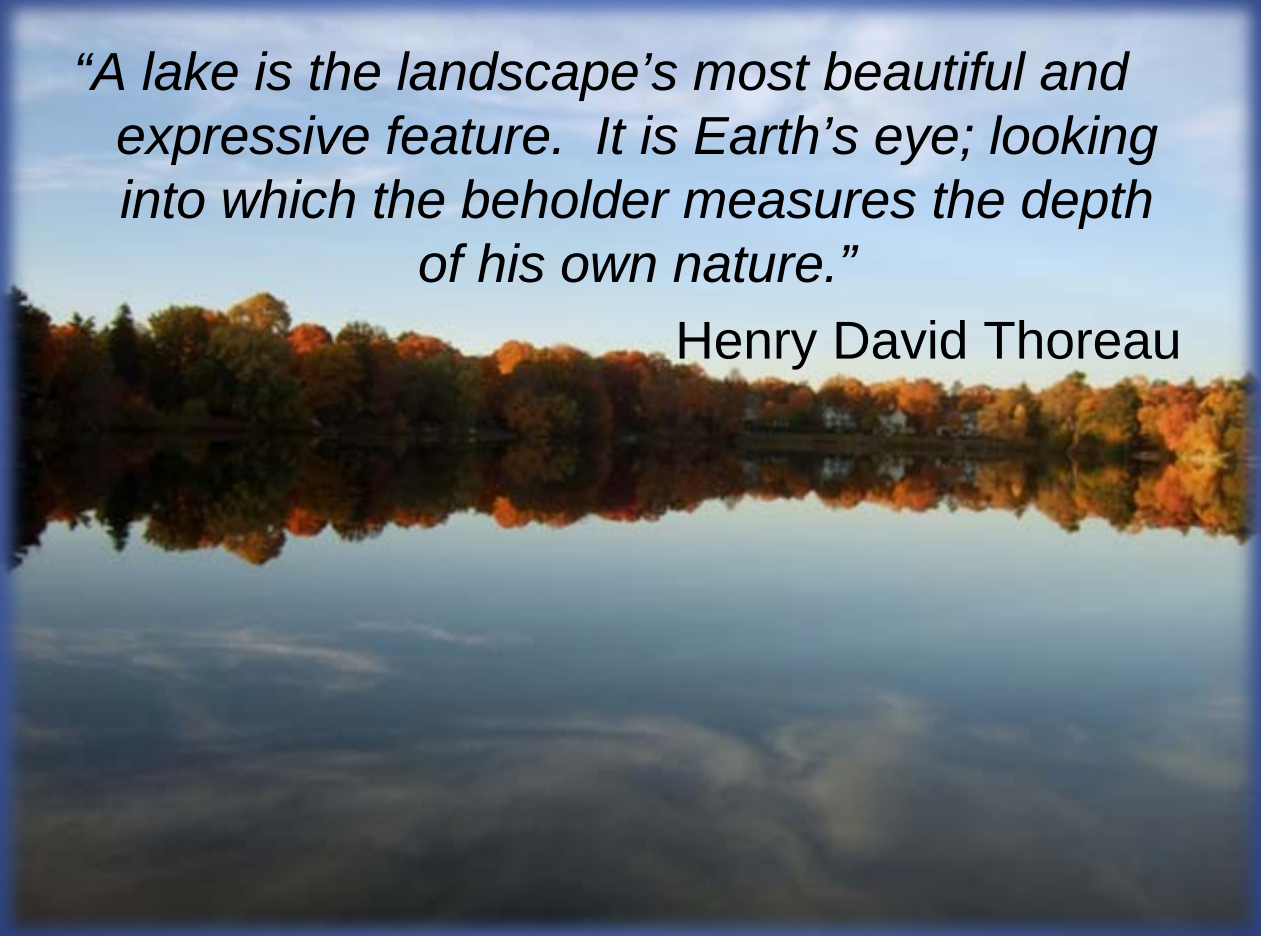
Crystal Lake Conservancy
Annual Forum



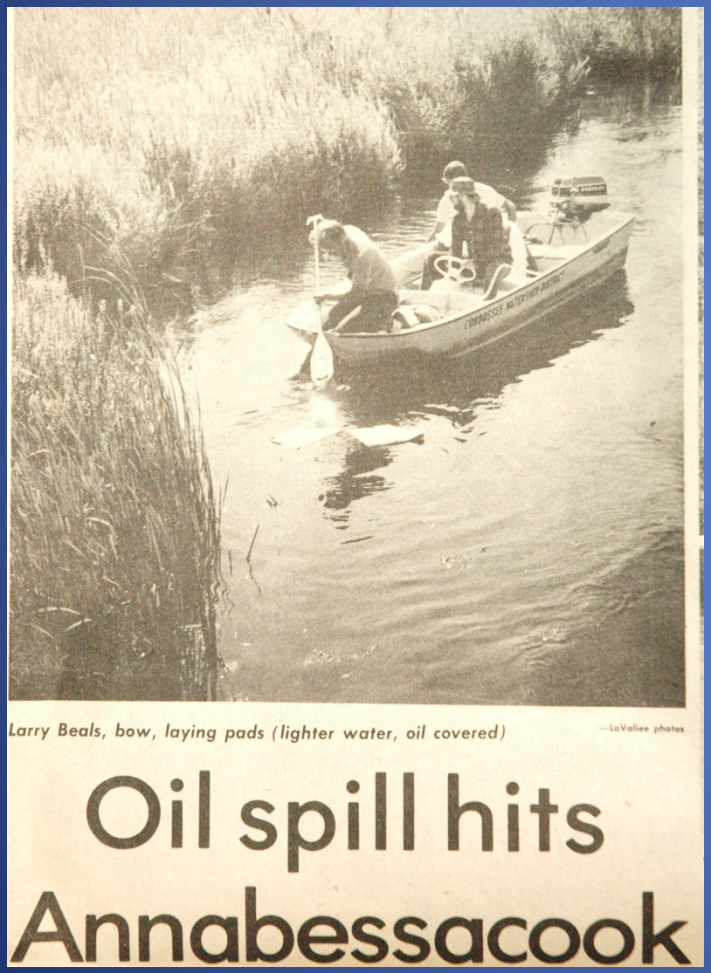
October 6, 2010

BEALS·ASSOCIATES

What we hope to accomplish this Evening Regarding Crystal Lake

- A geologic perspective
- An historic perspective
- An introduction to limnology
- A review of Crystal Lake Data Collection
- A review of the Crystal Lake Watershed
- and, Recommendations for the Future

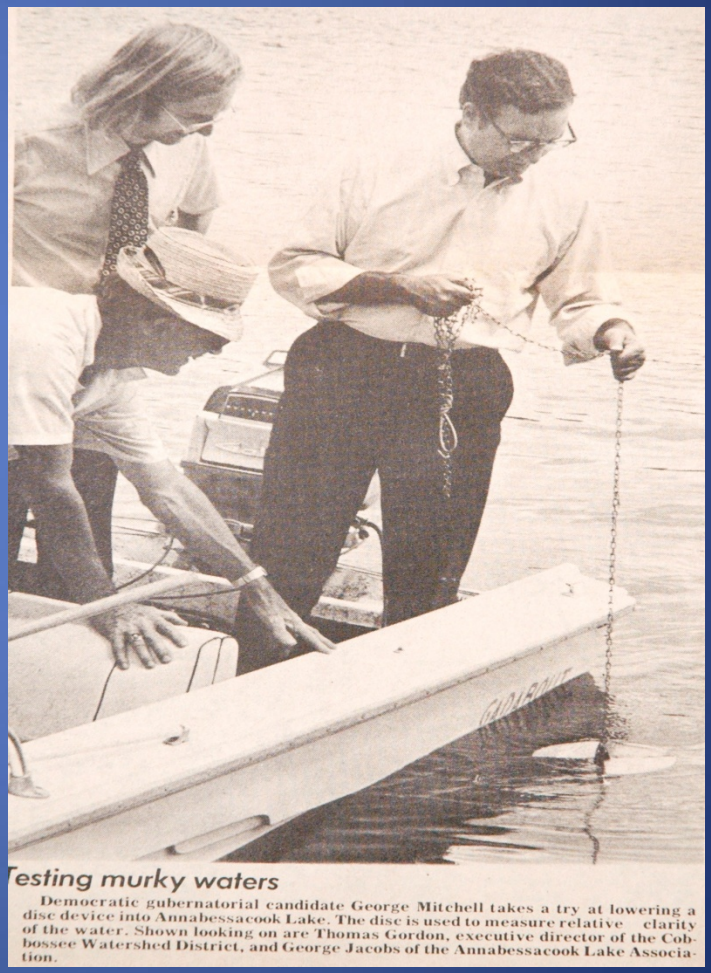
Lawrence M. Beals
Beals Associates, Inc.
Early Experience



Larry Beals, bow, laying pads (lighter water, oil covered)

—LaVallee photos

Oil spill hits Annabessacook



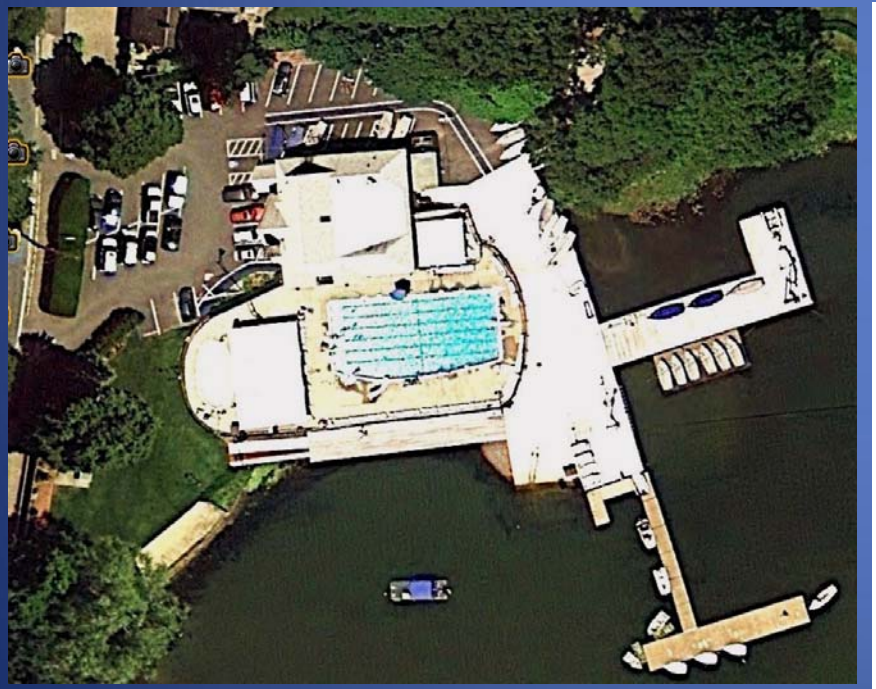
Testing murky waters

Democratic gubernatorial candidate George Mitchell takes a try at lowering a disc device into Annabessacook Lake. The disc is used to measure relative clarity of the water. Shown looking on are Thomas Gordon, executive director of the Cobbossee Watershed District, and George Jacobs of the Annabessacook Lake Association.

Current Experience
Beals Associates, Inc.

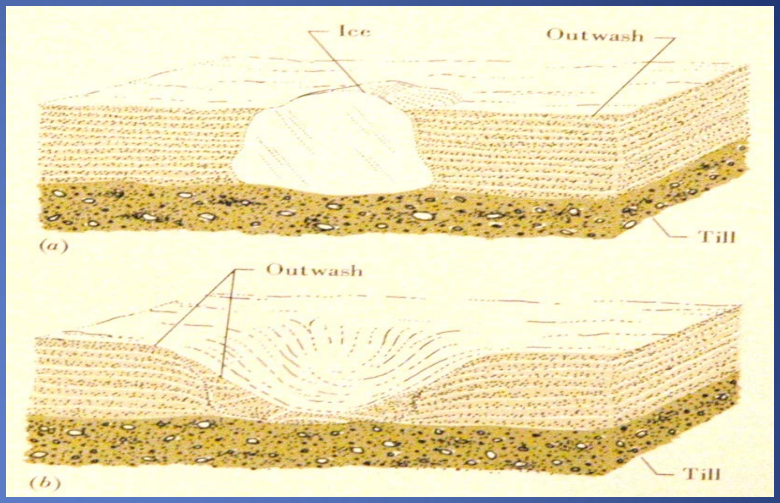
Land Planning
Civil Engineering

Landscape Architecture
Surveying



BEALS · ASSOCIATES

Formation of a Kettle Pond (Crystal Lake)

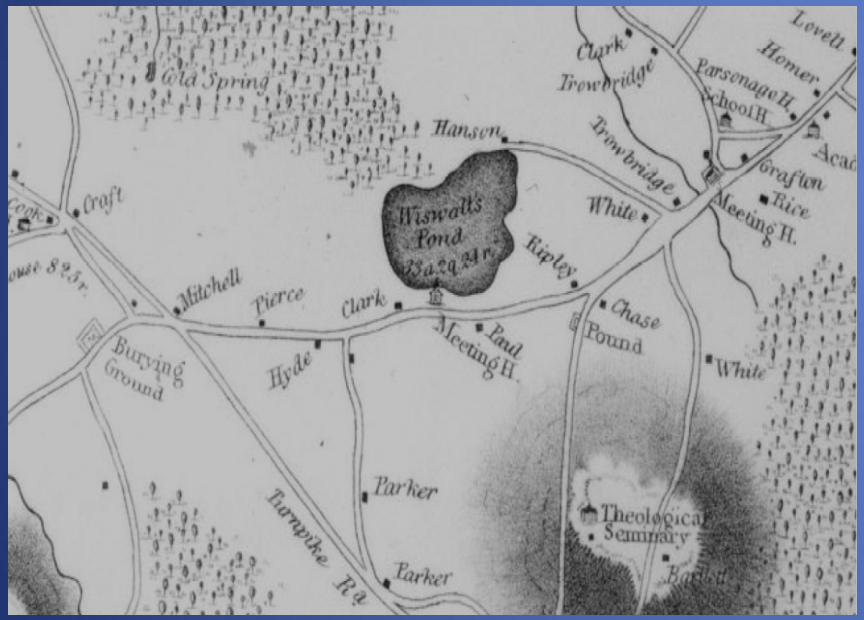


Crystal Lake Statistics

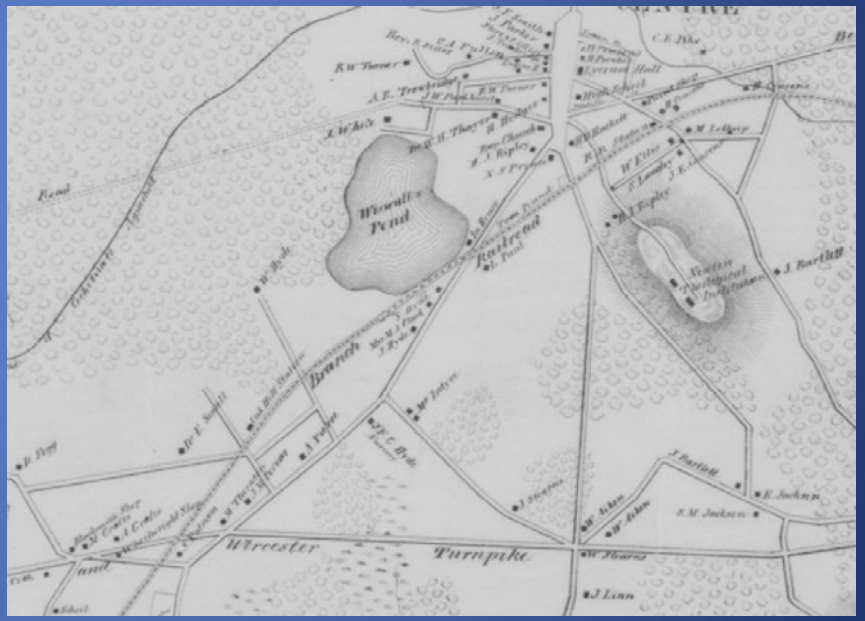
- 33 acres (13 ha)
- Classified as a Great Pond
- Drains into the Charles River
- Shoreline is about one mile
- Length is 1,200 ft (N/S)
- Width is 1,000 ft (E/W)
- Greatest Depth is about 31 ft

Crystal Lake Watershed Development

Wiswall's Pond - 1831



Wiswall's Pond - 1855



BEALS·ASSOCIATES

Continued Development

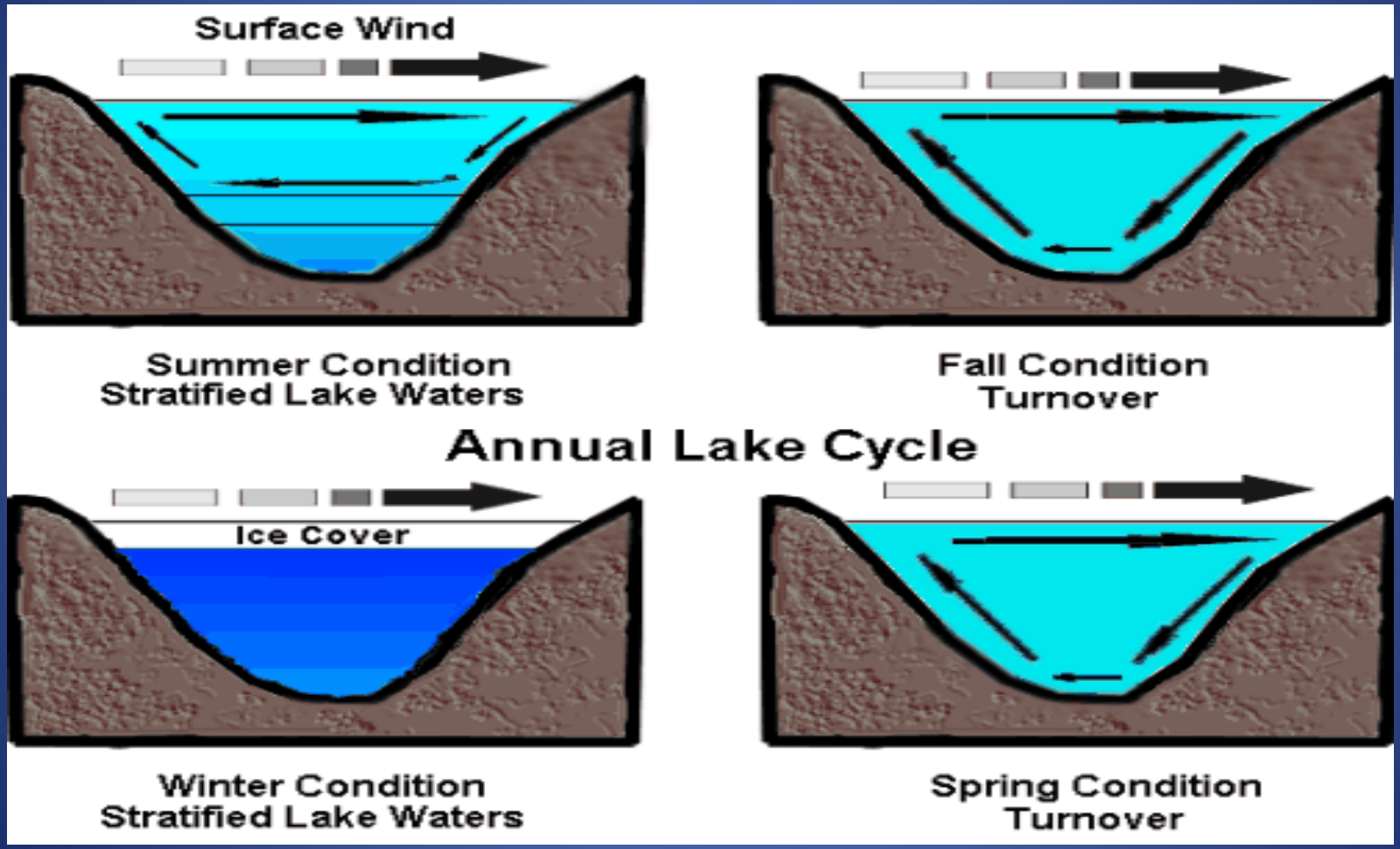
Crystal Lake 1897

Crystal Lake Today

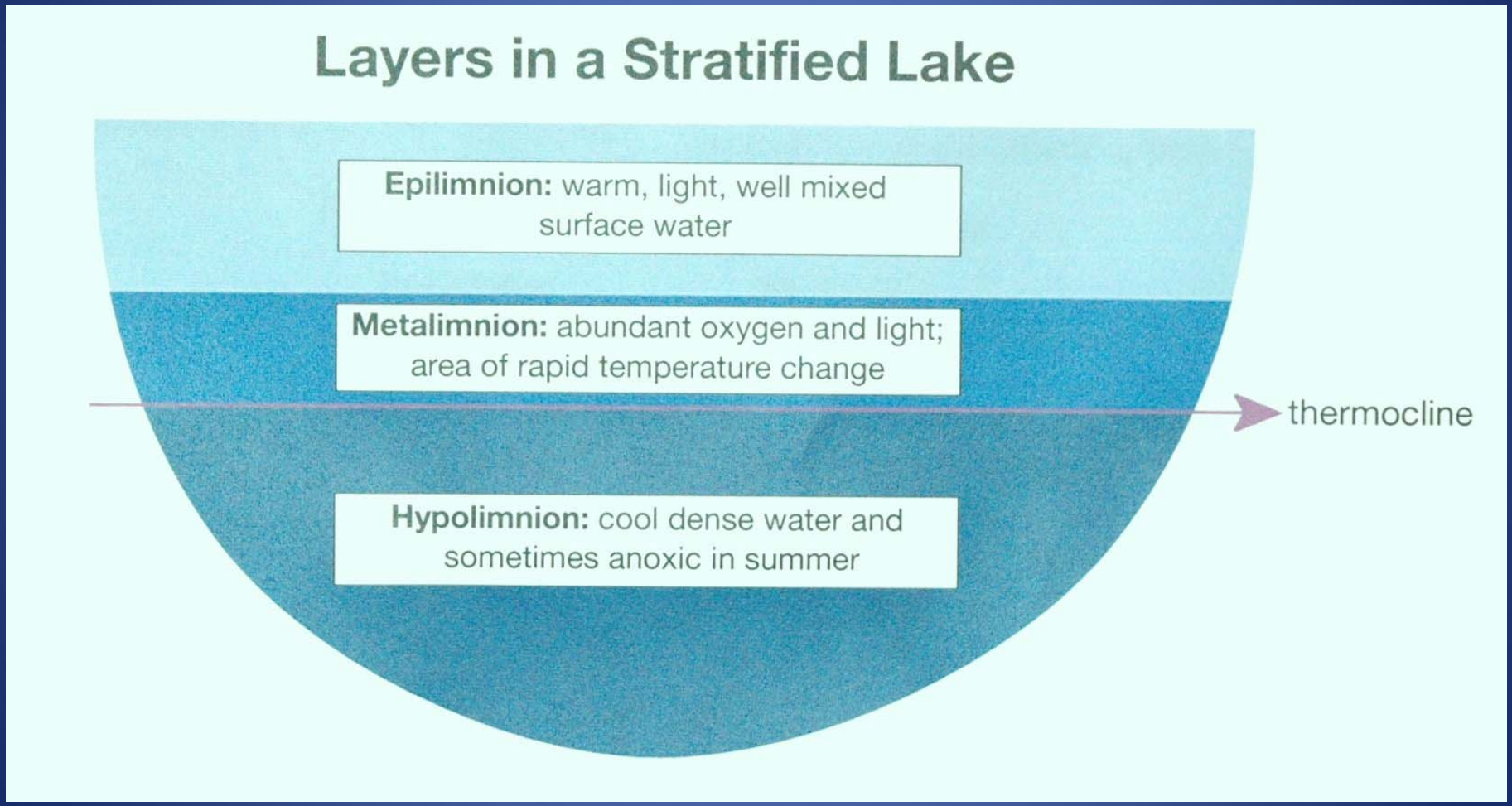
A Brief Recap before Limnology 101

- Crystal Lake is a kettle pond with a small watershed
- Crystal Lake has a densely developed watershed
- Crystal Lake depends on this small, densely developed watershed and ground water sources for its supply of water

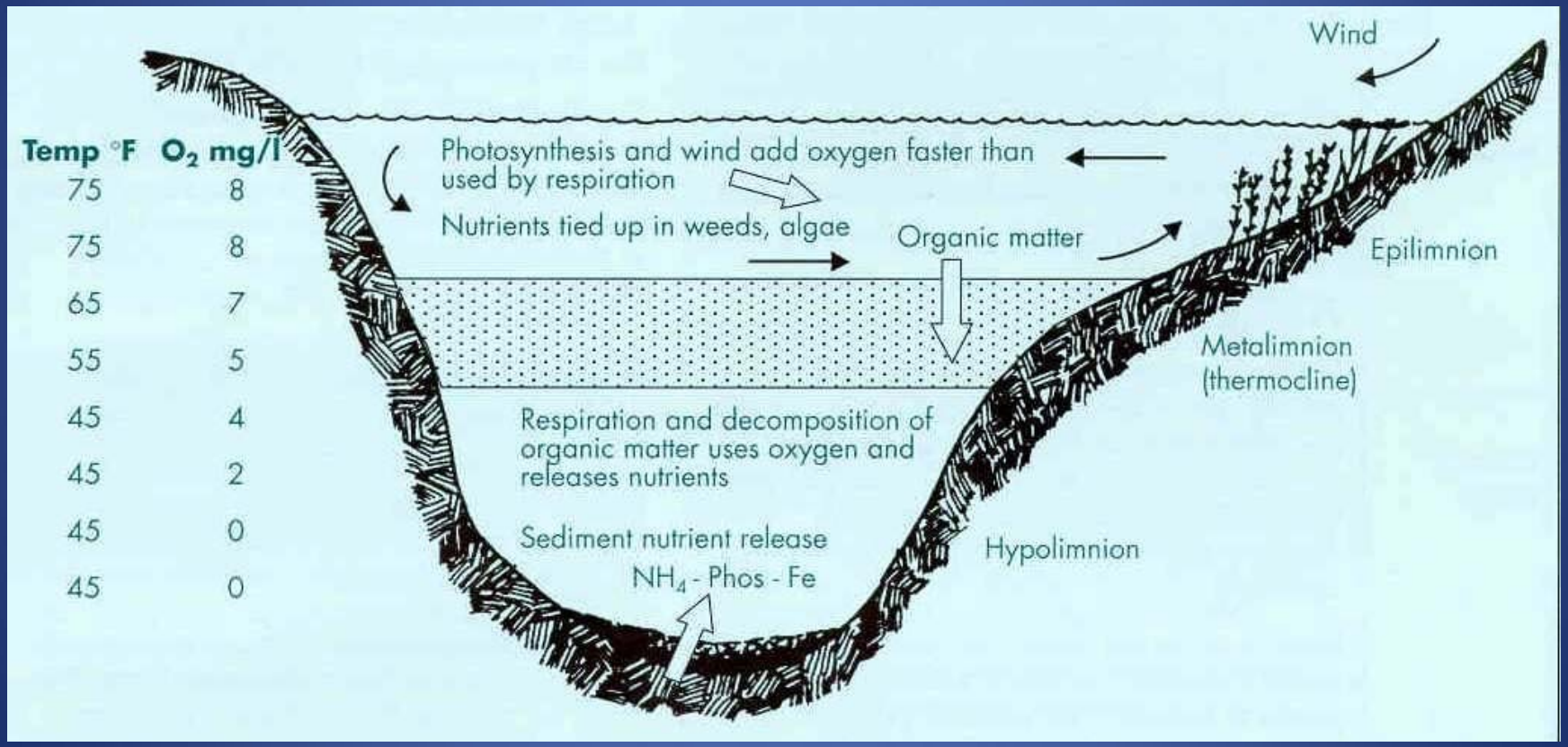
Crystal Lake Limnology
Thermal Stratification and Seasonal Turnovers



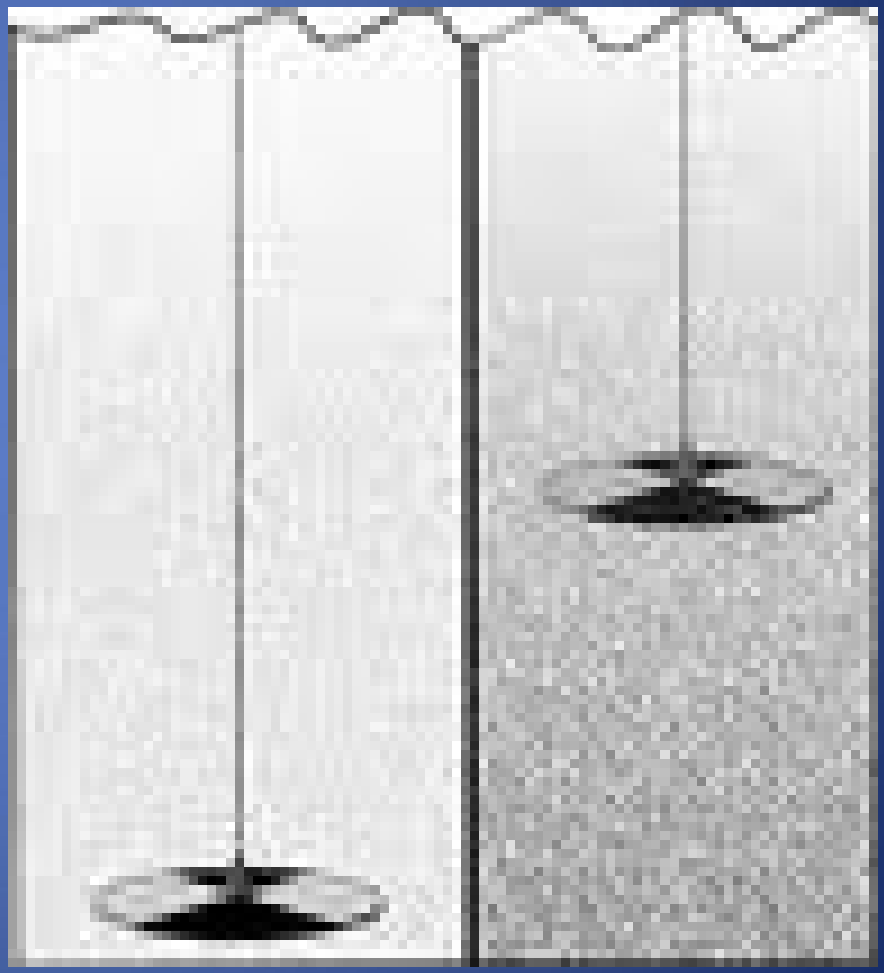
Thermal Layers in Crystal Lake During the Summer



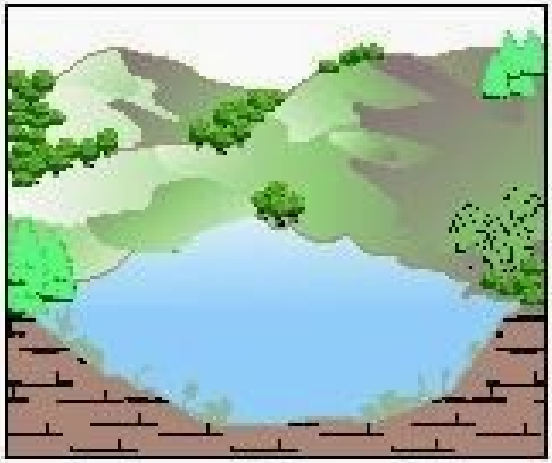
Dissolved Oxygen (DO)

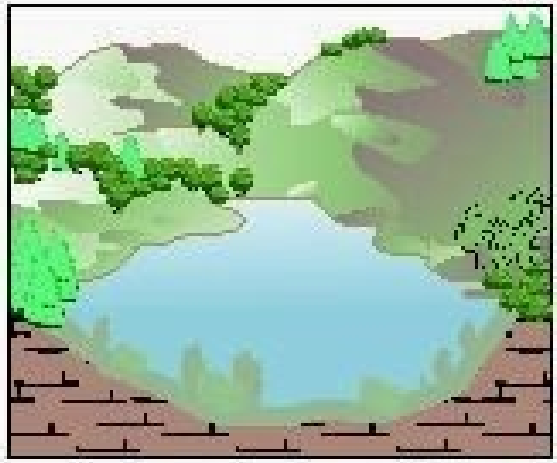


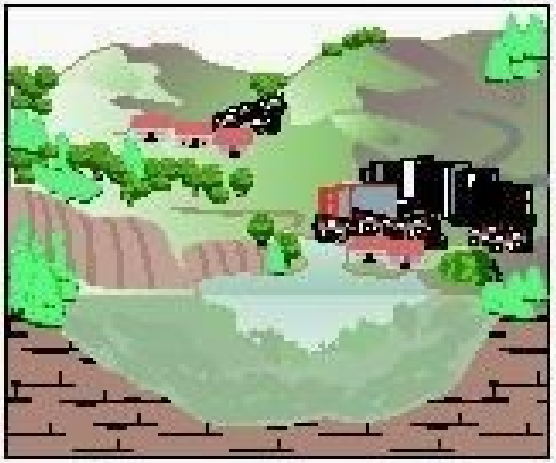
Visibility (Secchi Disk)



Lake Enrichment and Eutrophication







NATURAL EUTROPHICATION AND LAKE AGING occurs over centuries, and results from natural sources of nutrients and sediments

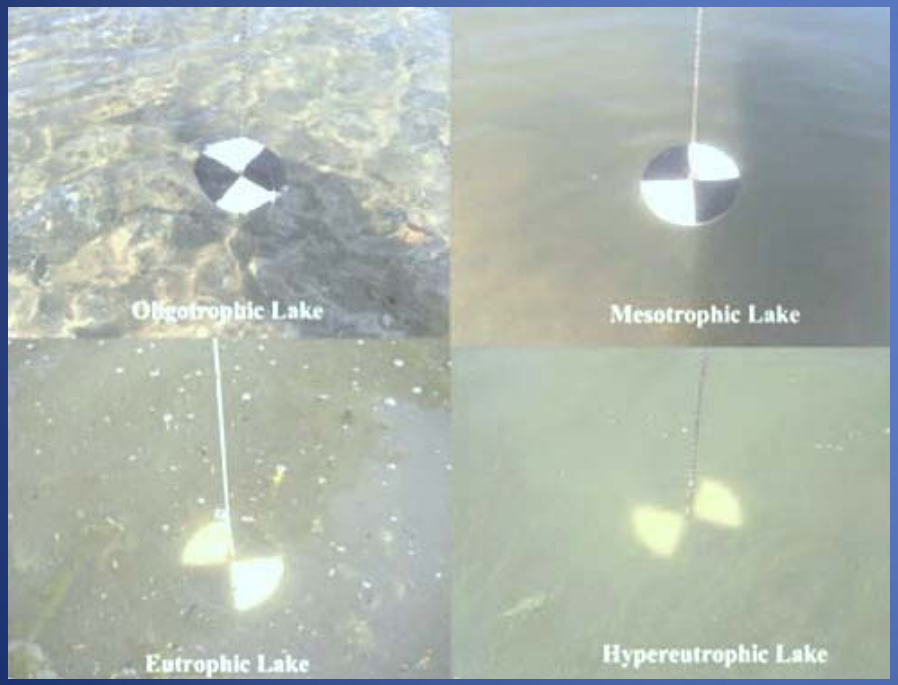
N A T U R A L : C E N T U R I E S

CULTURAL EUTROPHICATION AND LAKE AGING occurs over decades, and results from human-induced urban runoff, sewage effluent, industrial waste, fertilizers, pesticides, and excess sediments

C U L T U R A L : D E C A D E S

Evaluating the Trophic Status of Crystal Lake

- Secchi Disk Comparison



- Recognizing Problems:
  - Algal Blooms
  - Nuisance aquatic plants
  - Poor drinking water
  - Disappearing fisheries
  - Low dissolved oxygen
  - Shoaling (sedimentation)

Applying the Principles of Limnology To Crystal Lake

Volunteers collected lots of Data

Crystal Lake Field Research - Testing Averages

Date	3/11/2010	3/18/2010	3/25/2010	4/6/2010	5/26/2010	5/29/2010
Week	1.00	2.00	3.00	4.00	5.00	6.00
Avg. Surface Temp. (°F)	42.00	45.50	47.94	54.23	76.60	73.60
Avg. 10' Temp. (°F)	41.75	44.33	47.17	49.28	68.40	69.75
Avg. 20' Temp. (°F)	41.38	43.67	45.58	45.32	63.00	62.00
Max. Depth Temp. (°F)	41.00	43.00	44.00	42.08	58.00	57.00
Avg. Secchi Depth (ft)	11.20	7.84	6.52	9.47	12.13	13.40

Date	6/2/2010	6/6/2010	6/9/2010	6/16/2010	6/26/2010	7/3/2010
Week	7.00	8.00	9.00	10.00	11.00	12.00
Avg. Surface Temp. (°F)	75.50	75.77	72.00	71.00	82.48	78.00
Avg. 10' Temp. (°F)	72.17	73.75	72.00	70.17	78.50	75.67
Avg. 20' Temp. (°F)	66.80	67.80	63.00	62.00	73.60	69.50
Max. Depth Temp. (°F)	58.00	59.00	59.00	56.00	68.00	62.00
Avg. Secchi Depth (ft)	12.95	11.30	11.20	7.58	6.93	8.00

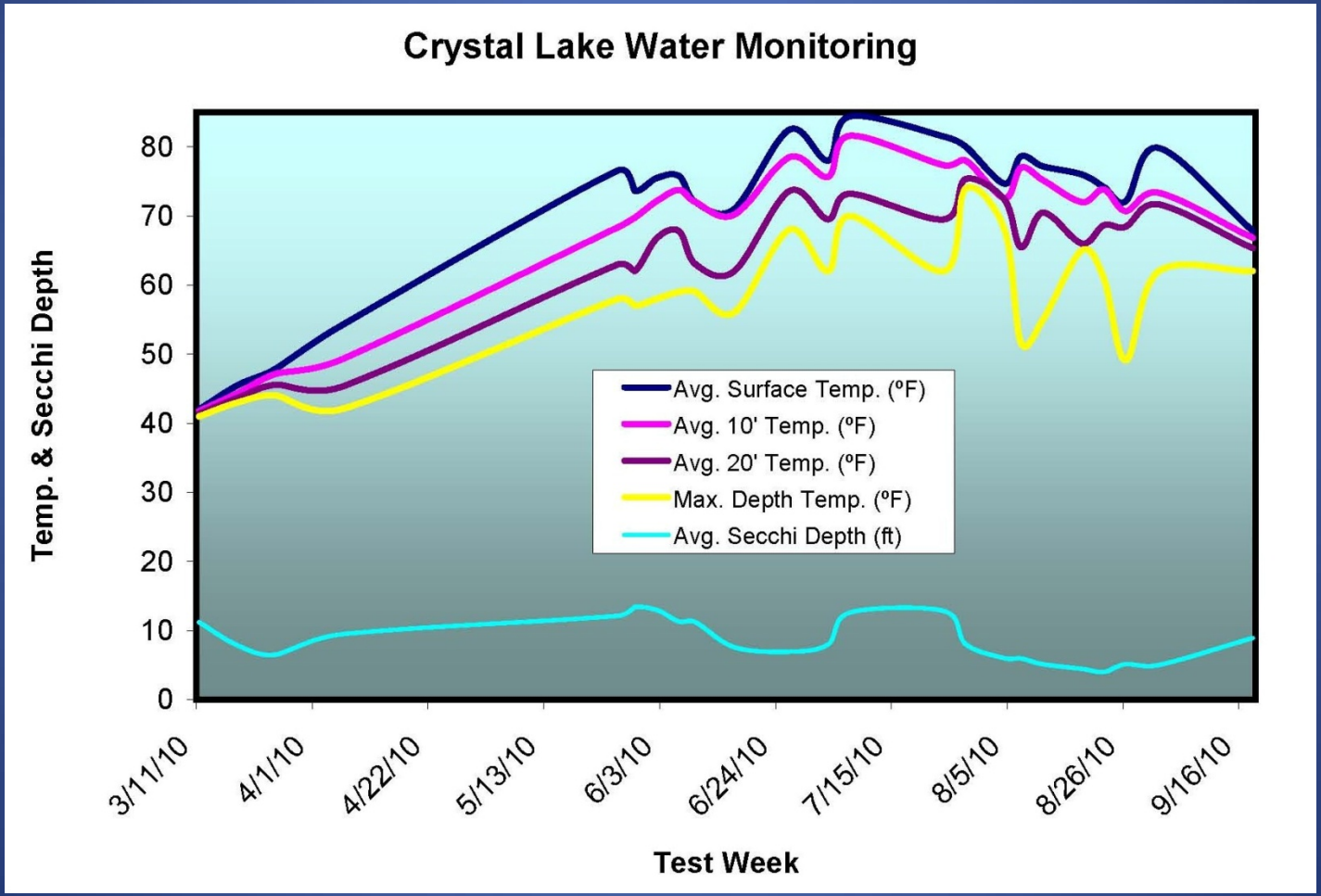
Date	7/7/2010	7/24/2010	7/28/2010	8/4/2010	8/7/2010	8/11/2010
Week	13.00	14.00	15.00	16.00	17.00	18.00
Avg. Surface Temp. (°F)	84.40	81.50	80.00	74.67	78.62	77.17
Avg. 10' Temp. (°F)	81.60	77.33	78.00	72.60	76.96	75.17
Avg. 20' Temp. (°F)	73.20	69.50	75.33	72.33	65.44	70.50
Max. Depth Temp. (°F)	70.00	62.00	74.00	68.00	51.62	55.00
Avg. Secchi Depth (ft)	12.60	12.83	8.00	6.00	5.96	5.12

Date	8/18/2010	8/22/2010	8/26/2010	9/1/2010	9/18/2010
Week	19.00	20.00	21.00	22.00	23.00
Avg. Surface Temp. (°F)	76.00	74.17	72.14	79.83	67.83
Avg. 10' Temp. (°F)	72.00	73.83	70.70	73.33	66.83
Avg. 20' Temp. (°F)	66.00	68.67	68.45	71.67	65.33
Max. Depth Temp. (°F)	65.00	61.00	49.10	62.00	62.00
Avg. Secchi Depth (ft)	4.45	4.00	5.15	5.02	8.92

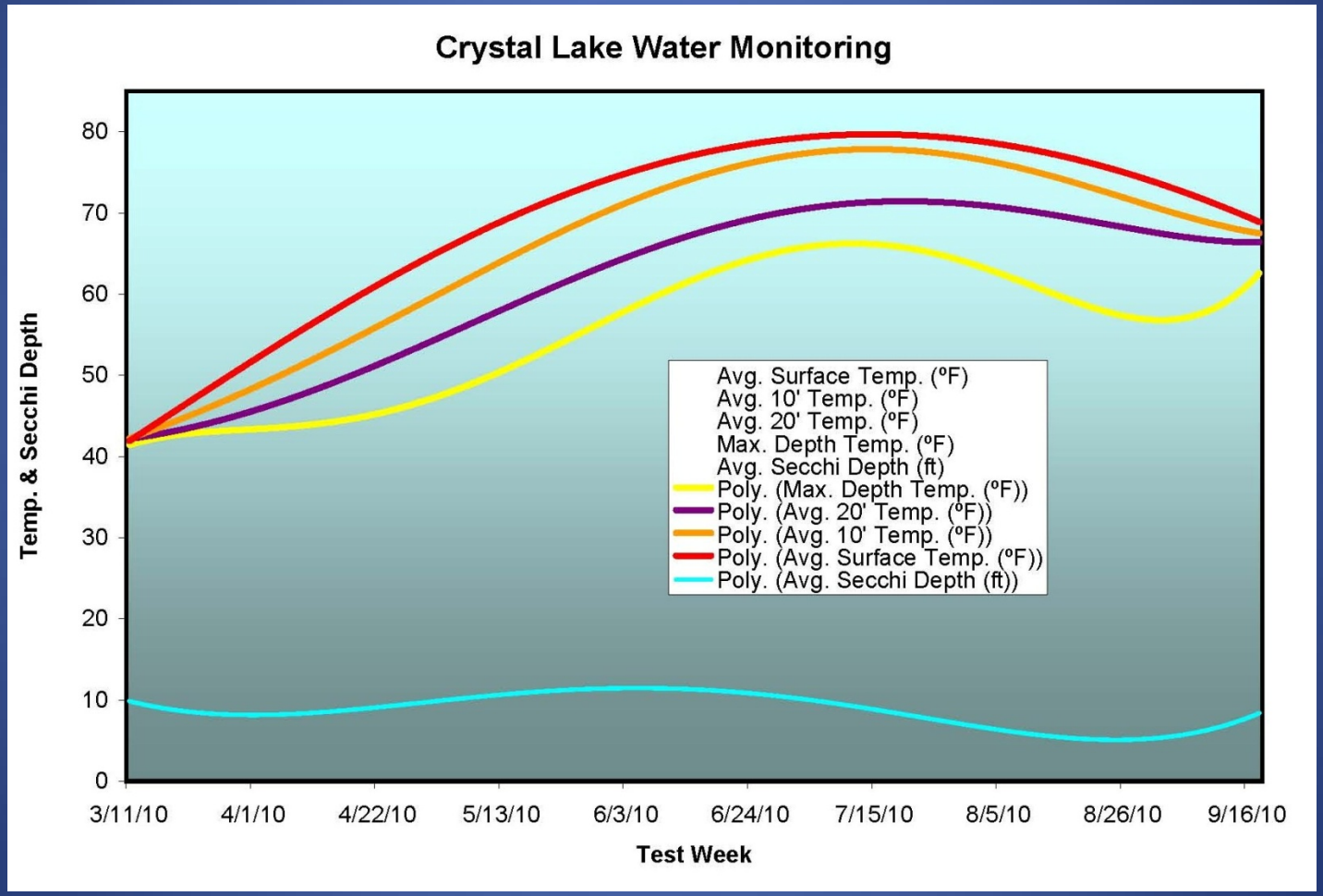
2010 Testing Program

- Secchi Disk Visibility
- Temperature
- Dissolved Oxygen

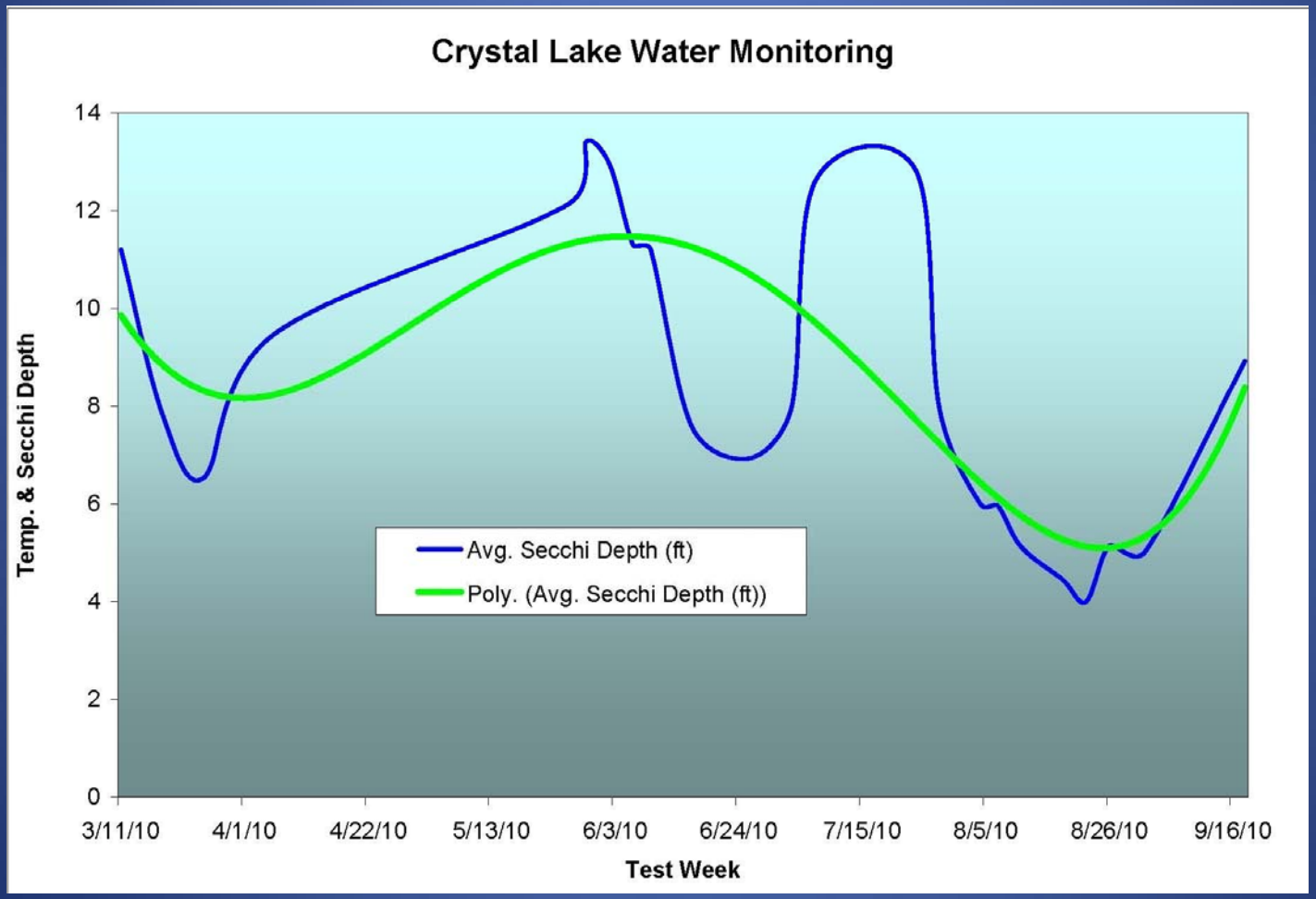
Raw Temperature and Secchi Disk Data Plotted versus Time



Poly line plot of Temperature and Secchi Disk versus Time

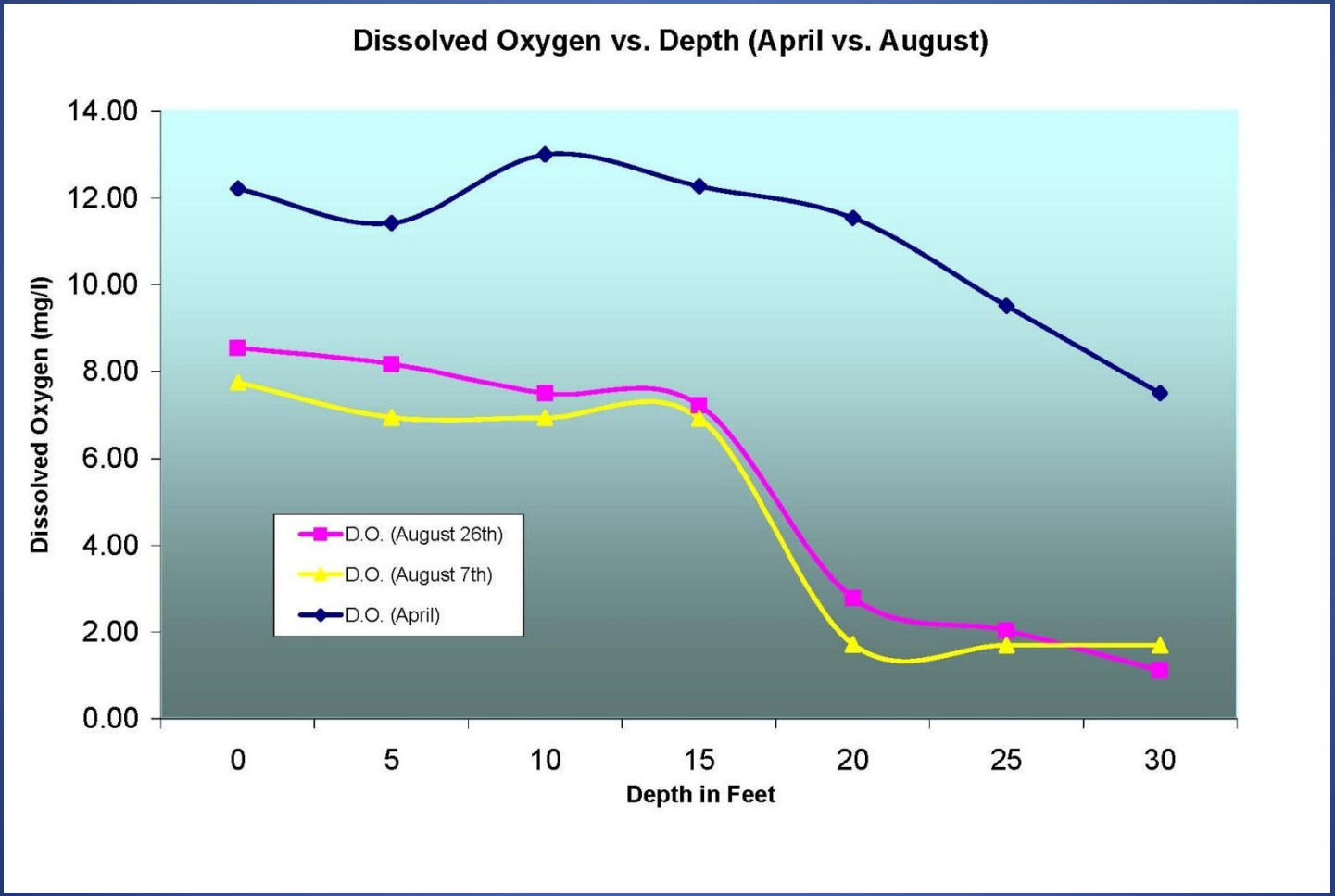


Secchi Disk Visibility
Spring, Summer, and into the Fall 2010



BEALS·ASSOCIATES

Dissolve Oxygen Concentrations versus Time and Depth



Crystal Lake Bathymetry

October 6, 2010

BEALS · ASSOCIATES

The Crystal Lake Watershed

BEALS·ASSOCIATES

Storm Water Discharge Point into Crystal Lake

October 6, 2010

BEALS·ASSOCIATES

Recommendations for the Future

In Crystal Lake

- Continue Monitoring the Lake
- Expand testing to include bacteria, nutrients, and suspended solids
- Monitor storm events in addition to regular monitoring

In the Watershed

- Collect information on land uses throughout the watershed
- Begin and education program to help the residents understand ways to reduce impacts
- Develop programs to reduce pollutant loads entering the lake