Hinckleys Pond

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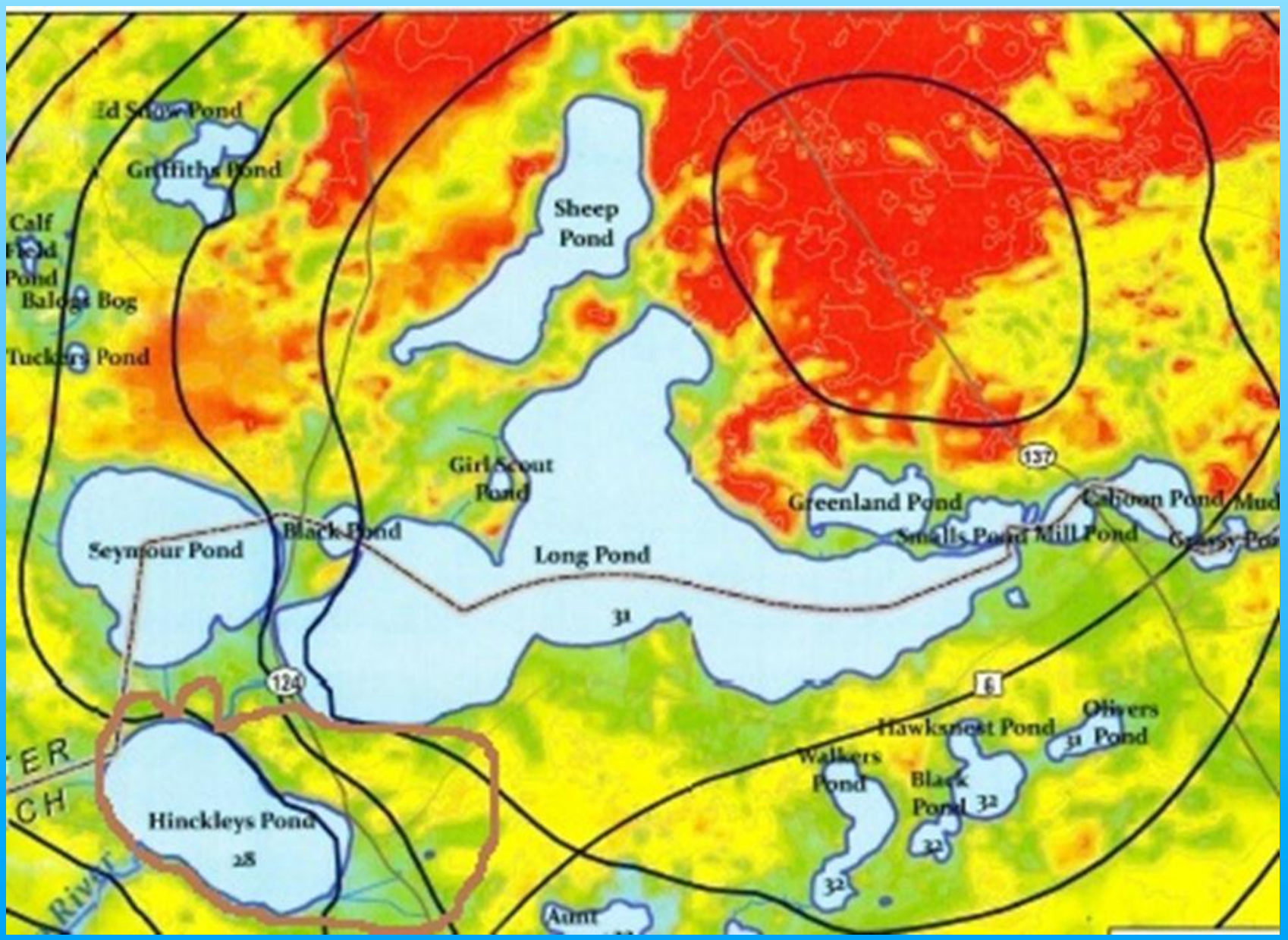

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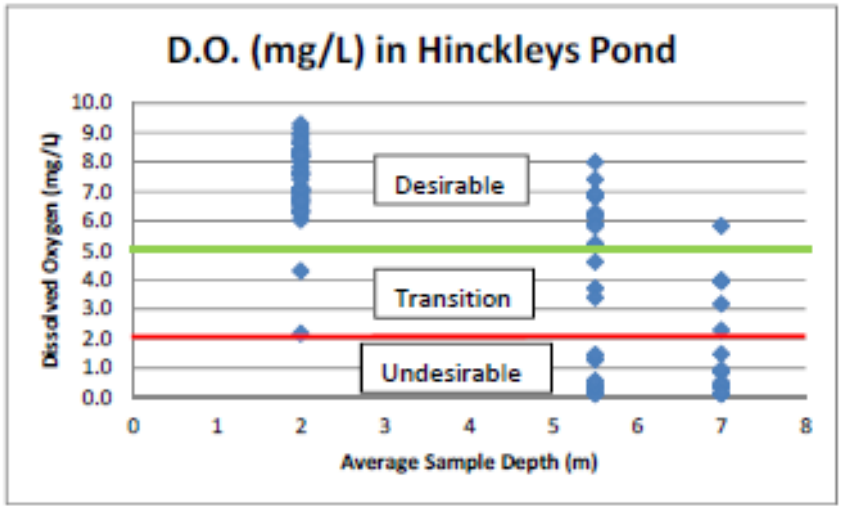
Contours in feet.

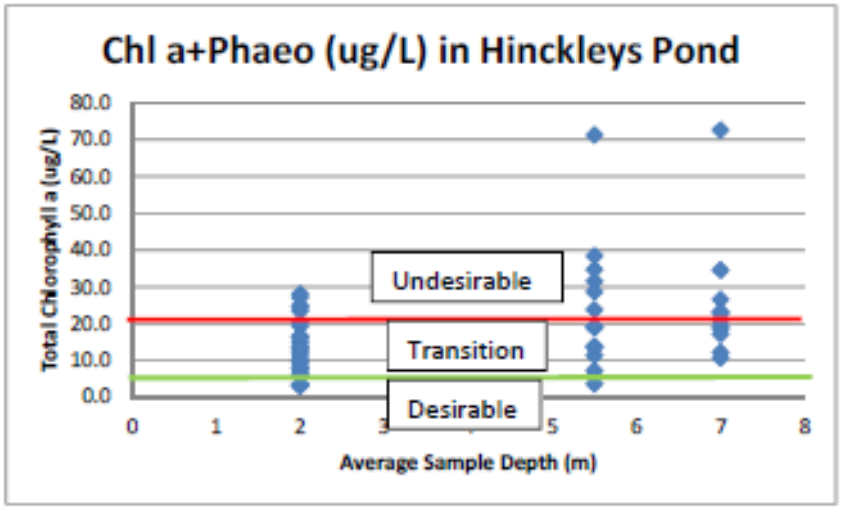
Hinckleys Pond

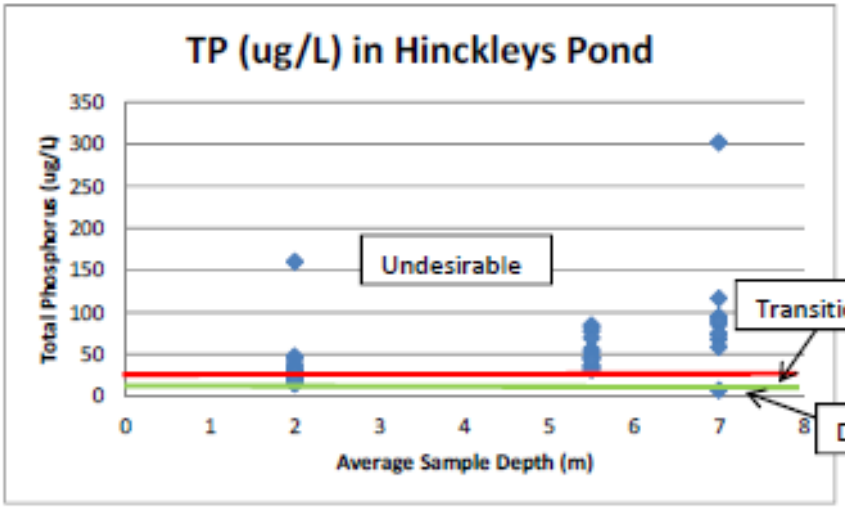
Table 1. Bathymetric features of Hinckleys Pond.

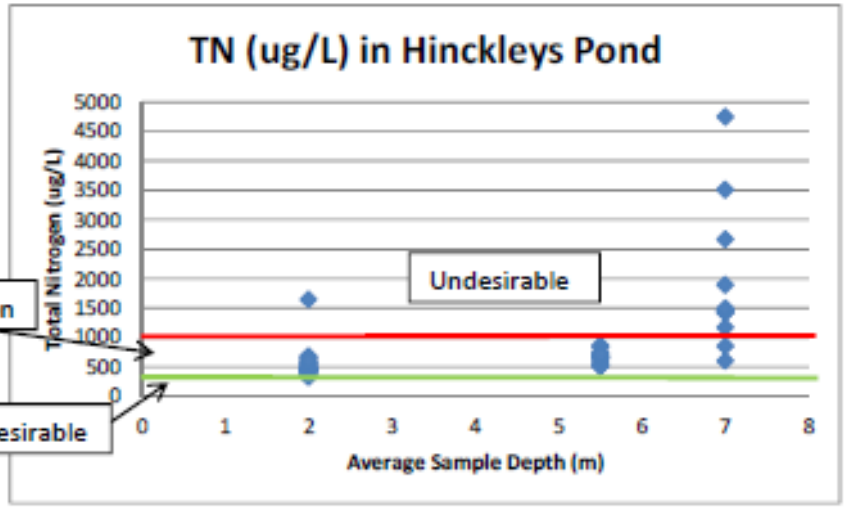
Depth (ft)	Area (ac)	Area (ha)	Volume (ac ft)	Volume (ft3)	Volume (m3)
0-5	174.0	70.2	800.3	34860565	987551
5-10	146.1	58.9	647.9	28220458	799446
10-15	113.0	45.6	476.8	20770581	588402
15-20	77.7	31.3	258.4	11255792	318861
20-25	25.7	10.3	75.3	3279565	92906
25-28	4.5	1.8	11.2	485862	13764
Total			2269.8	98872823	2800930

Hinckleys Pond



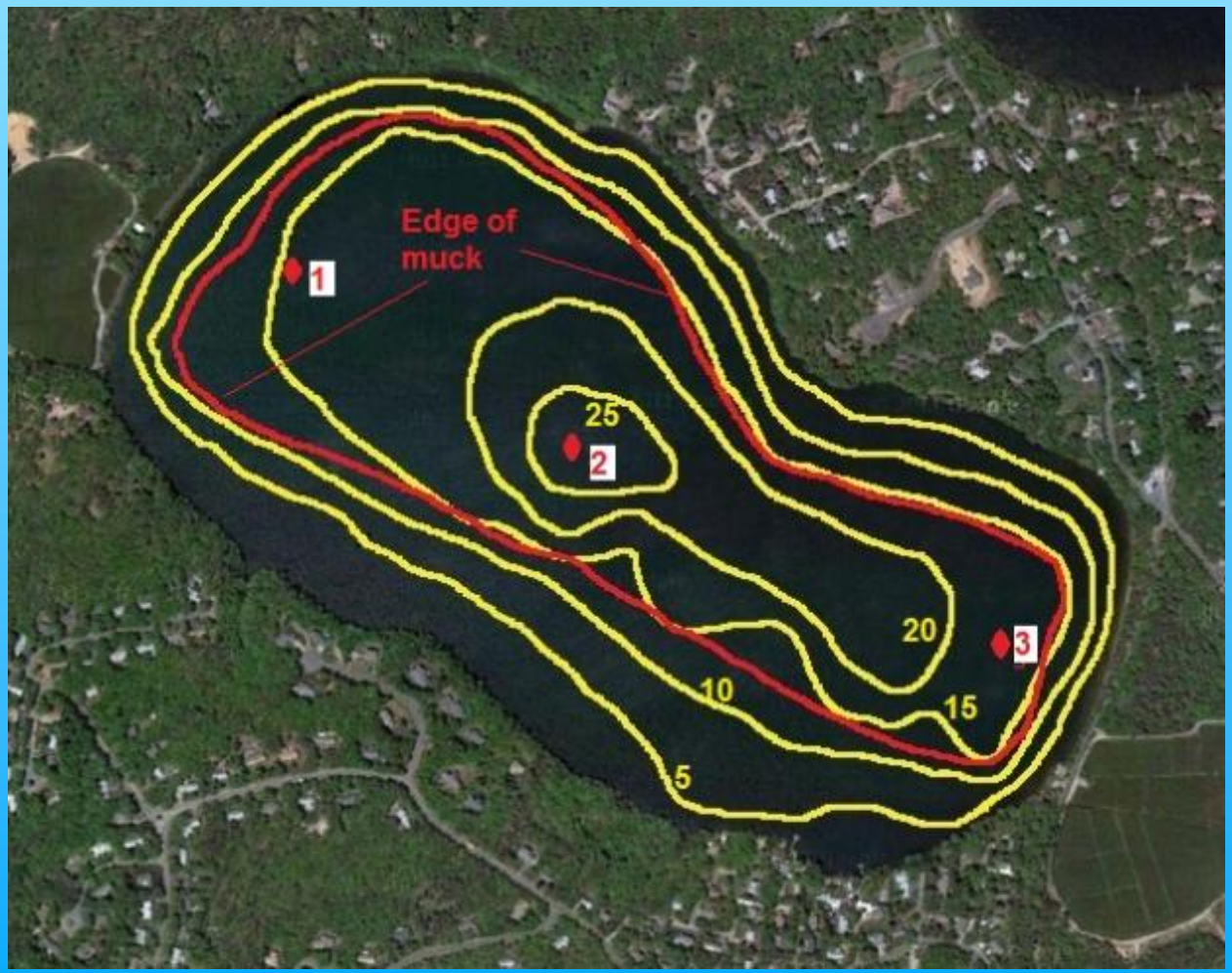






Red and green lines indicate approx. thresholds

Hinckleys Pond



Contours in feet, numbers are sediment sampling locations, redline is approx. “muck” line

Hinckleys Pond

Table 1. Sediment quality data from the December 2009 sampling.

Station	Total P (mg/kg)	% Solids	Fe-P (mg/kg)	Loose-P (mg/kg)
West	6720	10.2	1380	0.45
East	95.4	75.8	34.2	0.21

					Initial Concentration		Fe-P (mg/kg) at Aluminum Dose =			
Station	Total P (mg/kg)	% Solids	% Moisture	% Volatile Solids	Fe-P (mg/kg)	Loose-P (mg/kg)	25 g/m2	50 g/m2	75 g/m2	100 g/m2
HS-1	6560	11.0	91.8	33.4	733	<6.8	184	268	126	68.5
HS-2	6350	11.8	91.8	32.6	806	<6.4	462	832	361	155
HS-3	5930	14.2	91.6	33.8	504	<5.3	139	104	48.9	ND

Hinckleys Pond

Water and nutrient loads to Hinckleys Pond.

Source	Est. Range of Flow (cu. m/yr)	Best Est. of Flow (cu.m/yr)	% of Total Flow	Est. Range of TP Load (kg/yr)	Best Est. of TP Load (kg/yr)	% of Total P Load	Est. Range of TN Load (kg/yr)	Best Est. of TN Load (kg/yr)	% of Total N Load	TN:TP Load Ratio
Direct Precipitation	651,000 to 1,017,000	813,900	12.4	6.5 to 25.4	13.8	3.9	407 to 814	570	11.9	41.3
Flow from Long Pond	4,000,000 to 6,667,000	5,000,000	75.9	62.5 to 150	90.0	25.5	1500 to 2810	2155	45.1	23.9
Flow from Seymour Pond	900,000 to 1,230,000	1,065,000	16.2	21.3 to 42.7	28.8	8.2	799 to 1385	1144	23.9	39.8
Direct Stormwater Drainage to Hinckleys Pond	59,500 to 147,300	103,400	1.6	9.4 to 51.7	21.8	6.2	76 to 339	163	3.4	7.5
Cranberry Bog Discharge	36,400 to 54,600	45,500	0.7	9.3 to 84.9	22.8	6.5	12.3 to 18.4	15	0.3	0.7
Direct Groundwater Drainage to Hinckleys Pond (without Wastewater from within 300 ft)	156,000 to 573,200	364,600	5.5	1.6 to 11.5	3.6	1.0	78 to 287	182	3.8	50.6
Wastewater via Groundwater to Hinckleys Pond (within 300 ft)	9,600 to 23,000	9,600	0.1	2.4 to 31.6	7.6	2.2	119 to 418	157	3.3	20.7
Waterfowl	0	0	0.0	2.0 to 8.0	4.0	1.1	15 to 26	19	0.4	4.8
Internal Load	0	0	0.0	76.2 to 261	160.0	45.4	229 to 522	376	7.9	2.4
Total		6,588,100	100.0	0	352.4	100.0		4781	100.0	13.6

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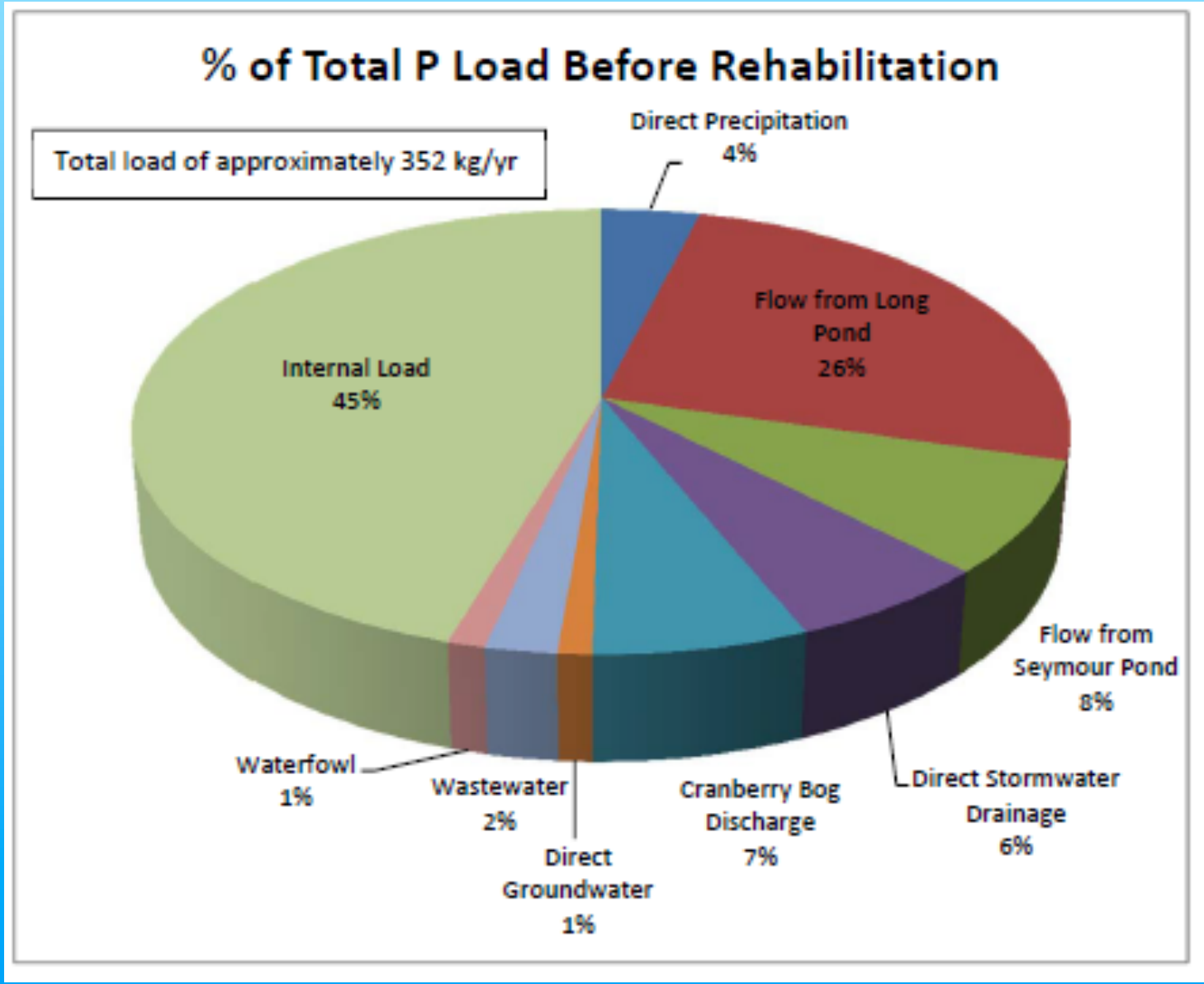

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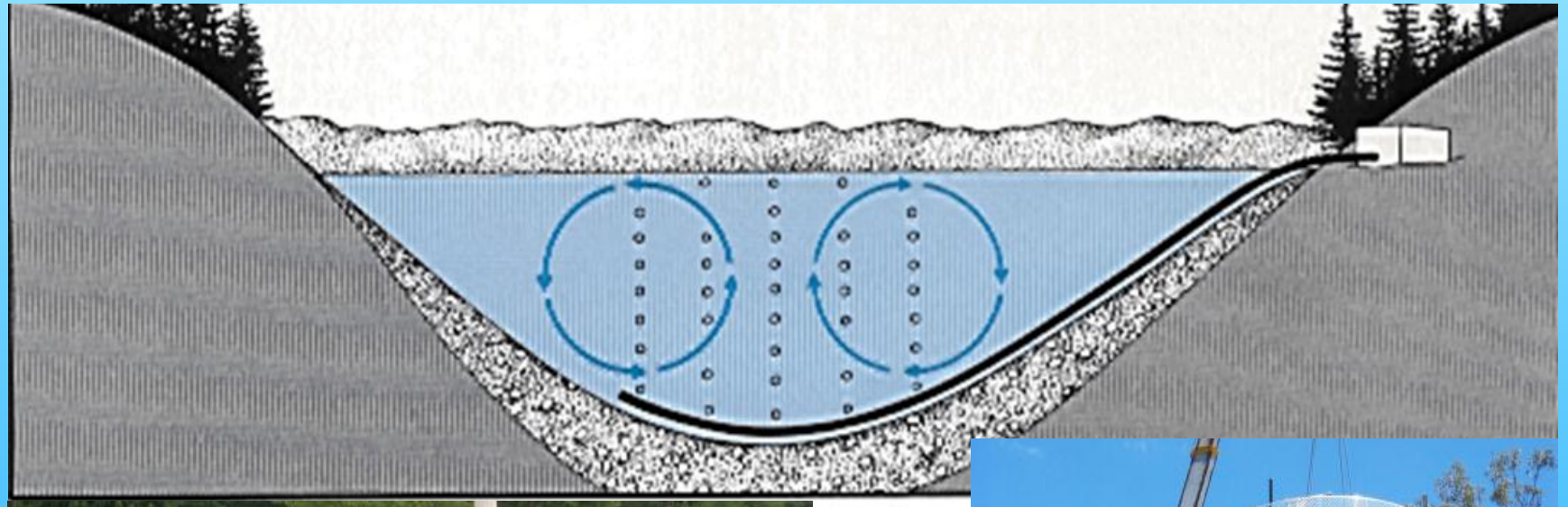

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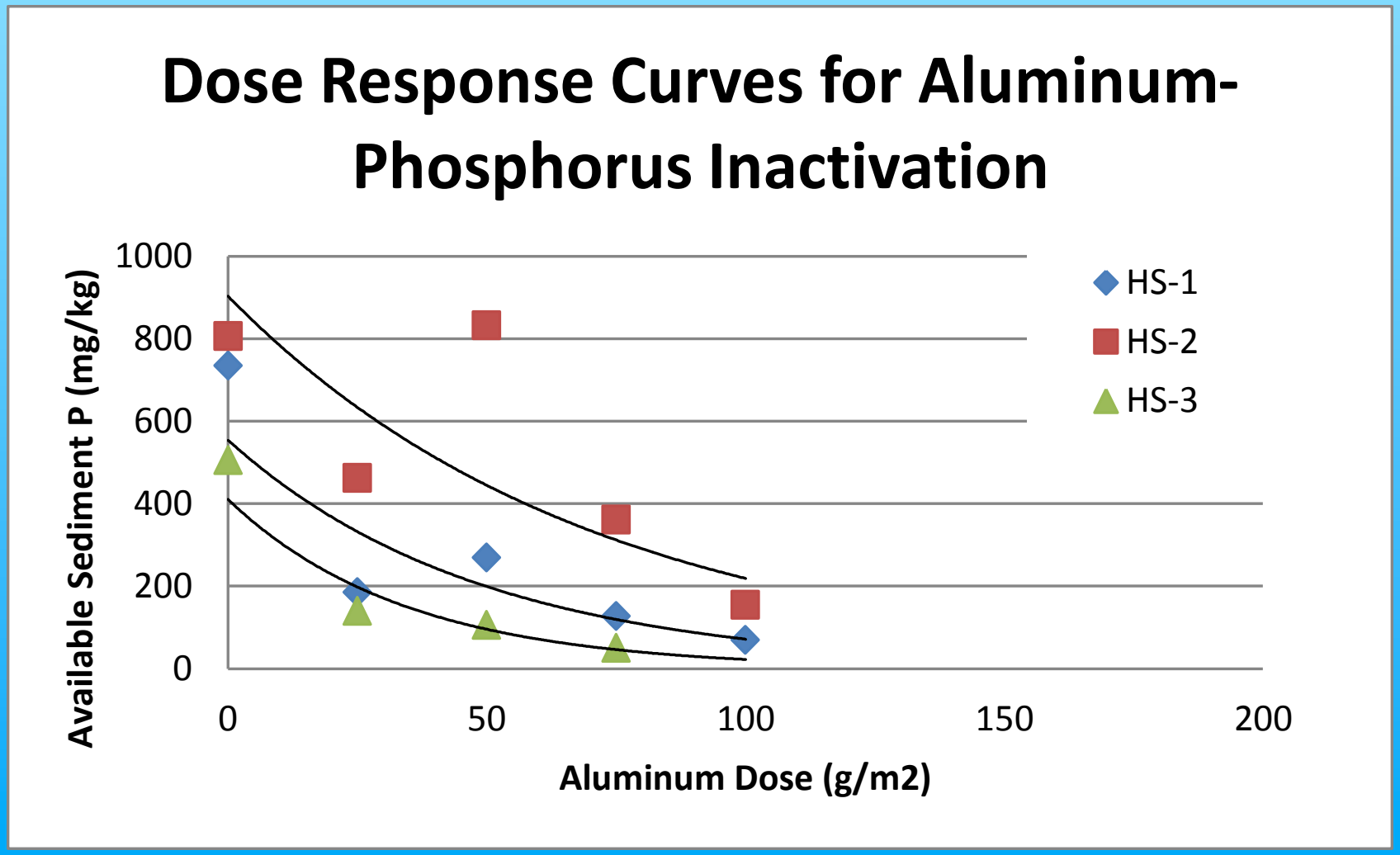

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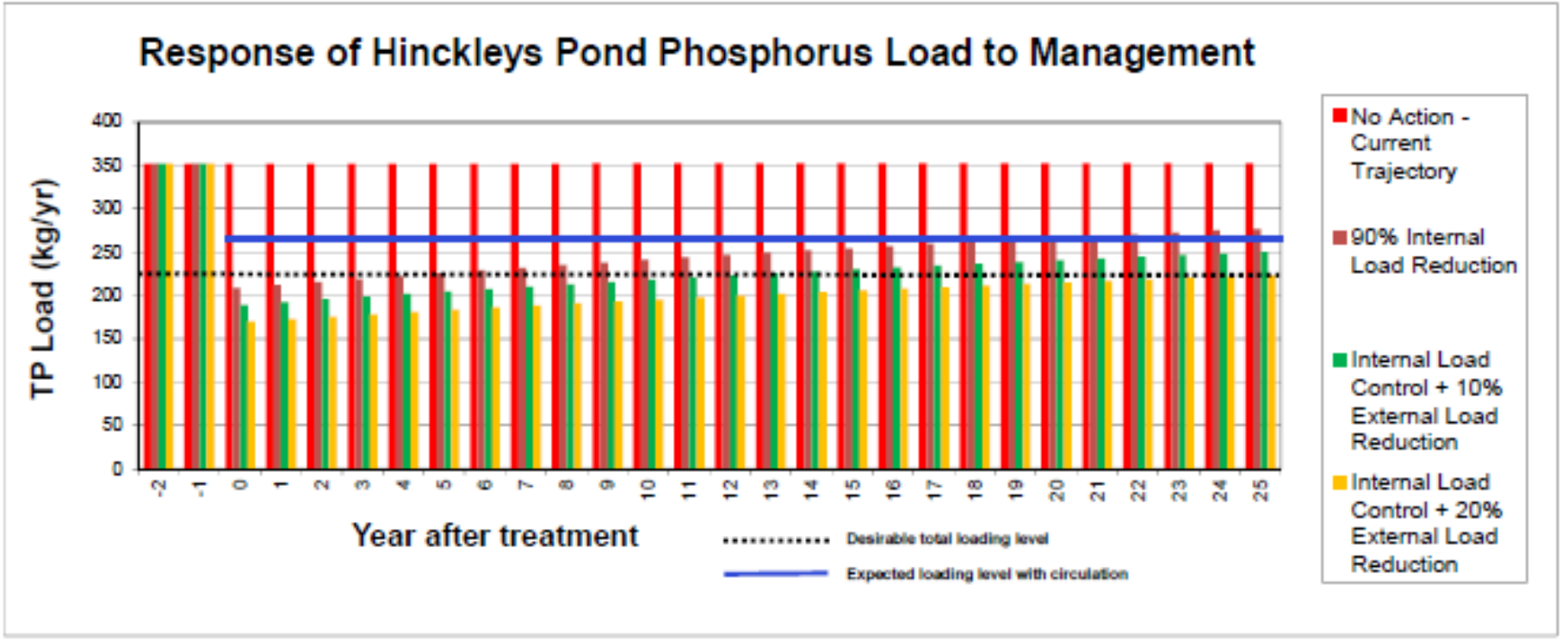
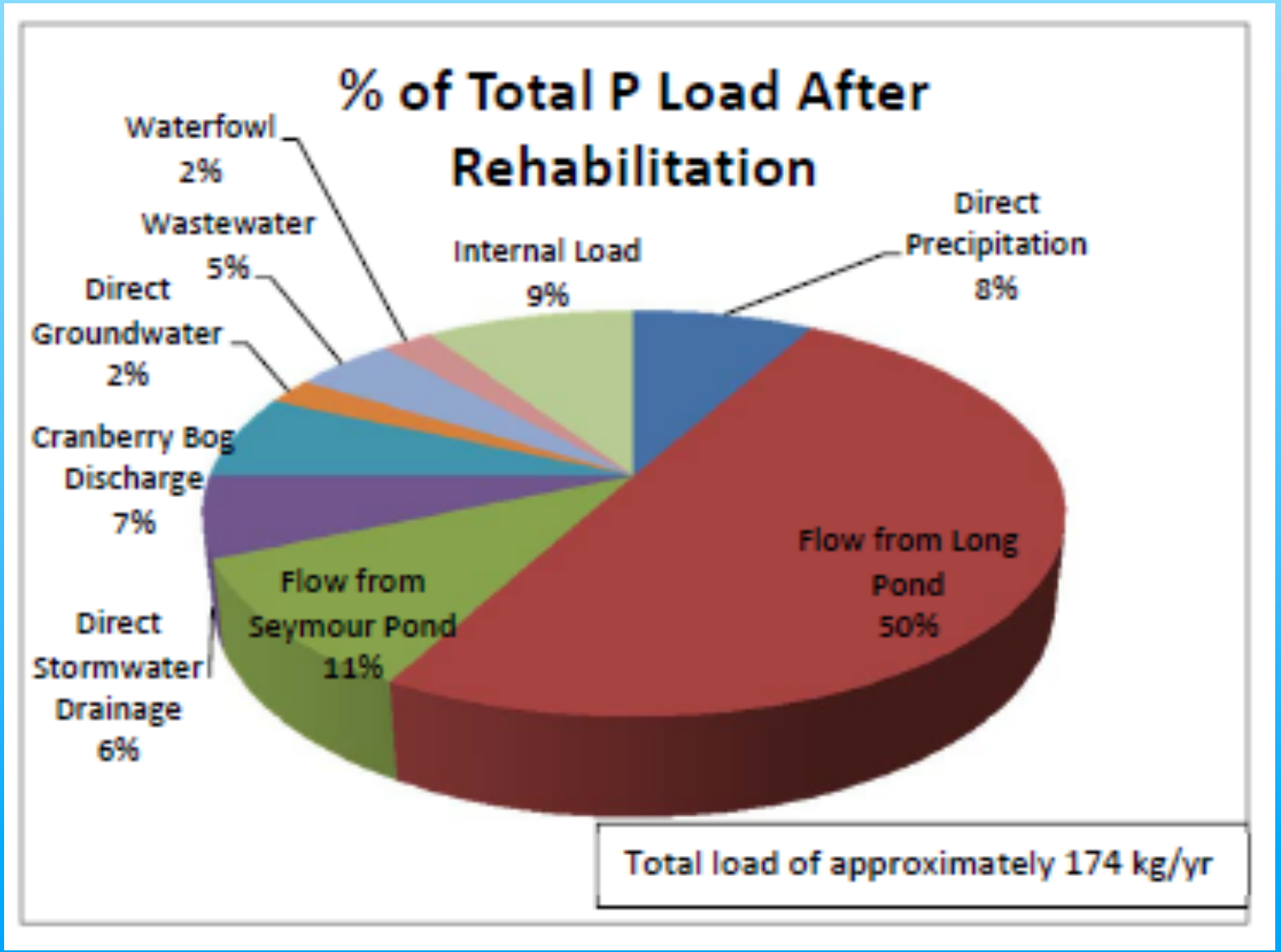


- Circulation will lower available P, stabilize the system, and minimize cyanobacteria, but may not prevent all algal blooms.
- Aluminum treatment can initially achieve more desirable conditions, but with continued loading, conditions will revert.
- Watershed management protects the investment and prolongs benefits of any treatment.

Hinckleys Pond



Hinckleys Pond

Pond Variable (units)	Current Actual Value	Current Predicted Value	90% Internal Load Reduction (P inactivation by aluminum)	75% Internal Load Reduction (spring-summer circulation system)	90% Internal Load Reduction plus 20% Load Reduction from Long Pond	90% Internal Load Reduction plus 10% External Load Reduction	90% Internal Load Reduction plus 20% External Load Reduction
Total Phosphorus (kg/yr)	352.4	351.5	207.6	231.6	187.6	191.0	174.4
Total Phosphorus (ug/L)	30	32	18	21	16	17	15
Total Nitrogen (ug/L)	525	520	520	520	448	485	449
Secchi Depth (m)	1.7	1.6	2.5	2.3	2.7	2.7	2.9
Mean Chlorophyll a (ug/L)	13.2	13.8	6.7	7.8	5.8	5.9	5.2
Peak Chlorophyll a (ug/L)	43.8	46.1	23.1	26.7	20.2	20.7	18.3
Chlorophyll a >10 ug/L (%)	75.0%	65.4%	14.4%	22.5%	8.8%	9.7%	5.9%
Chlorophyll a >15 ug/L (%)	51.9%	33.9%	3.0%	5.9%	1.5%	1.7%	0.9%
Chlorophyll a >20 ug/L (%)	34.6%	16.1%	0.7%	1.6%	0.3%	0.4%	0.2%
Chlorophyll a >30 ug/L (%)	11.5%	3.6%	0.1%	0.2%	0.0%	0.0%	0.0%
Chlorophyll a >40 ug/L (%)	3.8%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%

- **Do not believe any number as extremely accurate by itself; look at relative values, and focus on the change in distribution of predicted algae (chlorophyll) levels.**
- **Some level of watershed management appears necessary for long-term improvement to a desirable condition**

Hinckleys Pond

Approximate cost of alternative systems

Circulation System						Phosphorus Inactivation			
Air Driven		SolarBee		WEARS		Sediment		Water Column (with circulation)	
Capital	O&M	Capital	O&M	Capital	O&M	Capital	O&M	Capital	O&M
200,000	10,000	240,000	2,000	200,000	3,000	550,000	0	50,000	25,000

- Think in terms of a 20-25 year timeframe; mixing may only be slightly less expensive than aluminum over that period, but with potentially less desirable results
- The combination system (far left and far right) is potentially the most expensive, but provides maximum flexibility to maintain desirable conditions
- Some form of aluminum treatment appears worthwhile; further sediment testing is needed to refine dose and cost assessments

Hinckleys Pond

Watershed management actions that can be taken directly by Harwich include:

- **Capture and infiltrate runoff from James Road south of pond**
- **Capture and infiltrate runoff from Catherine Rose Rd north of pond**
- **Encourage reduction in phosphorus laden fertilizer use and trapping of runoff on individual land parcels within the watershed**
- **Examine the drainage from Cape Cod Technical School and Rt 124 that currently enters the Jenkins Bog; reduce inputs**
- **Aggressively pursue stormwater issues on the Harwich side of Long and Seymour Ponds**
- **Aggressively enforce Title 5 regulations regarding wastewater disposal and educate residents about the importance of proper disposal system management**

Hinckleys Pond

More challenging approaches that are worth pursuing include:

- Work with the Town of Brewster to investigate internal load inactivation potential for Seymour Pond
- Work with the Town of Brewster to investigate watershed loading to Seymour and Long Ponds and options for reduction
- Work with the Cape Cod Cranberry Growers Association and the local bog owners to implement the best possible nutrient management plans; target a 50% reduction in discharge phosphorus concentrations

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