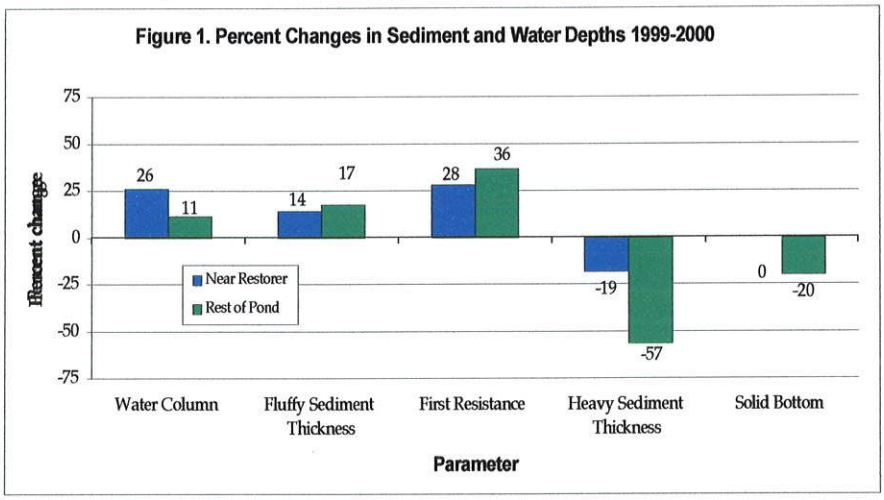
Field analysis for Phase 1 was completed on September 8, 9, and 10, 1999. Plant collection and taxonomy was completed by Gerald Myers, staff botanist at Living Technologies Inc. and horticultural operator of the South Burlington Living Machine wastewater treatment facility. Paul Zabriskie, Michael Carr and Lauren Roth of OAI placed location markers and conducted sediment measurements. Preliminary, graphical results of the Phase 1 investigation were provided to the Whitman's Pond Committee for presentation at the last Weymouth Town Meeting (Appendix D). Final results of the Phase 1 investigation are included later in this report.

Restorer represent those sediments immediately impacted by the Restorer and are compared with samples taken from other parts of the pond. This summarized data is presented in Table 1 below. Detailed data for specific collection points can be found in Appendix B.

Table 1. Water column and sediment depth for Weymouth Pond, 1999 and 2000.

All units are in cm.		Water Column	Fluffy Sediment Thickness	First Resistance	Heavy Sediment Thickness	Solid Bottom
Near Restorer	1999	51.3	32	79	122	201
	2000	64.8	36.5	101.3	99.1	200.3
	Difference	**13.4**	**4.5**	**22.3**	**-22.9**	**-0.7**
Rest of Pond	1999	42.3	34.6	69.2	120.7	189.8
	2000	53.6	52.1	105.6	64.1	169.8
	Difference	**11.3**	**17.5**	**36.5**	**-56.6**	**-20.1**

A data point at the Southwest Corner of the pond (Appendix B) indicates no change in water column or sediment depth and is assumed to be in a location that is relatively stable. Taking this as an indication that pond water levels have not changed over the course of two years we can assume that any changes in water column depth reflect an increase or decrease in sediment depth. Figure 1 summarizes the changes (%) in water depth and several layers of sediments between 1999 and 2000. Water column depth increased significantly more near the Restorer than in other parts of the pond. This suggests that organic matter in top sediments has been digested by organisms seeded from the Restorer. Furthermore, this finding is supported by the fact that fluffy sediments (top sediments with a high organic matter content) increased significantly less in the area near the Restorer than in other parts of the pond. The reason for fluffy sediment increase throughout the pond is likely to be a result of the time in which samples were taken. Samples in 1999 were taken during September, before most plant dieback, while samples from 2000 were taken in mid-November, after plant dieback. Since decaying plants contribute to fluffy sediment thickness, a lower increase of fluffy sediments near the Restorer suggests that fewer plants are growing near the Restorer than in other parts of the lake. This idea is supported by plant observations presented discussed in Section 5.



Reduction of invasive plants such as water milfoil was a primary goal of this restoration project. Fluffy sediments may also have increased less near the Restorer because seeded microorganisms from the Restorer should accelerate natural rates of organic matter breakdown.

The increase in depth of top and mid level sediments and the decrease in depth of heavy bottom sediments raises many questions. It is possible that bottom sediments are becoming loosened and converting into lighter, less packed top sediments. Alternatively, this result could be the result of sampling error. Standard sediment measurements over the course of several years are necessary to discern what might be occurring.

4. VOLATILE SOLIDS DATA

Organic matter is the component of sediments that can be broken down through biochemical reactions of microorganisms that are propagated in the Restorer and dispersed into the Weymouth pond system. Thus, if the Restorer is operating properly we would assume the percent of organic matter (measured as volatile solids) in top sediments to decrease in areas closer to the Restorer. Such reductions appear to have occurred between the years of 1999 and 2000 (Figure 2). Increases in organic matter in parts of the pond not near the Restorer may be due to plant diebacks that occur in the fall. Such dieback occurred after the 1999 samples were taken but prior to the 2000 samples. Sources of organic pollution, unknown to the writers, could also be contributing to organic matter build-up throughout the pond. Percent moisture of the two grouped sets of samples changed only slightly and in a very similar way suggesting that data collected during 1999 and 2000 is comparable (Figure 2). However, insufficient data exists to develop a statistically valid statement, and sampling error could have occurred in either 1999 or 2000. More complete standard testing over the course of a longer period of time is necessary to determine whether the reduction in organic matter of top sediments is indeed occurring near the Restorer.

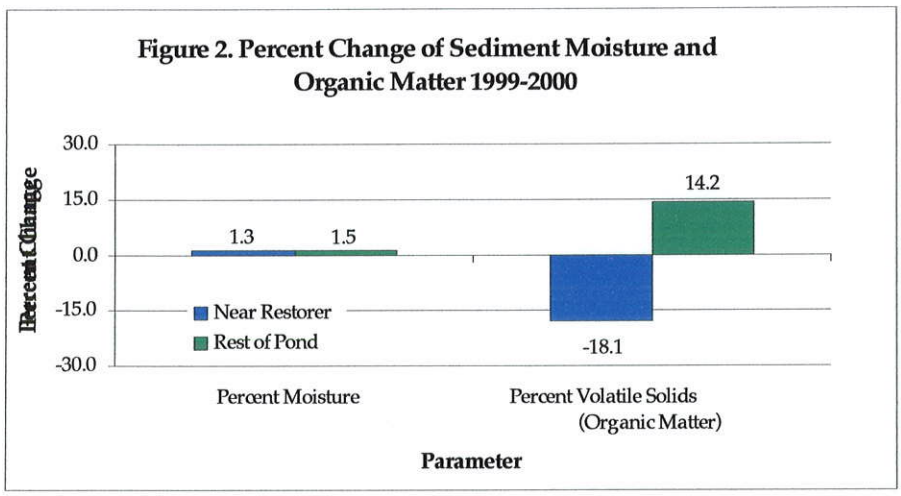
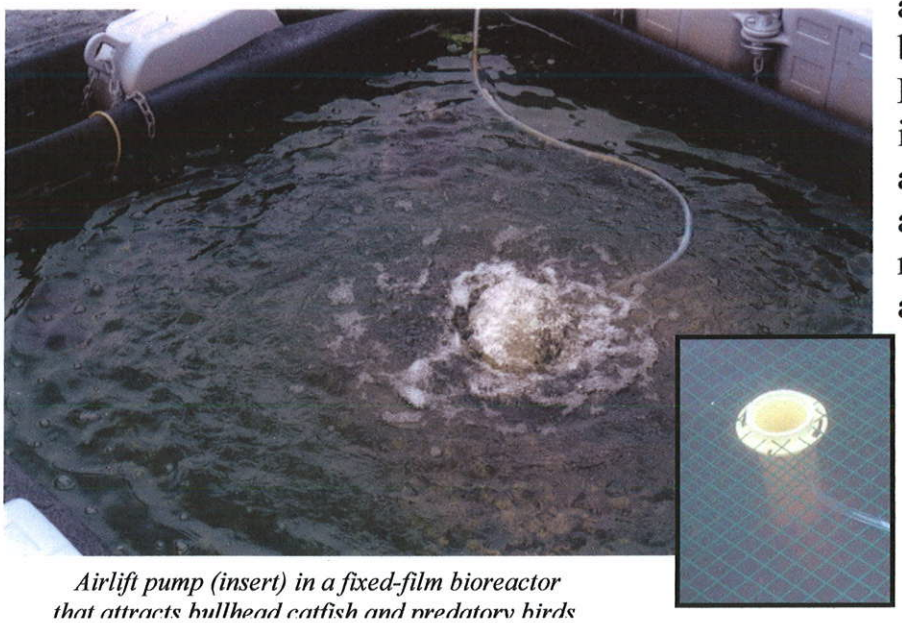


Figure 2. Percent Change of Sediment Moisture and Organic Matter 1999-2000

However, the West Cove Restorer did suffer setbacks from the local swans and geese. Many of the plants selected by OAI for their treatment effectiveness are among those most palatable to waterfowl. Favored species had to be replanted several times during the 2000 growing season. Appendix E includes lists of those plants that were grown (and eaten) in the summer of 2000. The placement of a monofilament strand around the outer perimeter of the Restorer did slow the grazing, but additional efforts will be required in 2001. See the 2001 preliminary operational plan for more information.

Bioaugmentation, the introduction of beneficial bacteria, was part of the operational regimen. BactaPur™, a formulation produced by Aquaresearch Ltd., of North Hatley, Quebec, was added to both the fixed-film reactors and plant zones during regular operational visits. Bioaugmentation re-inoculates the Restorer with a variety of specialized bacterial species. Formulations used include *Nitrosomonas* and *Nitrobacter*, autotropic bacteria that naturally convert ammonia into nitrate and on into inert nitrogen gas. Other bacterial species are proven to accelerate digestion of carbonaceous bottom sediments.



Airlift pump (insert) in a fixed-film bioreactor that attracts bullhead catfish and predatory birds

Research shows that accelerated bacterial digestion will not occur in an environment limited by the micronutrients required for cellular production. Unfortunately, when Alum was injected in the West Cove sediments, many essential micronutrients were locked-up in compounds with aluminum salts. To counter this condition, supplements of micronutrients were spread in the Restorer reactors, plant rafts, and surrounding sediments during each operator inspection.

2.2 Operational Plan for 2001

Several minor structural modifications are planned for 2001. These include monofilament and netting to prevent ducks, geese, swans and signets from climbing onto the plant rafts to graze on tender plant shoots. Once established, most mature plants are no longer palatable to waterfowl.

Bird netting will also be installed over the internal reactors to prevent herons from landing on the reactors. While the hunting herons provided a heart-warming visual for shoreline residents, the Restorer will function more efficiently if catfish are allowed to feed on the surface of the reactors. Operators will continue to release catfish to maintain appropriate populations.

Modifications to the aeration design will expand the influence of aeration on the sediments. OAI tested an aeration design that eliminated conventional check-valves and pressure relief valves at the blowers. This design delivered far more air to the Restorer than was anticipated by the aeration engineers at AREA Systems Specialist, Inc. The 2001 design will take advantage of the excess air using self-ballasted Hinde aeration tubing.

In accord with the second year operational protocol, mooring chains will be lengthened to allow the Restorer to migrate over a larger area of the West Cove. This will further expand the zone of influence around the Restorer. In future years it is anticipated that the Restorer will be moved to other locations around the pond to degrade older sediments in remote locations away from the dominant Southwest to Northeast flow in the West Cove.

Ocean Arks International also plans to seek funding for expanded deep sediment testing in the West Cove. As a point of interest outside of its contractual obligations, OAI has been testing bottom sediments from West Cove for percent solids and percent volatile solids. The results are discussed in the following sections. These results pose some interesting questions that require deep sediment testing to investigate.

3. SEDIMENT AND WATER COLUMN DEPTH DATA

The condition of bottom sediments is the best indicator of the state of a pond. Sediment data are more reliable than water data because changes in sediments occur on a much slower time scale. For purposes of comparison in this report, sediment data was broken into two groups. Samples taken within 25 meters of the

Restorer represent those sediments immediately impacted by the Restorer and are compared with samples taken from other parts of the pond. This summarized data is presented in Table 1 below. Detailed data for specific collection points can be found in Appendix B.

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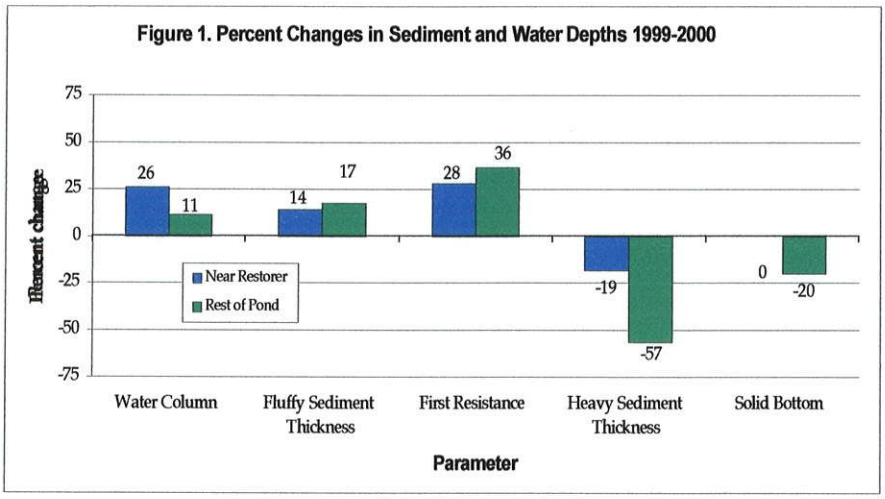

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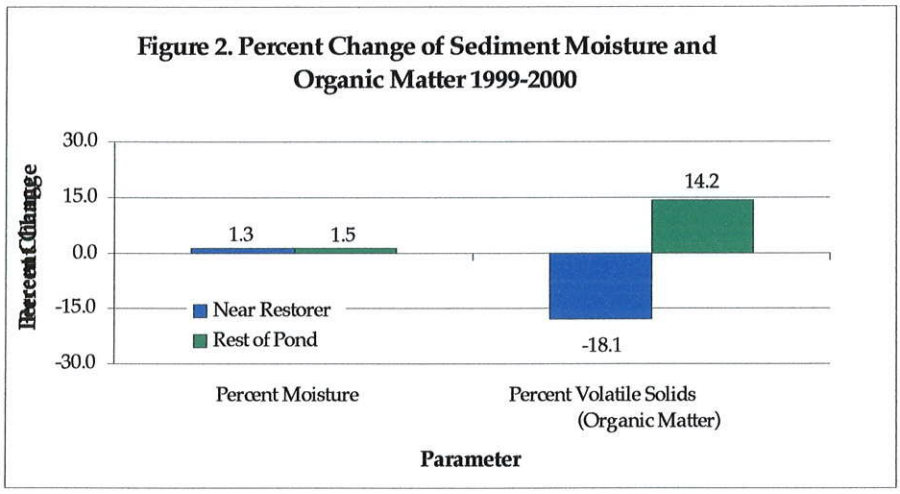


Figure 2. Percent Change of Sediment Moisture and Organic Matter 1999-2000

REFERENCES

Betke, R.E. 1997. *Diagnostic feasibility study: Western basin of Whitman's Pond, Weymouth, and Massachusetts*. Lycott Environmental, Inc., Southbridge MA.

Weymouth Sediments Data

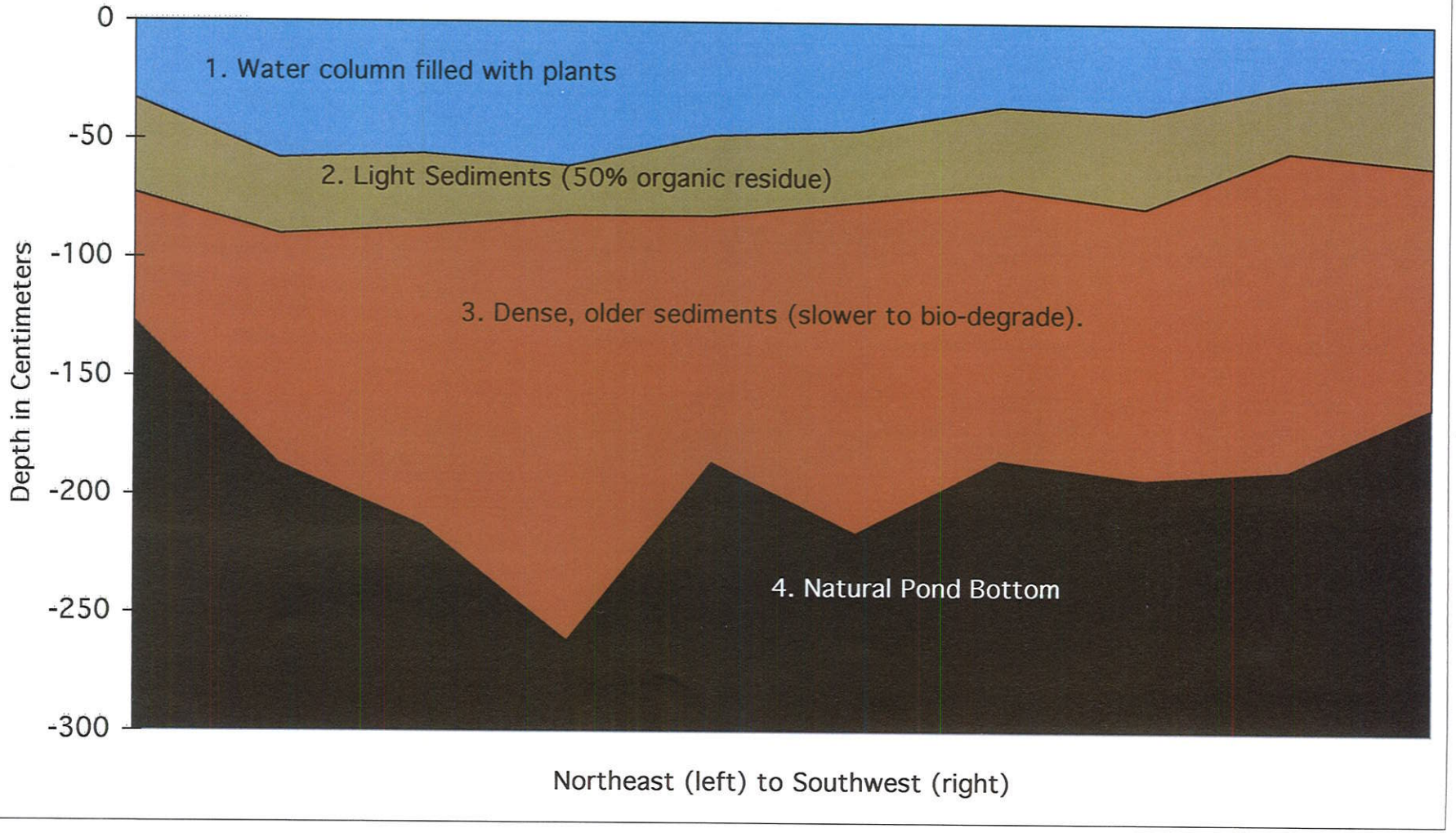
<-- Pink highlight indicates questionable data

Percent Volatile Solids

1999	2000	Change	
52%	46%	6%	Southwst Corner (green/orange buoy)
	47%		West side, middle, ornage buoy
	60%		Northwest, near submerged tree and bushes
63%	51%	11%	At corner of west leg and north leg
	42%		25 meters west of Restorer
54%	45%	9%	25 meters north of restorer
52%			25 meters east of restorer
42%	43%	-1%	2nd from north end
33%	72%	-39%	North end
	44%		near culvert under the road
43%	45%	-2%	100 meters north of Restorer (no buoy) Top sample
	94%		100 meters north of Restorer (no buoy) Bottom sample
			near blower shed
			southeast near island
			south of restorer, near fences
	32%		interior of Restorer
	95%		interior of Restorer, hard pan
	65%		interior of Restorer
	94%		interior of Restorer, hard pan
	91%		interior of Restorer

Appendix A

Depth of Sediments in West Cove
September 9, 1999



Sediment Depth Data, 1999

Location, 99	2000	Water Column (cm)	Fluffy Sediment Thickness	First Resistance (cm)	Heavy Sediment Thickness	Solid Bottom (cm)
1, Buoy	1	38	40	78	115	193
2, Buoy		26	29	54	135	189
2	9	33	40	73	54	127
2, Surface						
3	10	53	45	98	135	233
6	8	58	32	90	97	187
8	11	56	31	87	126	213
10		61	21	82	180	262
12	4	60				
13	6	48	34	82	104	186
13a	7					
14	13			62	178	240
15	3			17	66	83
16 & 17	5	46	30	76	140	216
16 & 23	2	36	35	70	115	185
17				73	158	231
17a						
18	14			55	108	163
24	15	20	40	60	102	162
			Units in centimeters			
		45	34	70	121	191
	Square Meters --->		83600	83600		83600
	Cubic Meters Volume --->		37,234	28,541		101,045
			9.16	<-- millions of gallons of water in pond		

Sediment Depth Data, 2000

14-Nov-00	Water Column (cm)	Fluffy Sediment Thickness	First Resistance (cm)	Heavy Sediment Thickness	Solid Bottom (cm)		depths in inches, 11/14/00		
1	38	41	79	104	183	Southwst C	15	31	72
2	38	43	81	114	196	West side,	15	32	77
3	36	34	70	22	91	Northwest,	14	27.5	36
4	38	50	88	77	165	At corner o	15	34.5	65
5	64	43	107	114	221	25 meters	25	42	87
6	81	24	105	102	207	25 meters	32	41.5	81.5
7	76	29	105	103	208	25 meters	30	41.5	82
8	72	17	89	89	178	2nd from n	28.5	35	70
9	66	48	114	18	132	North end	26	45	52
10	71	130	201	38	239	near culver	28	79	94
11						100 meters north of Restorer (no buoy) Top sample			
12						100 meters north of Restorer (no buoy) Bottom sample			
13	61	30	91	86	178	near blowe	24	36	70
14	46	41	86	84	170	southeast r	18	34	67
15	70	17	86	112	198	south of re	27.5	34	78
T1						interior of Restorer			
B1						interior of Restorer, hard pan			
T2						interior of Restorer			
M2						interior of Restorer, hard pan			
B2						interior of Restorer			
	Units in centimeters								
	58	42	100	82	182				
Square Meters --->		83600	83600		83600				
Cubic Meters Volume --->		48,676	35,118		68,358				
		11.97	<-- millions of gallons of water in pond						

Change from 1999 ----->	11,442	m3 more water	(32,686) m3 less dense sediments
	6,578	m3 more fluffy sediments	
	18.7%	more light sediments	
	2.81	million gallons more water	
	23.5%	increase in water volume	

Volatile Solids Data, 1999

Location, 99	2000	Tare	Wet Sample	*Wet grams*	Dry Sample	*Dry grams*	Ashed Sample	*Ashed Grams*	Percent Moisture	Percent Volatile Solids
1, Buoy	1	43.6890	51.7551	*8.0661*	44.2706	*0.5816*	43.9708	*0.2818*	93%	52%
2, Buoy										
2	9	45.9032	60.1478	*14.2446*	46.8809	*0.9777*	46.5553	*0.6521*	93%	33%
2, Surface		44.8416	51.5670	*6.7254*	45.9911	*1.1495*	45.4003	*0.5587*	83%	51%
3	10									
6	8	45.1971	55.2502	*10.0531*	46.0008	*0.8037*	45.6596	*0.4625*	92%	42%
8	11	44.7253	58.2922	*13.5669*	45.8771	*1.1518*	45.3823	*0.6570*	92%	43%
10		44.0899	55.5230	*11.4331*	45.0161	*0.9262*	44.6123	*0.5224*	92%	44%
12	4	44.4820	53.9843	*9.5023*	45.0077	*0.5257*	44.6770	*0.1950*	94%	63%
13	6	44.8521	61.9738	*17.1217*	46.3161	*1.4640*	45.5323	*0.6802*	91%	54%
13a	7	44.4877	76.6332	*32.1455*	47.2657	*2.7780*	45.8265	*1.3388*	91%	52%
14	13									
15	3									
16 & 17	5									
16 & 23	2									
17		44.7371	66.0445	*21.3074*	46.2919	*1.5548*	45.5637	*0.8266*	93%	47%
17a		44.1066	66.9580	*22.8514*	45.6619	*1.5553*	44.9428	*0.8362*	93%	46%
18	14									
24	15									
									92%	48%

Volatile Solids Data, 2000

14-Nov-00	Tare	Wet Sample	*Wet grams*	Dry Sample	*Dry grams*	Ashed Sample	*Ashed Grams*	Percent Moisture	Percent Volatile Solids
1	44.4760	59.6810	*15.2050*	45.5155	*1.0395*	45.0370	*0.5610*	93%	46%
2	43.6825	64.2424	*20.5599*	45.0020	*1.3195*	44.3760	*0.6935*	94%	47%
3	43.6710	49.2626	*5.5916*	43.9115	*0.2405*	43.7679	*0.0969*	96%	60%
4	44.7100	50.2950	*5.5850*	44.9940	*0.2840*	44.8480	*0.1380*	95%	51%
5	45.8872	51.0210	*5.1338*	46.2622	*0.3750*	46.1050	*0.2178*	93%	42%
6	45.1833	49.9222	*4.7389*	45.5035	*0.3202*	45.3610	*0.1777*	93%	45%
7									
8	44.0722	48.8450	*4.7728*	44.3963	*0.3241*	44.2560	*0.1838*	93%	43%
9	45.8971	78.7971	*32.9000*	49.9520	*4.0549*	47.0181	*1.1210*	88%	72%
10	44.0835	55.0251	*10.9416*	44.8150	*0.7315*	44.4951	*0.4116*	93%	44%
11	45.1889	55.4275	*10.2386*	46.0340	*0.8451*	45.6500	*0.4611*	92%	45%
12	44.8328	56.2250	*11.3922*	46.2080	*1.3752*	44.9120	*0.0792*	88%	94%
13									
14									
15									
T1	44.7024	52.4850	*7.7826*	45.4543	*0.7519*	45.2136	*0.5112*	90%	32%
B1	44.7165	47.6029	*2.8864*	45.0824	*0.3659*	44.7350	*0.0185*	87%	95%
T2	44.8258	50.2640	*5.4382*	45.3000	*0.4742*	44.9903	*0.1645*	91%	65%
M2	44.7156	52.6100	*7.8944*	46.0252	*1.3096*	44.7940	*0.0784*	83%	94%
B2	44.4700	50.5155	*6.0455*	45.1035	*0.6335*	44.5275	*0.0575*	90%	91%

Appendix D

Many of the nuisance plant species are opportunistic aggressors in an environment of excess nutrients. The Restorer works to starve the unwelcome species by digesting the stockpiles of food that exist in sediments and floating sludge.

Despite heavy growth of nuisance aquactic plant species, the pond still supports the microbial life required for the Restorer to digest the sediments and clean the water. Above a large snail suns itself on a lilypad during Ocean Arks' recent sampling inspection.

Floating sludge clogs the water column at the northern end of the West Cove. With a texture of chocolate mayonnaise on a hot day, these late summer mats of "bio-solids" are a primary target of the Restorer. Due to the shallow depths and hydrodynamics of the pond, elimination via bio-digestion will probably occur in the summer of 2001.

Appendix E

PLANT INVENTORY FOR WEYMOUTH, MASSACHUSETTS

Initial Planting:

Plant	Common Name	Quantity
Betula nigra	River Birch	1
Decodon verticillatus	Water Willow	25
Dryopteris thelypteris	Marsh Fern	100
Hydrocotyle verticillata	Water Pennywort	100
Iris pseudacorus	Yellow Flag Iris	10
Lemna minor	Duckweed	approx. 1 sq meter
Peltandra virginica	Tuckahoe	25
Pontedaria cordata	Pickerel Weed	25
Quercus bicolor	Swamp White Oak	2
Salix nigra	Black Willow	25
Saururus cernuus	Lizards Tail	100
Typha latifolia	Common Cattail	50

June Planting:

Plant	Common Name	Quantity
Dryopteris thelypteris	Marsh Fern	40
Hydrocotyle verticillata	Water Pennywort	100
Iris pseudacorus	Yellow Flag Iris	10
Peltandra virginica	Tuckahoe	1
Pontedaria cordata	Pickerel Weed	10
Salix sp. (coll.Native)	Willow	5
Salix nigra	Black Willow	25
Saururus cernuus	Lizards Tail	10
Scirpus cyperinus	Wool Grass	25
Typha latifolia	Common Cattail	7

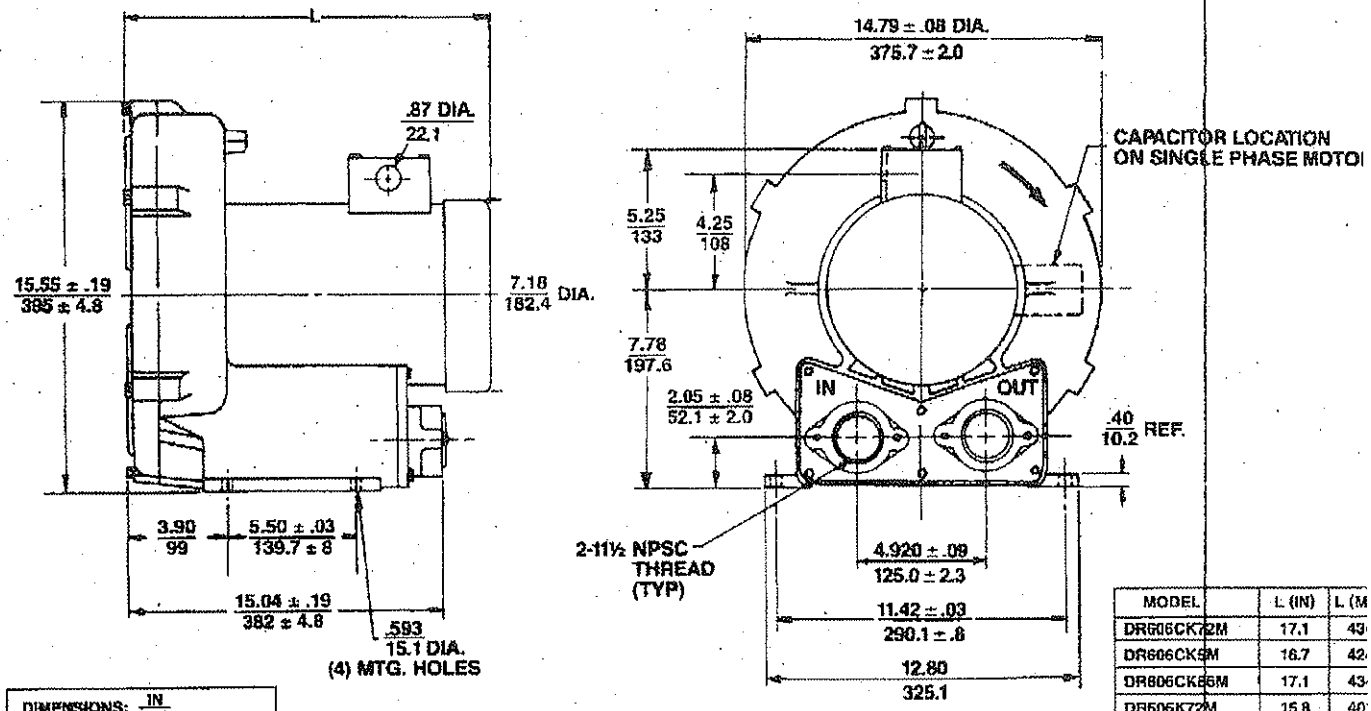
July Planting:

Plant	Common Name	Quantity
Typha angustifolia	Narrow-Leaved Cattail	500

AMETEK Rotron TMD

DR 606 & CP 60 Regenerative Blowe

Scale CAD drawing available upon reque



DIMENSIONS: IN / MM
TOLERANCES: .XX ± .08/2
(UNLESS OTHERWISE NOTED)

MODEL	L (IN)	L (M
DR606CK72M	17.1	43
DR606CK5M	16.7	42
DR606CK86M	17.1	43
DR606K72M	15.8	40
DR606K58M	17.1	43
CP606CR72MLR	16.7	42

SPECIFICATIONS

MODEL	DR606CK72M	DR606CK5M	DR606CK86M	DR606K72M	DR606K58M	DR606D72M	CP606CR72ML
Part No.	038526	038532	038530	038527	038529	080077	038247
Motor Enclosure – Shaft Material	TEFC – CS	TEFC – CS	TEFC – CS	TEFC – CS	TEFC – CS	TEFC – CS	ChemTEFC–S
Horsepower	4	4	4	3	3	5	Same as DR606CK72M 038526 except add Chemical Processing (CP) features from catalog inside front cov
Voltage [1]	230/460	230	575	230/460	115/230	208-230/460	
Phase – Frequency [1]	Three - 60 Hz	Single - 60 Hz	Three - 60 Hz	Three - 60 Hz	Single - 60 Hz	Three - 60 Hz	
Insulation Class [2]	F	F	F	F	F	F	
NEMA Rated Motor Amps	10.4/5.2	17.4	4.1	7.6/3.8	24.9/12.4	14-12.8/6.4	
Service Factor	1.0	1.0	1.0	1.15	1.0	1.15	
Locked Rotor Amps	94/47	121	80	88/44	194/97	96/48	
Max. Blower Amps [3]	11.4/5.7	18	4.56	9.5/4.75	27.8/13.9	11-10/5	
Recommended NEMA Starter Size	1/0	2	0	0/0	1.5/1	1/1	
Shipping Weight	98 lb (45 kg)	106 lb (48 kg)	92 lb (42 kg)	96 lb (44 kg)	98 lb (45 kg)	98 lb (45 kg)	

[1] Rotron motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors a factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz.** Our d voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-2 VAC-1 ph-50 Hz.** All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside certified range.

[2] Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated mot or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperatur Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet ambient temperatures above 40°C.

[3] Maximum blower amps corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and ambient temperature reaches the maximum operating temperature.

Specifications subject to change without notice. Please consult your Local Field Sales Engineer for specification updates.

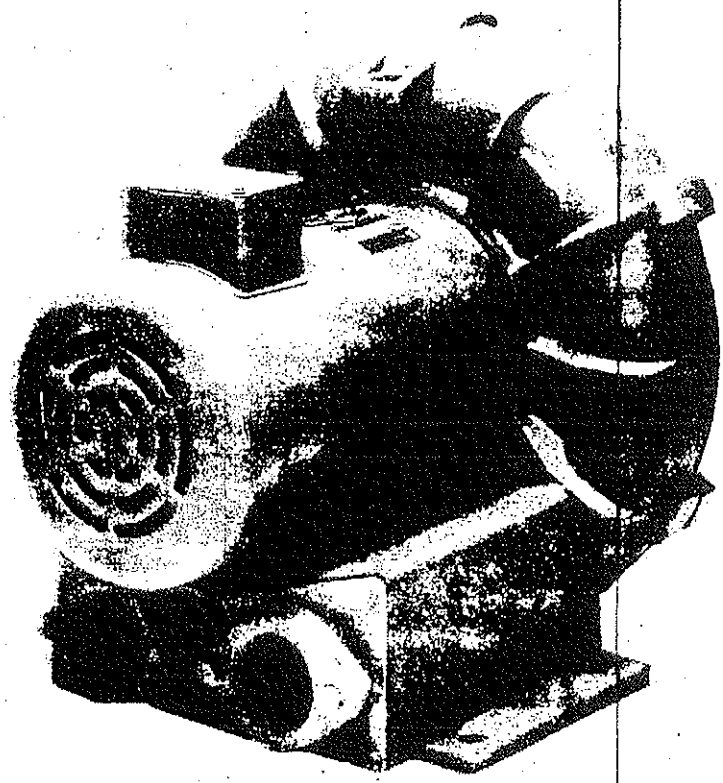
DR 606 & CP 606
Regenerative Blower

FEATURES
- Manufactured in the USA – ISO 9001 compliant
- CE compliant – Declaration of Conformity on file
- Maximum flow: 200 SCFM
- Maximum pressure: 100 IWG
- Maximum vacuum: 6.1" Hg (83 IWG)
- Standard motor: 4.0 HP, TEFC
- Cast aluminum blower housing, impeller & cover; cast iron flanges (threaded)
- UL & CSA approved motor with permanently sealed ball bearings
- Inlet & outlet internal muffling
- Quiet operation within OSHA standards

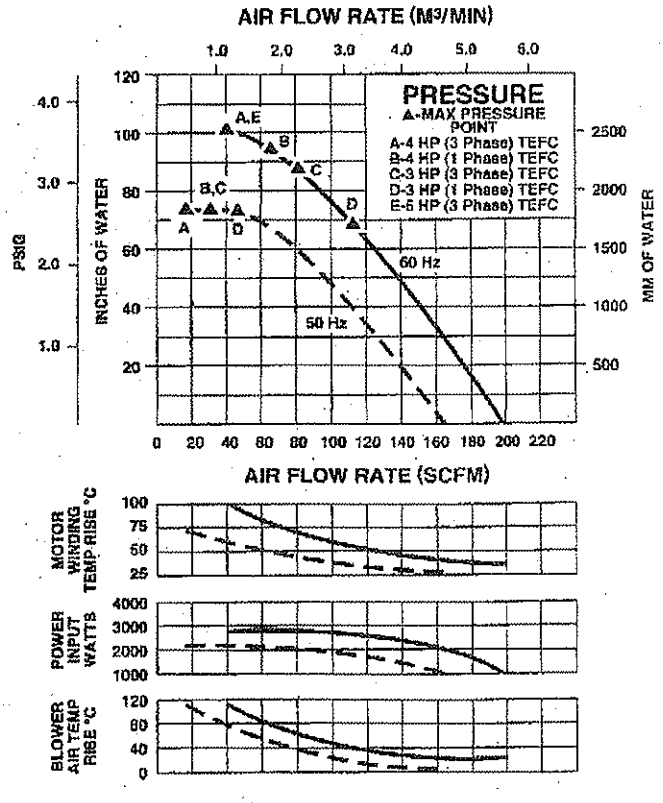
MOTOR OPTIONS
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

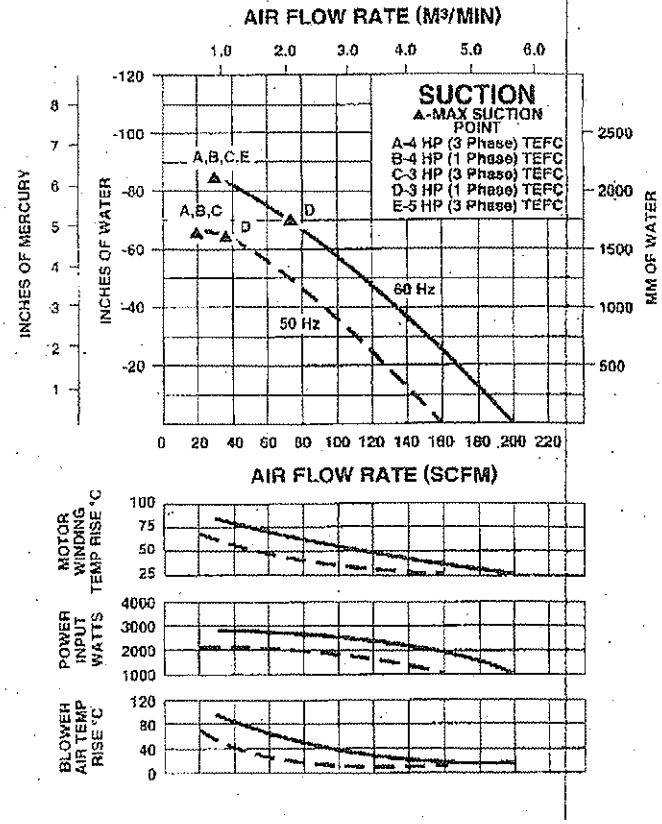
BLOWER OPTIONS
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES (See Catalog Accessory Section)
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges & relief valves
- Switches – air flow, pressure, vacuum or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package



BLOWER PERFORMANCE AT STANDARD CONDITIONS





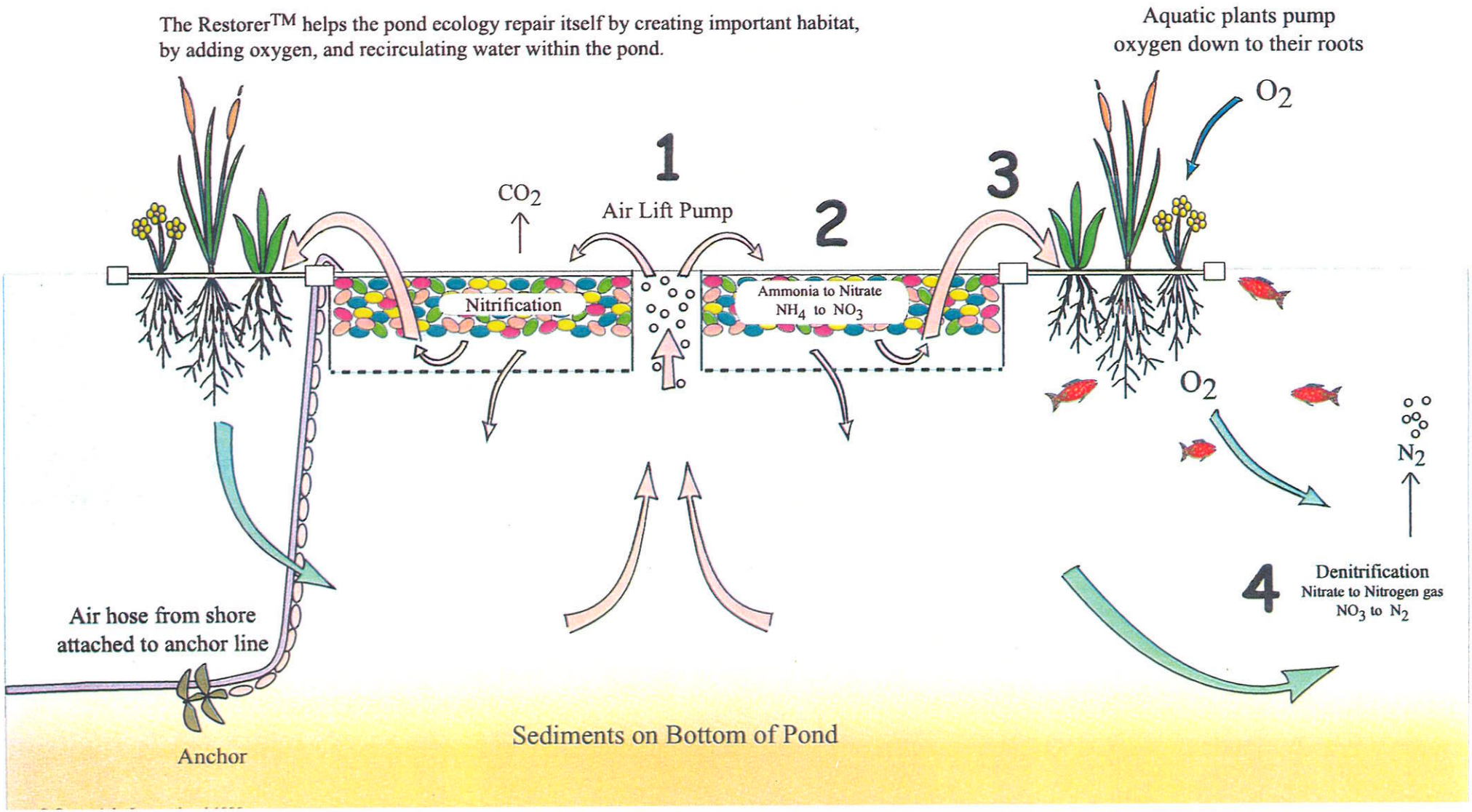
Ocean Arks International

The Restorer™

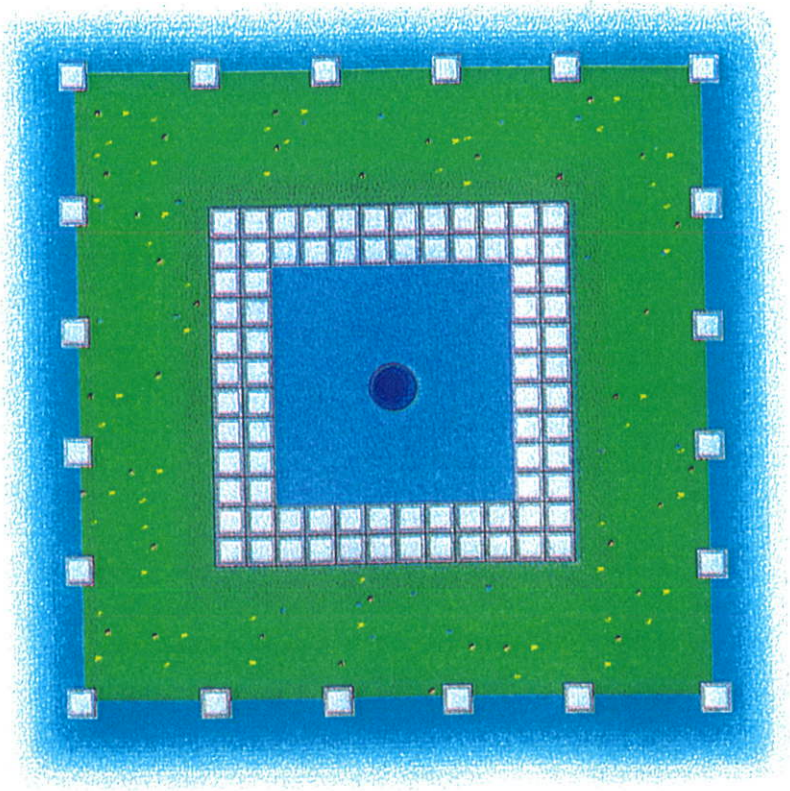
The Restorer™ "jump starts" the pond ecology, enabling organisms to metabolized nutrients in the pond.

1) Air lift raises nutrient-rich sediments from bottom of pond and oxygenates the water.
2) Nutrients flow downward through porous media containing nitrifying bacteria.
3) A second air lift passes water over roots of aquatic plants at periphery of the Lake Restorer. The root zone is an oxygen-rich habitat for nutrient-consuming organisms.
4) Nitrate is consumed by oxygen-hungry micro-organisms in sediments, releasing nitrogen gas.

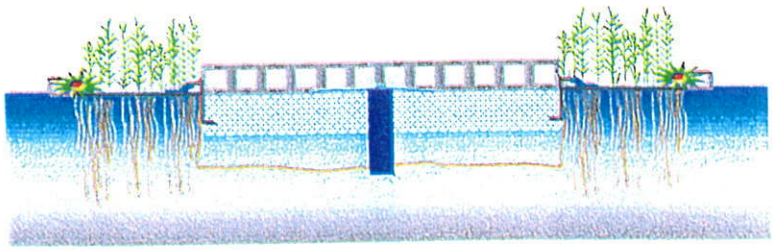
The Restorer™ helps the pond ecology repair itself by creating important habitat, by adding oxygen, and recirculating water within the pond.



Restorer III



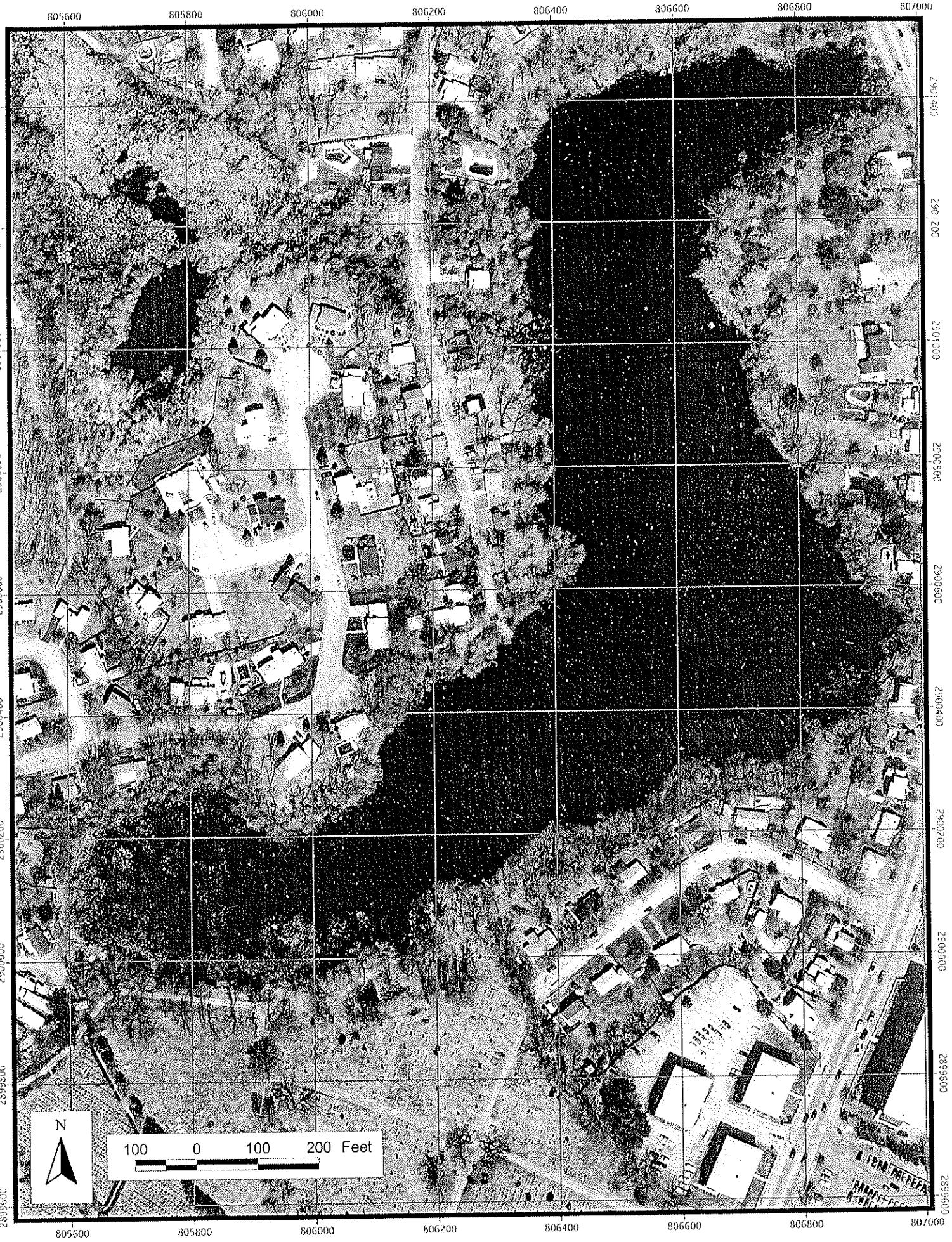
PLAN VIEW



CROSS SECTION

RESTORER III SPECIFICATIONS

Bouyancy:	9,500 kg displacement
Overall Pond Surface Area:	100 M^2
Manufactured Media Volume:	18 M3
Aeration Capacity:	50 SCFM
Hydraulic Throughput:	9,000 M3/D (2,375,000 gpd)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Appendix H

Operational Log Sheets - West Cove

OCEAN ARKS INTERNATIONAL
176 Battery Street, 3rd Floor • Burlington, VT 05401 USA • (802) 860-0011 • Fax (802) 860-0022

Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove ____

Date: May 18th

Time: all day.

Weather: cloudy late afternoon Thunderstorms

OAI Staff/Contractors: Jonathan, Jim, Mike Carr, Paul Z.

Guests: Jim Cunningham.
Arthur Matthews

Mechanical:

- **Blower temperature** good.
- **Blower bearings/noise** none.
- **Filter maintenance** new on both blowers
- **Pipelines secure** ✓
- **Pressure relief** 48" and blowing off heavily
- **Mechanical adjustment & observations** – Electrical installed tested Blower startup. WOW – more air than projected.

Structural:

- **Buoyancy**
- **Media Reactors** – added additional media.
- **Other notable issues / adjustments** adjustments to the cables supporting the reactors.

Biological

- **Minerals added**
- **Bacteria added** 10 Liters to plant racks and reactors
- **Plants added** full planting with purchased stock and native transpl
- **Aeration adjustments**
- **Plant maintenance**

Other notable items / issues / adjustments / activities

We've operational!

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Weymouth Restorer Operations Log Sheets

Location: West Cove ✓ South Cove ____

Date: May 24

Time: 10:00

Weather: clear 70°

OAI Staff/Contractors: Jonathan

Guests:

Mechanical:

- **Blower temperature** ✓
- **Blower bearings/noise** ✓
- **Filter maintenance** ✓
- **Pipelines secure** needs ballast.
- **Pressure relief** – heavy blow off – way more air than projected
- **Mechanical adjustment & observations**

Structural:

- **Buoyancy**
- **Media Reactors** – filamentous algea starting to foul reactors.
- **Other notable issues / adjustments**

Biological

- **Minerals added**
- **Bacteria added**
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance**

Re-set many plants. Birds are walking on rafts; Knock down and notable. Water may still be too cold for some species to kick in.

Other notable items / issues / adjustments / activities

will need to replant some species. Call to Burlington

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: June 6th

Time: 10:00

Weather: overcast 75°

OAI Staff/Contractors: Jonathan

Guests:

Mechanical:

- **Blower temperature** OK — All are 100%
- **Blower bearings/noise** Quiet
- **Filter maintenance** N
- **Pipelines secure** — OK. — need ballast to sink further in pond so as not to obstruct
- **Pressure relief** OK
- **Mechanical adjustment & observations** boaters

Structural:

- **Buoyancy** — needed for under Coir rafts.
- **Media Reactors** good
- **Other notable issues / adjustments**

Biological

- **Minerals added** N
- **Bacteria added** N
- **Plants added** Plant rack mostly submerged — will adjust some supplemental floatation.
- **Aeration adjustments**
- **Plant maintenance**

Other notable items / issues / adjustments / activities

* geese chowing on soft center of new shoots.

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Weymouth Restorer Operations Log Sheets

Location: West Cove ✓ South Cove _____

Date: 6-9-00

Time: 9³⁰ AM

Weather: Clear / Sunny - Warm

OAI Staff/Contractors: MIKE CARR
JONATHAN TODD

Guests:

Mechanical:

- **Blower temperature** FINE
- **Blower bearings/noise** NONE
- **Filter maintenance** OK
- **Pipelines secure** YES
- **Pressure relief** OK
- **Mechanical adjustment & observations** /

Structural:

- **Buoyancy** ok
- **Media Reactors** OK
- **Other notable issues / adjustments** Sank air lines - Secured at influent to Restorer

Biological

- **Minerals added**
- **Bacteria added**
- **Plants added**
- **Aeration adjustments** None
- **Plant maintenance** Tidied up Racks - Removed dead / rotten stems

Other notable items / issues / adjustments / activities

SANK AIR LINE TO RESTORER
~2 @ 2"

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: June 22

Time: 11:30 – 5:30

Weather: partly cloudy, 78°

OAI Staff/Contractors: Paul Zabinskie, Ben Zabinskie, Jonathan Todd

Guests: Jim Cunningham,

Mechanical:

- **Blower temperature** OK
- **Blower bearings/noise** Quiet – new gasket on blower housing
- **Filter maintenance** cleaned
- **Pipelines secure** OK
- **Pressure relief** OK
- **Mechanical adjustment & observations**

Structural:

- **Buoyancy** added float under plant rafts.
- **Media Reactors** catfish and snails.
- **Other notable issues / adjustments**
  catfish seem to be cleaning off filamentous algea!

Biological

- **Minerals added**
- **Bacteria added** – 5 liters
- **Plants added** – see list – partial planting.
- **Aeration adjustments**
- **Plant maintenance**

Other notable items / issues / adjustments / activities

Pond weeds growing vigorously along shoreline.
no sign yet around restorer.

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: Sat June 24

Time: 1:30

Weather: rain 80°

OAI Staff/Contractors: Paul Z, Ben Z.

Guests:

Mechanical:
- Blower temperature
- Blower bearings/noise
- Filter maintenance
- Pipelines secure
- Pressure relief
- Mechanical adjustment & observations

Structural:
- Buoyancy – seems to be holding well under plant rafts.
- Media Reactors
- Other notable issues / adjustments

Biological
- Minerals added
- Bacteria added
- Plants added — Finished planting second lot.
- Aeration adjustments
- Plant maintenance — Released 2 catfish from inner reactors.

Other notable items / issues / adjustments / activities

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: July 11

Time: 8:30

Weather: 75° Ptly Cld.

OAI Staff/Contractors: John Todd, Ph.D.

Guests:

Mechanical:

- **Blower temperature** OK
- **Blower bearings/noise**
- **Filter maintenance** N
- **Pipelines secure** ✓
- **Pressure relief** OK
- **Mechanical adjustment & observations**

Structural:

- **Buoyancy**
- **Media Reactors**
- **Other notable issues / adjustments**

Biological

- **Minerals added**
- **Bacteria added** 5 Liters
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance** — Plants having difficulty due to predation from waterfowl. Removed deceased dead specimens.

Other notable items / issues / adjustments / activities

Attached growth looks good. Bullhead Catfish in 2 internal reactors, both grazed clean

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: July 26

Time: 2:00

Weather: partly cloudy 75°

OAI Staff/Contractors: Jonathan

Guests:

Mike -
need to arrange overnight shipping of Cattail stock to 10 Shanks Pond Falmouth. JT

Mechanical:

- **Blower temperature** Fine
- **Blower bearings/noise** quiet
- **Filter maintenance** Yes
- **Pipelines secure** ✓
- **Pressure relief** tightened on raft
- **Mechanical adjustment & observations**

Structural:

- **Buoyancy**
- **Media Reactors** good
- **Other notable issues / adjustments** Installed Monofilament to deter nest birds.

Biological

- **Minerals added** – Kelp meal, 5 Kg
- **Bacteria added** 5 liters in reactors and on plant rafts
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance** plants still suffering. all new shoots being eaten.

Other notable items / issues / adjustments / activities

single strand of monofilament around perimeter.
removed 2 skulls from catfish from internal reactors.

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: August 2

Time: 10-3

Weather: Overcast 75°

OAI Staff/Contractors: Jonathan Todd, Roberto Obando

Guests:

Mechanical:

- **Blower temperature** ✓
- **Blower bearings/noise** OK
- **Filter maintenance** ✓
- **Pipelines secure** ✓
- **Pressure relief** OK
- **Mechanical adjustment & observations**

Structural:

- **Buoyancy**
- **Media Reactors**
- **Other notable issues / adjustments**

Biological

- **Minerals added** — 80 lbs to Restorer cells
  160 lbs to plant rafts and 50' radius around restorer
- **Bacteria added**
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance** Plants look better than they have all season. Monofilament must be working.

Other notable items / issues / adjustments / activities

planted 300 narrow leaf cat tails, have reed stock.

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: Aug 15.

Time: 2:45

Weather: overcast

OAI Staff/Contractors: Jonathan, Shant

Guests:

Mechanical:

- **Blower temperature** ✓
- **Blower bearings/noise** ok
- **Filter maintenance** cleaned #2
- **Pipelines secure** ✓
- **Pressure relief** ok
- **Mechanical adjustment & observations** none required, even it seems. "like that!"

Structural:

- **Buoyancy**
- **Media Reactors** – catfish bones abound: released one.
- **Other notable issues / adjustments**

Biological

- **Minerals added** 40 lbs. Eronite
- **Bacteria added** 5 Liters
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance** – new narrowleaf seem to be unhappy – could be transplant shock. Do not appear to be eaten.

Other notable items / issues / adjustments / activities

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: September 12

Time: 11:00

Weather: Sunny 70's

OAI Staff/Contractors: Jonatan

Guests: Jim Cunningham. — gave J. in tour of the site.

Mechanical:

- **Blower temperature** ok
- **Blower bearings/noise** ✓
- **Filter maintenance** N
- **Pipelines secure** ok
- **Pressure relief** ok
- **Mechanical adjustment & observations**

we saw significant improvements in the water column around the Restorer vs. away from The Restorer. Discussed plant problems at length.

Structural:

- **Buoyancy**
- **Media Reactors**
- **Other notable issues / adjustments**

Biological

- **Minerals added** 80 lbs. Ecomin
- **Bacteria added** 5 liters
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance** Plants still struggling, although grazing is greatly reduced with Rhomefilament.

Other notable items / issues / adjustments / activities

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: Sept 22

Time: 5:00

Weather: Overcast 65°

OAI Staff/Contractors: Jonathan Todd

Guests:

Mechanical:
- Blower temperature –
- Blower bearings/noise –
- Filter maintenance ✓
- Pipelines secure ✓
- Pressure relief –
- Mechanical adjustment & observations

Structural:
- Buoyancy –
- Media Reactors –
- Other notable issues / adjustments

Biological
- Minerals added
- Bacteria added
- Plants added
- Aeration adjustments
- Plant maintenance

Other notable items / issues / adjustments / activities

All is well here. Off to meeting of Whitmans Pond Committee. Have brief presentation on Restorer performance, issues, + Thru update.

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: September 25th

Time: 10:06

Weather: Rain 60°

OAI Staff/Contractors:

Guests:

Mechanical:

- **Blower temperature** - Switched blowers.
- **Blower bearings/noise** OK
- **Filter maintenance** cleaned both
- **Pipelines secure** OK
- **Pressure relief** 48" - glued it on.
- **Mechanical adjustment & observations** Replaced PVC ⌐ connection at blower housing.

Structural:

- **Buoyancy** good.
- **Media Reactors** clean due to more catfish and huge snails
- **Other notable issues / adjustments**

Biological

- **Minerals added** N
- **Bacteria added** N
- **Plants added** N
- **Aeration adjustments** None but above.
- **Plant maintenance** - reset several plants, removed some dozen or so that didn't make it.

Other notable items / issues / adjustments / activities

tightened mono fidanza -

checked mooring connections for wear - none.

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: October 13

Time: 12:00

Weather: Sunny 65°

OAI Staff/Contractors: Jonathan

Guests:

Mechanical:

- **Blower temperature** OK
- **Blower bearings/noise** OK
- **Filter maintenance** ✓
- **Pipelines secure** OK – reset
- **Pressure relief** – re-glued blow-off. need to modify in 2001
- **Mechanical adjustment & observations**

Structural:

- **Buoyancy** secured air lines on frame to reduce
- **Media Reactors** vibration and wind exposure.
- **Other notable issues / adjustments**

Biological

- **Minerals added** 40 lbs Economi
- **Bacteria added** 5 liters bactature
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance**

Other notable items / issues / adjustments / activities

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Weymouth Restorer Operations Log Sheets

Location: West Cove X South Cove _____

Date: November 15th

Time: 11:00 - 4.00

Weather: raining, low 50's

OAI Staff/Contractors: Pane Zabriskie. John Todd, Ph.D.

Guests: Jonathan Todd. Erika Brown.

Mechanical:

- **Blower temperature** good
- **Blower bearings/noise** good, quiet
- **Filter maintenance** Y
- **Pipelines secure** Y
- **Pressure relief** 48"
- **Mechanical adjustment & observations** prepare to shut down when pond nears freezing. Dec?

P2 measured 10.8 - 11.0 running Amps (@ 230 VAC) at the blower.

Structural:

- **Buoyancy** all OK.
- **Media Reactors** good. snail egg deposits. catfish bones and skull.
- **Other notable issues / adjustments** Saw and photographed a great Blue Heron on SE media cell

Biological

- **Minerals added** 80 lbs Ecomin to Restorer, 80 lbs to pond
- **Bacteria added** 5 liters 50' radius
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance** Aquatic plants still active...some look least They have all year.

Other notable items / issues / adjustments / activities

Full depth and sediment measurements around entire pond (14 stat Samples taken for % H2O and % Volatile until sample jar broke.

Appendix I

Operational Log Sheets – South Cove

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Weymouth Restorer Operations Log Sheets

Location: West Cove _____ South Cove X

Date: May 17th

Time: 3:30

Weather: cloudy cool.

OAI Staff/Contractors: ZABRISKIE, SARGERT

Guests:

Mechanical: building locked - no evaluation of mechanicals
- **Blower temperature**
- **Blower bearings/noise**
- **Filter maintenance**
- **Pipelines secure**
- **Pressure relief**
- **Mechanical adjustment & observations**

Structural: needs help. some woodwork to sturdy up corner.
- **Buoyancy**
- **Media Reactors** liner holes can be adapted to make this Restor operate more like current generation in West Cove. Air lines are leak.
- **Other notable issues / adjustments**

Biological
- **Minerals added** lots of volunteer plants and old perennials. Wa
- **Bacteria added** still to cold for much growth. Dead
- **Plants added** canada goose carcass in one cell.
- **Aeration adjustments**
- **Plant maintenance**

Other notable items / issues / adjustments / activities

need to find drawing from when this was made to evaluate structural repairs. Jonathan will need to check blowers. This can be made to work.

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Weymouth Restorer Operations Log Sheets

Location: **West Cove** _____ **South Cove** ✓

Date: 6-9-00

Time: 2 45

Weather: Sunny + warm

OAI Staff/Contractors: Mike Carr
Jonathan Todd

Guests:

Mechanical:
- **Blower temperature**
- **Blower bearings/noise**
- **Filter maintenance**
- **Pipelines secure**
- **Pressure relief**
- **Mechanical adjustment & observations**

Structural:
- **Buoyancy**
- **Media Reactors**
- **Other notable issues / adjustments**

Biological
- **Minerals added**
- **Bacteria added**
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance**

Other notable items / issues / adjustments / activities

While quite worn down, the Restorer continues to operate. New growth is taking hold. Blowers questionable. JT to keep an eye on.

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Weymouth Restorer Operations Log Sheets

Location: **West Cove** _____ **South Cove** X

Date: June 27

Time: 9:00

Weather: PC 80°

OAI Staff/Contractors: Jonathan Todd and Jonathan Mezzacappa

Guests:

Mechanical:
- **Blower temperature**
- **Blower bearings/noise**
- **Filter maintenance**
- **Pipelines secure**
- **Pressure relief**
- **Mechanical adjustment & observations**

Both blowers are down and need of rebuilt or replacement. Existing system is low volume / high pressure — May be worth looking at replacing with more efficient blowers.

Structural:
- **Buoyancy**
- **Media Reactors**
- **Other notable issues / adjustments**

Minor carpentry repair. Overall structure is rotting and has limited life left.

Biological
- **Minerals added**
- **Bacteria added**
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance**

Perennials from previous years are well established although look shabby. Some volenteer annuals also quite good root density. Removed some purple loosestrife.

Other notable items / issues / adjustments / activities

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Weymouth Restorer Operations Log Sheets

Location: West Cove _____ South Cove X

Date: 26th July

Time: 8 - 2

Weather: partly cloudy. 75°

OAI Staff/Contractors: Jonathan Todd, Stuart Barker

Guests:

Mechanical:
- **Blower temperature**
- **Blower bearings/noise**
- **Filter maintenance**
- **Pipelines secure**
- **Pressure relief**
- **Mechanical adjustment & observations** Picked up rebuilt compressor in Fairhaven in the am and installed it on South Cove. This compressor now drives the intake airlifts, with treated water flowing by gravity to outlet and discharge (also through muscate holes).

Structural:
- **Buoyancy** stabilized
- **Media Reactors** nylon net media in serviceable condition
- **Other notable issues / adjustments**

Biological
- **Minerals added** Kelp meal
- **Bacteria added** 5 litres
- **Plants added**
- **Aeration adjustments** above.
- **Plant maintenance**

Other notable items / issues / adjustments / activities

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Weymouth Restorer Operations Log Sheets

Location: West Cove _____ South Cove X

Date: August 15

Time: 1:00

Weather: Overcast 75

OAI Staff/Contractors: Jonathan, Strart Baker

Guests:

Mechanical:

- **Blower temperature** ok
- **Blower bearings/noise** always loud.
- **Filter maintenance** N
- **Pipelines secure** y
- **Pressure relief** ok
- **Mechanical adjustment & observations** Installed second Sweetwater AQ7 blower/compressor to power the internal airlift. The air is done to simultaneously run influent (from compressor #1) and internal re-circ. Mussel hole allow accelerated flow through ala - the most some.

Structural:

- **Buoyancy** holding.
- **Media Reactors**
- **Other notable issues / adjustments**

Biological

- **Minerals added** 160 lbs Ecominerals
- **Bacteria added** 5 liters
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance** – Plants seem extremely hardy. Mostly native, some invasive removed.

Other notable items / issues / adjustments / activities

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Weymouth Restorer Operations Log Sheets

Location: West Cove _____ South Cove X

Date: Sept 22

Time: 4:30

Weather: overcast 65°

OAI Staff/Contractors: Jonathan Todd

Guests:

Mechanical:
- **Blower temperature**
- **Blower bearings/noise**
- **Filter maintenance**
- **Pipelines secure**
- **Pressure relief**
- **Mechanical adjustment & observations**

Visual inspection from shore. all looks good. Blowers sound normal.

Structural:
- **Buoyancy**
- **Media Reactors**
- **Other notable issues / adjustments**

Will give brief update of South Cove during my presentation to Whitman Pond Committee tonight.

Biological
- **Minerals added**
- **Bacteria added**
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance**

Other notable items / issues / adjustments / activities

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Weymouth Restorer Operations Log Sheets

Location: West Cove _____ South Cove ✓

Date: October 13

Time: 11:00

Weather: Sunny 65°

OAI Staff/Contractors: Jonathan

Guests:

Mechanical:

- **Blower temperature** OK
- **Blower bearings/noise** loud as usual
- **Filter maintenance** OK
- **Pipelines secure** OK
- **Pressure relief** OK
- **Mechanical adjustment & observations**

Structural:

- **Buoyancy** – holding ..... for now. structure is questionable, as far as overwinter
- **Media Reactors**
- **Other notable issues / adjustments**

Biological

- **Minerals added** 40 lbs. Ecomin
- **Bacteria added** 5 liters BactaPur
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance** – not exactly an English Garden, but good operation plant root mass.

Other notable items / issues / adjustments / activities

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Weymouth Restorer Operations Log Sheets

Location: West Cove _____ South Cove X

Date: November 15

Time: 10:30

Weather: rain, overcast, cold.

OAI Staff/Contractors: Paul Zabriskie, John Todd, Ph.D.

Guests: Jonathan Todd, Erica Brown

Mechanical:

- **Blower temperature** ok. Blowers removed for year-end servicing.
- **Blower bearings/noise**
- **Filter maintenance**
- **Pipelines secure**
- **Pressure relief**
- **Mechanical adjustment & observations**

Structural:

- **Buoyancy** — looks fragile on Southeast corner — ice may take its toll = wood is pretty beat.
- **Media Reactors**
- **Other notable issues / adjustments**

Biological

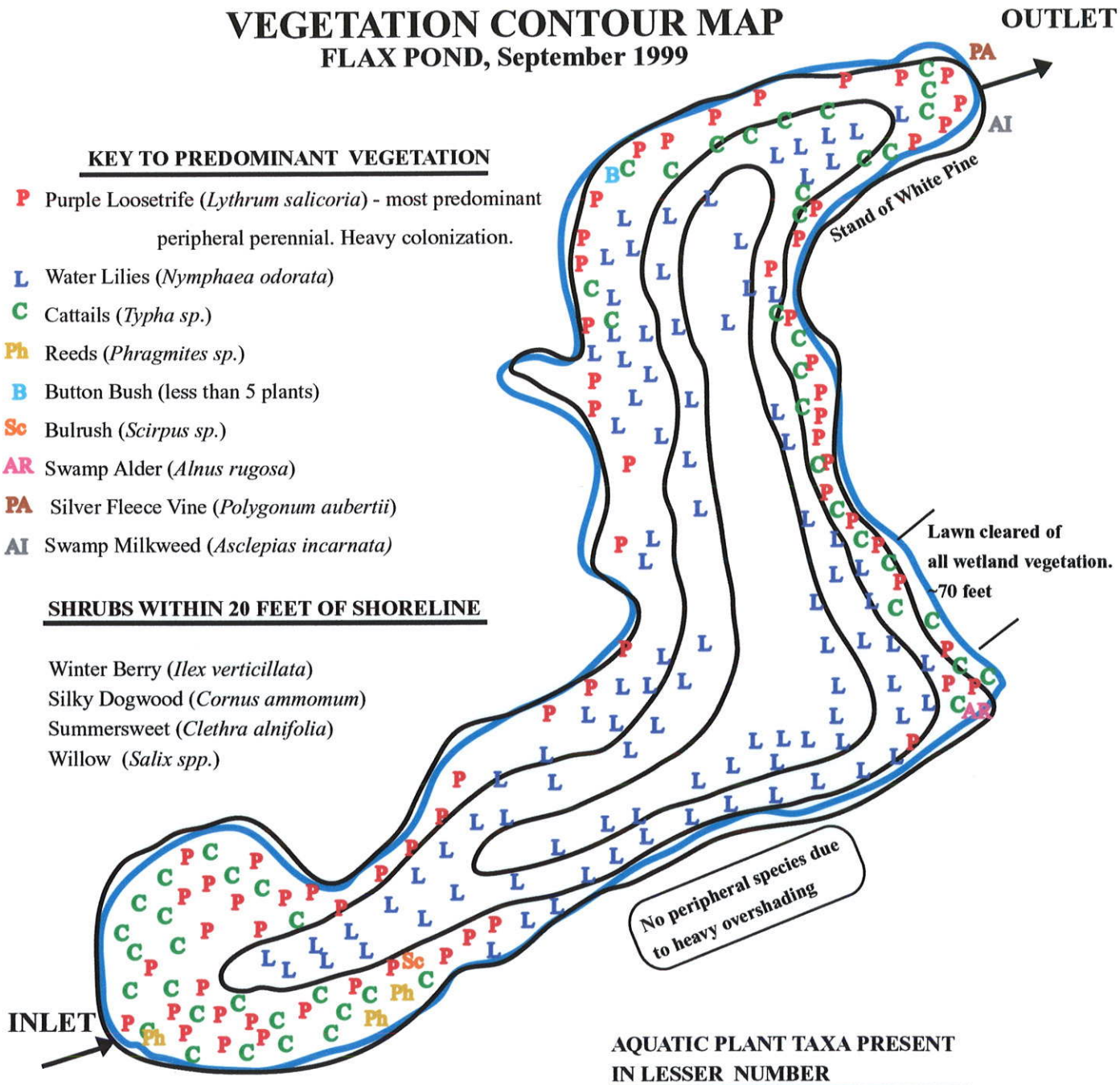
- **Minerals added**
- **Bacteria added**
- **Plants added**
- **Aeration adjustments**
- **Plant maintenance** – plants are hardy. still acting but looks like many have set in for winter

Other notable items / issues / adjustments / activities

end of season operations at South Cove.

Appendix J

VEGETATION CONTOUR MAP
FLAX POND, September 1999



KEY TO PREDOMINANT VEGETATION

- **P** Purple Loosetrife (*Lythrum salicoria*) - most predominant peripheral perennial. Heavy colonization.
- **L** Water Lilies (*Nymphaea odorata*)
- **C** Cattails (*Typha sp.*)
- **Ph** Reeds (*Phragmites sp.*)
- **B** Button Bush (less than 5 plants)
- **Sc** Bulrush (*Scirpus sp.*)
- **AR** Swamp Alder (*Alnus rugosa*)
- **PA** Silver Fleece Vine (*Polygonum aubertii*)
- **AI** Swamp Milkweed (*Asclepias incarnata)*

SHRUBS WITHIN 20 FEET OF SHORELINE

Winter Berry (*Ilex verticillata*)
Silky Dogwood (*Cornus ammomum*)
Summersweet (*Clethra alnifolia*)
Willow (*Salix spp.*)

AQUATIC PLANT TAXA PRESENT IN LESSER NUMBER

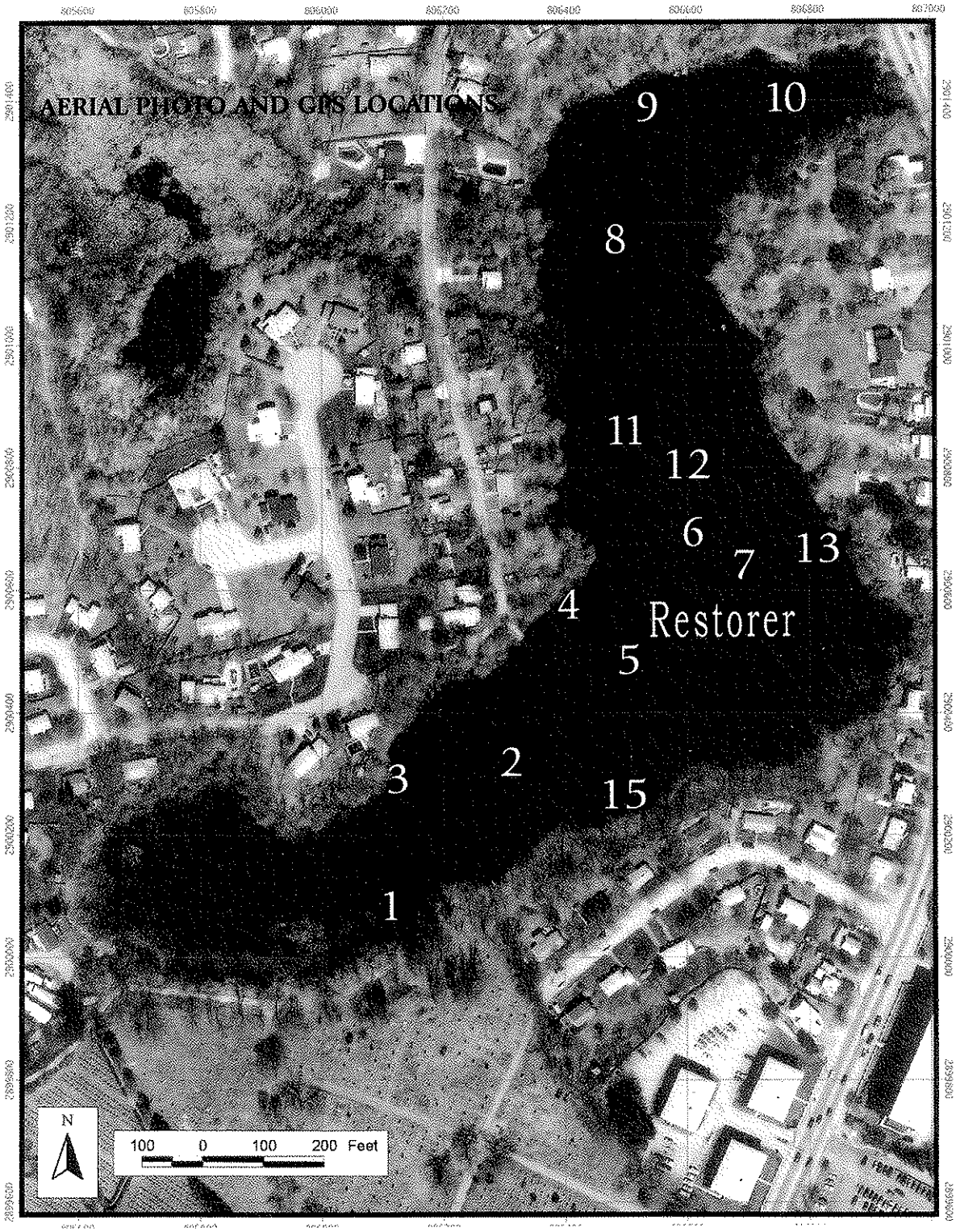
Duckweed (*Lemna minor*)
Spike Rush (*Eleocharis sp.*)
Sedge (*Cyperus spp.*)
False Nettle (*Boehmeria cylindrica*)
Pickerel Weed (*Pontederia cordata*)
Smart Weed (*Polygonum spp.*)
Water Shield (*Brasenia schreberi*)
Arrowhead (*Sagittaria latifolia*)
Beggar's Tick (*Bidens spp.*)
Touch Me Not (*Impatiens spp.*)

OTHER BOTANICAL NOTES

* Black Locust (*Robinia pseudoaccia*) saplings (3'-8') scattered throughout. This species is invasive in vermont.
* Surprisingly few grasses, sedges, or rushes.
* Lythrum represents 60% of the area covered by emergent vegetation.

Appendix K

Map of Intitial Sediment Depths, 1999



ID #	Tot. Sediment Depth
1	155 cm
2	149 cm
3	
4	
5	170 cm
6	138 cm
7	
8	129 cm
9	94 cm
10	180 cm
11	157 cm
12	
13	
14	
15	142 cm

Note: For complete sedimet depth profiles for 1999 and 2000, please see Appendix B.