

Sturbridge Lakes Monitoring Report 2002-2003

Sturbridge Conservation Commission

Town Hall

April 29, 2004

Tonight's Presentation

- Sturbridge Conservation Lake Policy
- 2002 -2003 Lake Monitoring Program
- Results from Lake Sampling
- Comparisons between Lakes
- MA DEP's Generic Environmental Impact Review (GEIR) for Lake Management
- 2004 Lake Monitoring Program

SCC Lakes Policy

The town of Sturbridge is fortunate to have abundant water resources, including many lakes and ponds with significant scenic, ecological and recreational values. For the most part, these waterbodies exhibit good water quality and are largely unimpaired by nuisance algal blooms and excessive macrophyte growth. Future water quality in these lakes and ponds will be challenged by the continuing growth and development in the watersheds. It is therefore necessary to monitor the lakes regularly to detect undesirable trends at an early stage and to promote and develop appropriate and effective lake and watershed management

Lakes and Ponds of Sturbridge

- Big Alum Pond
- Cedar Lake
- Leadmine Pond
- South (Quacumquasit) Pond
- Walker Pond
- Long Pond (East Brimfield Reservoir)
- McKinstry Brook Pond Complex

SCC Lakes and Ponds Inventory, Monitoring, and Management Strategy

- Conduct Annual Lake and Pond Monitoring
- Develop Lake and Pond Water Quality and Biotic Inventory and Database
- Watershed Delineation and Characterization
- Develop long-term Lake Management and Watershed Protection Plans

Lakes Monitoring Program 2002-03

- Lakes sampled during mid-summer (8/02;7/03)
- Central location (deep hole) and other site
 - Shallow (0.5 ft) and deep (2-3 ft of bottom)
- Thermal and dissolved oxygen (DO) profiles
- Secchi Disk Transparency (SDT)
- Water Quality Samples taken:
 - Nutrients - nitrogen and phosphorus fractions
 - Other - alkalinity, hardness, TSS, iron, conductivity
 - Biological – chlorophyll a, zooplankton

List of Lake Sampling Stations

Lake	Stations	Parameters
Big Alum Lake	BA-1S	TP, DP, NH3, NO3, NO2, TKN, ALK, HARD, TSS, CL, CU, FE, NA, Chl A, ZOOB, SDT
	BA-1D	TP, DP, NH3, NO3, NO2, TKN, ALK, TSS, CL, CU, FE, NA, HS, COD
	BA-2	TP, DP, NH3, NO3, NO2, TKN, ALK, HARD, TSS, FE, CL, SDT
Cedar Lake	CL-1	TP, DP, NH3, NO3, NO2, TKN, ALK, HARD, TSS, CL, CU, FE, NA, Chl A, ZOOB, SDT
	CL-1D	TP, DP, NH3, NO3, NO2, TKN, ALK, TSS, CL, CU, FE, NA, HS, COD
	CL-2	TP, DP, NH3, NO3, NO2, TKN, ALK, HARD, TSS, FE, CL, SDT
Leadmine Pond	LP-1S	TP, DP, NH3, NO3, NO2, TKN, ALK, HARD, TSS, CL, CU, FE, NA, Chl A, ZOOB, SDT
	LP-1D	TP, DP, NH3, NO3, NO2, TKN, ALK, TSS, CL, CU, FE, NA, HS, COD
	LP-2	TP, DP, NH3, NO3, NO2, TKN, ALK, HARD, TSS, FE, CL, SDT
South Pond	SP-1S	TP, DP, NH3, NO3, NO2, TKN, ALK, HARD, TSS, CL, CU, FE, NA, Chl A, ZOOB, SDT
	SP-1D	TP, DP, NH3, NO3, NO2, TKN, ALK, TSS, CL, CU, FE, NA, HS, COD
	SP-2	TP, DP, NH3, NO3, NO2, TKN, ALK, HARD, TSS, FE, CL, SDT
Walker Pond	WP-2S	TP, DP, NH3, NO3, NO2, TKN, ALK, HARD, TSS, CL, CU, FE, NA, Chl A, ZOOB, SDT
	WP-2D	TP, DP, NH3, NO3, NO2, TKN, ALK, TSS, CL, CU, FE, NA, HS, COD
	WP-1, 3, 4, 5	TP, DP, NH3, NO3, NO2, TKN, ALK, HARD, TSS, FE, CL, SDT

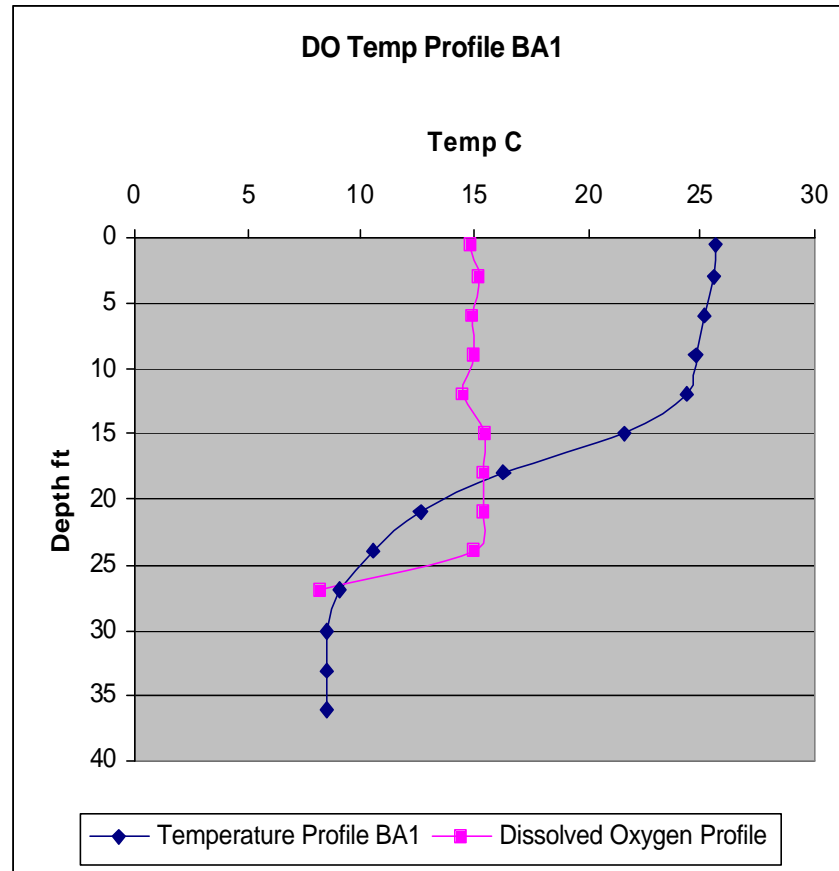
Big Alum Pond Fact Sheet

- Lake Area = 195 acres
- Watershed Area = 579 acres
- Maximum depth = 45+ ft
- Lake basin is of natural origin, but enhanced by outlet dam (13 ft high)
- Dam reportedly built in 1912 by Fiskdale Mills for hydropower supply

Big Alum Pond Characteristics

- Big Alum Pond is a deep, dimictic lake that thermally stratifies each summer;
indication of some hypolimnetic anoxia
- Water quality is good
 - Nutrients levels of phosphorus and nitrogen are on high end of moderate
 - Secchi disk depth: transparency on 8/02/02 = 17.5 ft;
on 7/25/03 = 15.5 ft
 - Probably an oligo-mesotrophic waterbody (desirable);
good support of ecological and recreational uses

Big Alum Pond Temperature & DO Profile Station BA-1 (7/03)



Big Alum Pond BA-1 (7/03)

Nutrients and Secchi Disk Depth

	Station #1	Station #1
Parameter (mg/L)	Shallow	Deep (35 ft)
TOT. PHOSPHORUS	0.057	0.031
NITRATE-N	<0.02	<0.02
AMMONIA-N	0.03	0.22
T. KJELDAHL-N	0.36	0.68
TOT. NITROGEN	0.34	0.47
SECCHI DISK (ft)	15.5	-

Big Alum Pond BA-1 (7/03)

Other Water Quality Parameters

	Station #1	Station #1
Parameter (mg/L)	Shallow	Deep (35 ft)
ALKALINITY	13.5	14.3
HARDNESS	19.6	21
TOT. SUSPENDED SOL.	4	ND
IRON	0.264	0.675
SALINITY	<0.1	<0.1
SP. CONDUCT. (uS/CM)	92	128

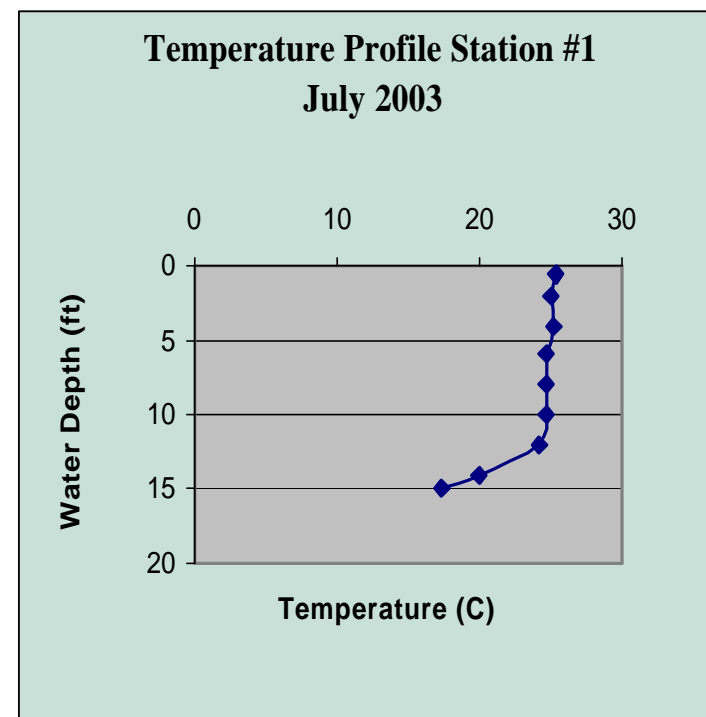
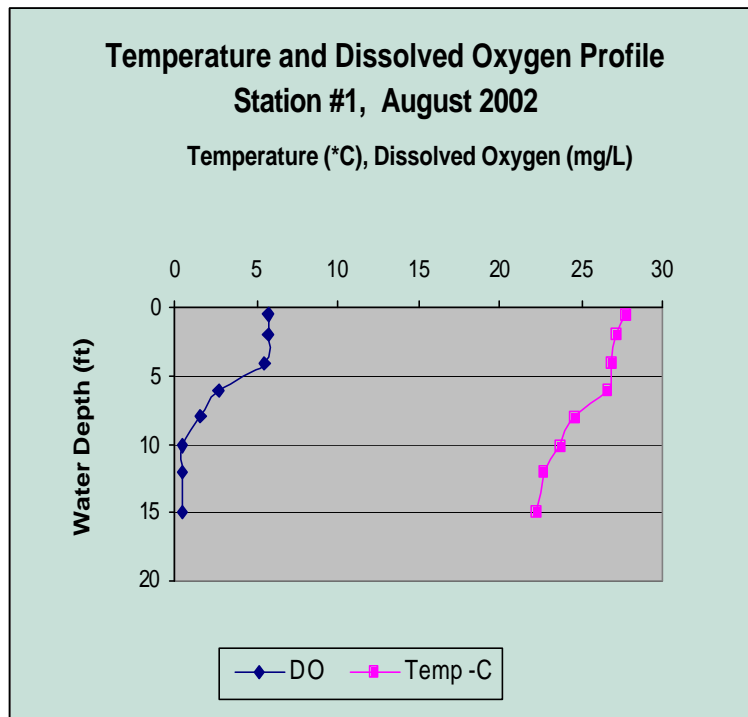
Cedar Lake Fact Sheet

- Lake Area = 183 acres
- Watershed Area = 2,183 acres
- Maximum depth = >15 ft
- Lake is of natural origin, but largely created by impoundment
- First impounded about 1847

Cedar Lake Characteristics

- Cedar Lake is a shallow lake and it only partially thermally stratifies each summer
- Water quality is fair
 - Nutrients levels of phosphorus and NH₃ high;
 - Summer algal blooms and excessive macrophytes
 - Brown water color due to upstream wetlands
 - Secchi disk depth: transparency on 8/02/02 = 5 ft;
on 7/25/03 = 4.25 ft
- Cedar Lake is an eutrophic system
(means overly fertile or productive)

Cedar Lake - Temperature & DO Profile Station CL-1 (8/02 and 7/03)



Cedar Lake (7/25/03)

Nutrients and Secchi Disk Depth

	Station #1	Station #1	Station #2
Parameter (mg/L)	Shallow	Deep (15 ft)	Shallow
TOT. PHOSPHORUS	0.0422	0.0722	0.0735
NITRATE-N	<0.06	<0.06	<0.06
AMMONIA-N	0.627	0.932	0.54
T. KJELDAHL-N	<0.71	<0.71	<0.71
SECCHI DISK (ft)	4.25	NA	2.5 (bottom)

Cedar Lake (7/25/03)

Other Water Quality Parameters

Parameter (mg/L)	1S	1D (15 ft)	2
ALKALINITY	12.5	29.2	12.2
HARDNESS	29.6	30.2	27.2
TOT. SUSPENDED SOL.	6	6	4
IRON	0.566	0.721	0.685
SALINITY (ppt)	0.2	0.2	0.2
SP. CONDUCT. (uS/CM)	343	363	249

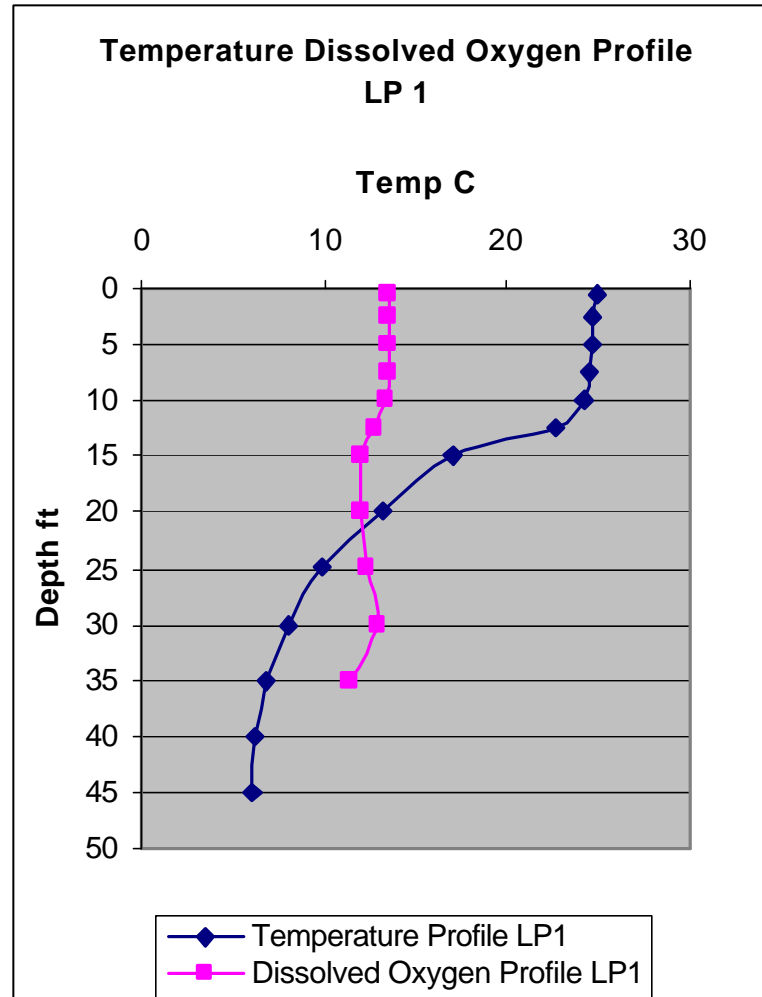
Leadmine Pond Fact Sheet

- Lake Area = 53 acres
- Watershed Area = 579 acres
- Maximum depth = >50 ft
- Pond is of natural origin, considered unregulated (not impounded)
- Long residence time in lake
- Native American name for Leadmine was Quassock

Leadmine Pond Characteristics

- Leadmine Pond is a dimictic lake, meaning it mixes fully in spring and fall and thermally stratified each season into warm, upper and cold, bottom waters.
- Water quality is good
 - Nutrient levels high moderate and bear monitoring as number and size of watershed residences increase
 - Secchi depth: 6/76 = 18.5'; 8/02 = 14.5'; 7/03 = 19'
 - Low amounts of macrophytes due to substrate, basin
- Lake considered oligo-mesotrophic

Leadmine Pond – Temperature & DO Profile Station LP-1 7/03)



Leadmine Pond LP-1 (7/03)

Nutrients and Secchi Disk Depth

	Station #1	Station #1
Parameter (mg/L)	Shallow	Deep (45 ft)
TOT. PHOSPHORUS	0.064	0.048
NITRATE-N	<0.02	<0.02
AMMONIA-N	0.03	0.22
T. KJELDAHL-N	0.36	0.68
TOT. NITROGEN	0.34	0.47
SECCHI DISK (ft)	19	-

Leadmine Pond LP-1 (7/03)

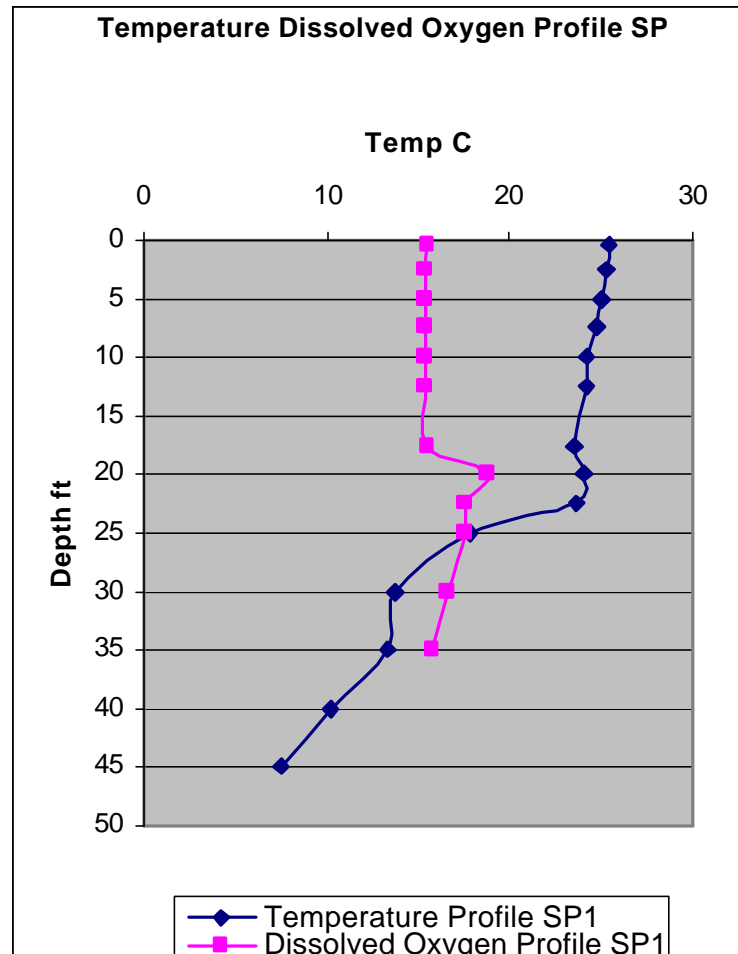
Other Water Quality Parameters

Parameter (mg/L)	Station #1	Station #1
	Shallow	Deep (45 ft)
ALKALINITY	10	7.5
HARDNESS	22	22.3
TOT. SUSPENDED SOL.	ND	6
IRON	0.308	1.24
SALINITY	<0.1	<0.1
SP. CONDUCT. (uS/CM)	106	68

South Pond Characteristics

- South Pond is a large lake connected to North Pond (Quaboag) by a narrow channel with only the SE embayment in Sturbridge
- Thermally stratified each season into warm, upper and cold, bottom waters.
- Water quality is good
 - Nutrient content moderate
 - Secchi disk depth: on 8/02 = 11 ft; on 7/03 = 13 ft
 - Considered a mesotrophic condition

South Pond – Temperature & DO Profile Station SP-1 (7/03)



South Pond SP-1 (7/03)

Nutrients and Secchi Disk Depth

Parameter (mg/L)	Station #1	Station #1
	Shallow	Deep (45 ft)
TOT. PHOSPHORUS	0.064	0.048
NITRATE-N	<0.02	<0.02
AMMONIA-N	0.03	0.22
T. KJELDAHL-N	0.36	0.68
TOT. NITROGEN	0.34	0.47
SECCHI DISK (ft)	19	-

South Pond SP-1 (7/03)

Other Water Quality Parameters

Parameter (mg/L)	Station #1	Station #1
	Shallow	Deep (45 ft)
ALKALINITY	10	7.5
HARDNESS	22	22.3
TOT. SUSPENDED SOL.	ND	6
IRON	0.308	1.24
SALINITY	<0.1	<0.1
SP. CONDUCT. (uS/CM)	106	68

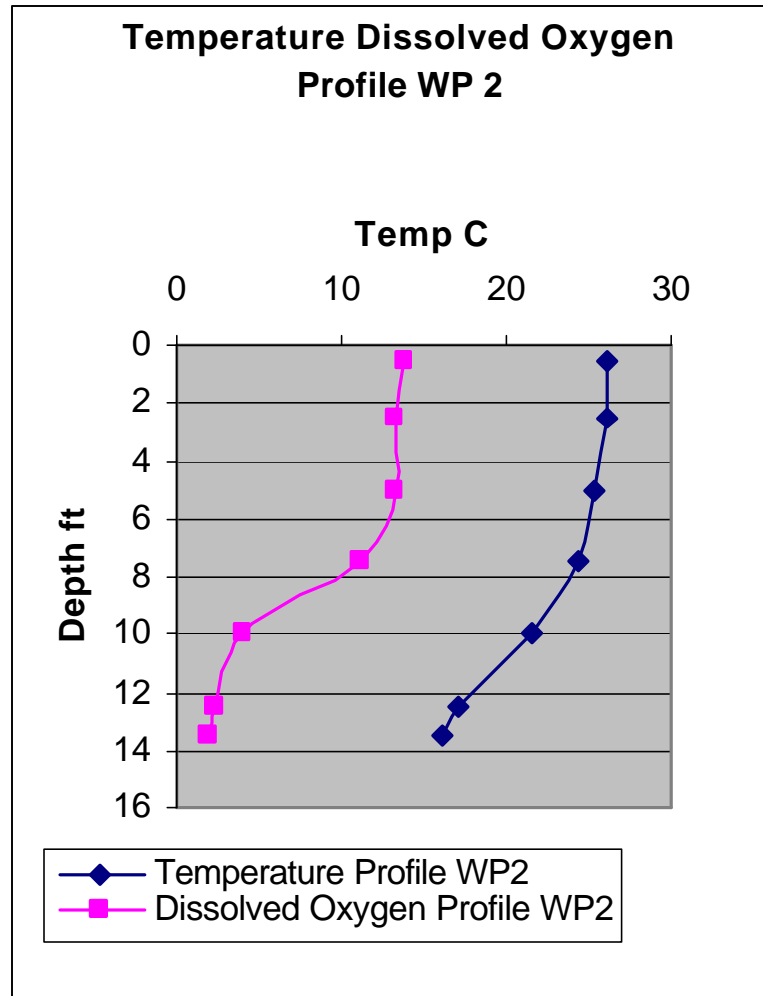
Walker Pond Fact Sheet

- Lake Area = 171 acres
- Watershed Area = 2,507 acres
- Maximum depth = >15 ft
- Pond is of natural origin, but largely wetlands flooded by impoundment
- Named after Nathaniel Walker, an early settler (1743)

Walker Pond Characteristics

- Walker Pond is a shallow pond, which poorly stratifies at deeper hole
- Water is colored, limits transparency, algae
- Water quality is moderate
 - Nutrient content moderate; some indication of P release from bottom
 - High iron content
 - Secchi depth: 8/02 = 6.8 ft'; 7/03 = 6 ft
- Pond considered mesotrophic

Walker Pond – Temperature & DO Profile Station WP-2 (7/03)



Walker Pond WP-2 (7/03)

Nutrients and Secchi Disk Depth

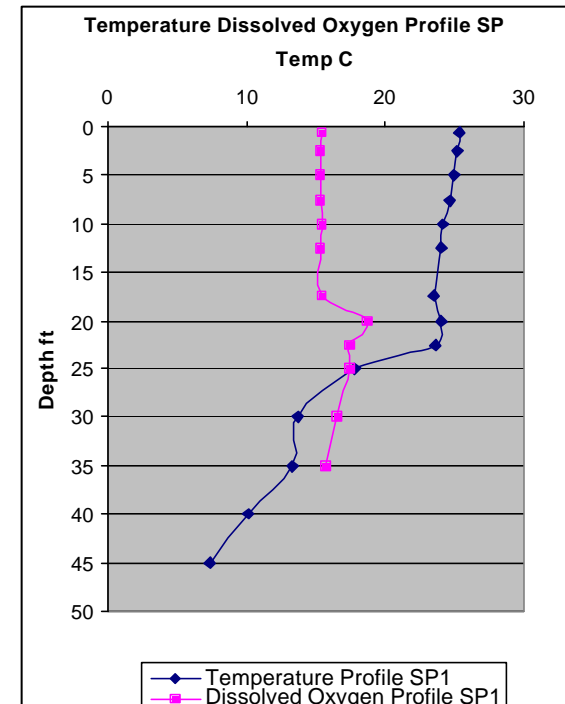
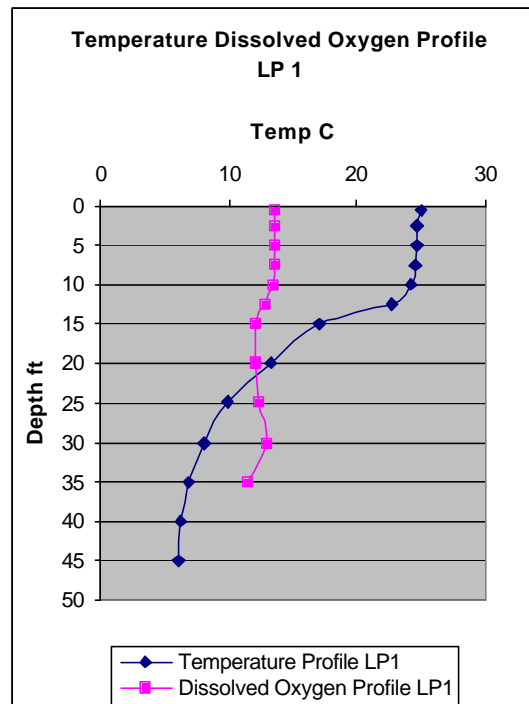
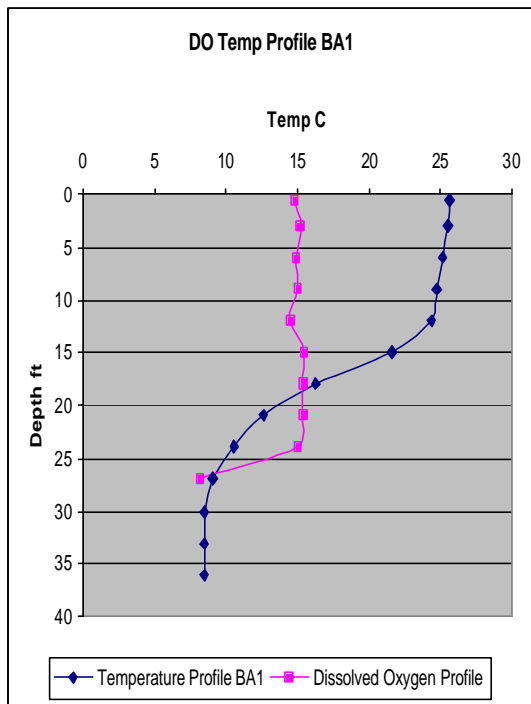
Parameter (mg/L)	Station #1	Station #1
	Shallow	Deep(12.5 ft)
TOT. PHOSPHORUS	0.038	0.182
NITRATE-N	<0.02	<0.02
AMMONIA-N	0.03	0.22
T. KJELDAHL-N	0.36	0.68
TOT. NITROGEN	0.34	0.47
SECCHI DISK (ft)	6	-

Walker Pond WP-1 (7/03)

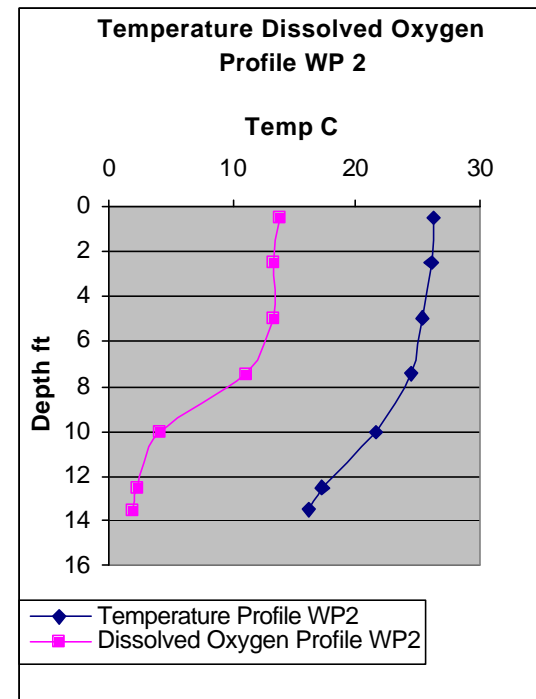
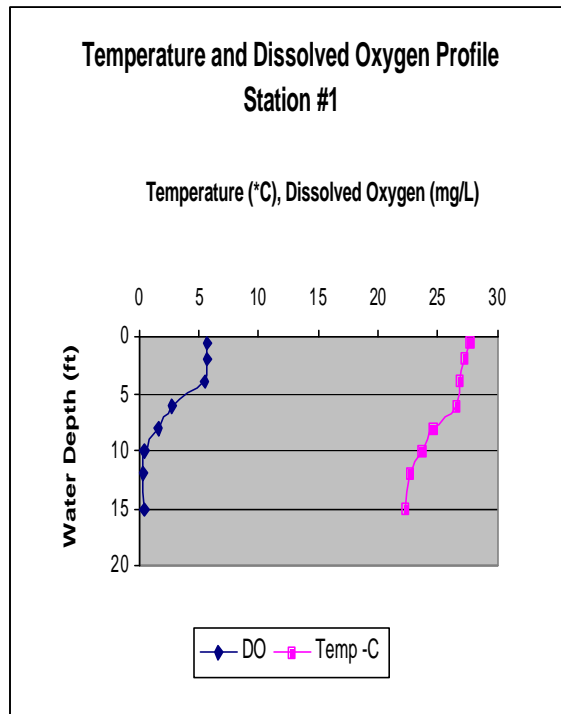
Other Water Quality Parameters

Parameter (mg/L)	Station #2	Station #2
	Shallow	Deep(12.5 ft)
ALKALINITY	7.1	16.9
HARDNESS	27.8	39.7
TOT. SUSPENDED SOL.	ND	7
IRON	0.59	9.68
SALINITY	0.1	0.2
SP. CONDUCT. (uS/CM)	263	409

Sturbridge Deep Lakes T/DO (2003)



Sturbridge Shallow Lakes T/DO (2003)



Comparison in Water Quality

- Shallow Lakes
 - Max. depth = 16 ft
 - SDT = 5 – 6 ft
 - Hardness = 28 – 35 mg/L
 - Sp. Cond = 248-356 μ S
 - Iron = 0.47 – 0.59 mg/L
 - Littoral zone macrophytes and organic sediments
 - Fast flushing systems
 - Large watershed:surface area ratios
- Deep Lakes
 - Max. depth = 45-60+ ft
 - SDT = 11 – 19 ft
 - Hardness = 11 – 22 mg/L
 - Sp. Cond = 88-108 μ S
 - Iron = 0.26 – 0.31 mg/L
 - Less macrophytes and inorganic (hard) sediments
 - Slow flushing systems
 - Lower watershed:surface area ratios

Generic Environmental Impact Review (GEIR)

- New publication brought out by MA DEP to provide guidance about lake management
- Provides a compendium of various lake management techniques and tools aimed at eutrophication and aquatic plant control
- Provides guidance to local Cons. Comm. regarding what information to ask for in a plan and typical orders of conditions for NOI
- GEIR massive (600+ pages) document, so there is a “Practical Guide”

Sturbridge Lakes Monitoring 2004

- SCC intends to conduct another round of physiochemical measurements and limited WQ sampling. Tentatively scheduled in early August
- As feasible, add aquatic vegetation inventory and mapping of littoral zones (underwater camera)
- Volunteers and boats are always appreciated !