Mississippi Valley Conservation

State of the Lake Environment Report December 2004

Blue Lake

Watershed Watch

Blue Lake

Blue Lake is located in the Township of North Frontenac. The lake's surface area is 0.289 square kilometres and the deepest point is 30 metres. Blue Lake supports a cold water fishery, in particular splake. In 2004, there were approximately 2 cottages and 2 campsites on the lake.

Limited water quality data is available for Blue Lake. Records indicate that shoreline property owners have not yet formed a Lake Association or participated in water quality testing available through the Ministry of Environment's Self Help Program or the Lake Partner Program. Comprehensive testing in 1999 and 2004 through Mississippi Valley Conservation's (MVC) *Watershed Watch Program*, provides for a comparison between water quality conditions as they exist now, to results obtained in 1983, (21 years ago), through the Ministry of Environment Recreational Lakes Program.

In general, the water quality in Blue Lake is very good**.** There is one sampling station on the lake at the deepest point as indicated on the bathymetric map included in this report. You will find graphs which follow, that water clarity, as measured by Secchi Disk readings, were observed as excellent. The average for 2004 is 9.4 metres, thus indicating that Blue Lake is an unenriched (few nutrients) or oligotrophic lake, compared to 5 years ago, when the average was 6.9 metres.

Directly related to water clarity is the amount of nutrients, in particular phosphorus, entering the lake. The Provincial Objective for phosphorus levels in cold water lakes is 10 micrograms per litre (ug/L). In 2004, the mean for the euphotic zone (depth at which sunlight can penetrate or two times the secchi disk depth) was 3.3 *ug/*L, below the Provincial Objective. The mean for the samples taken one metre off the bottom was also 11.0 *ug/*L, slightly above the Provincial Objective. Five years ago, the average phosphorus level was 5.3 *ug/*L, in the euphotic zone and 9.2 *ug/*L one metre off the bottom of the lake, Blue Lake has slightly decreased its average phosphorus levels in the euphotic zone and increased one metre off the bottom.

Chlorophyll a is a measure of the algal density in the lake. The average chlorophyll a density for the sampling station was 0.50 *ug/*L. Thus, indicating a low algal density for Blue Lake in 2004. In 1999, chlorophyll a levels were slightly higher at 0.78 *ug*/L. Therefore, indicating that Blue Lake is an unenriched (few nutrients) or oligotrophic lake.

Plants and animals are a direct reflection of their environment. The most critical time of year for conducting dissolved oxygen and temperature profiles is after August 31. Profiles are generally conducted at this time of year and at the deepest point in the lake. Aquatic vegetation and algae that has grown over the summer, has died off and settled on the bottom, using the available oxygen necessary to sustain aquatic life in the lower portion of the lake or the hypolimnion. Two other profiles were conducted in 2004, one in May, and one in July, in order to generate a more concise picture of the oxygen content of the lake.

The dissolved oxygen (DO) and temperature data, measured at the deepest point in the main basin, indicate oxygen concentrations in the deep water portion were reduced and temperature readings were fairly warm by late-summer. Cold water fish species, such as splake, were pushed down to below the 8 metre mark. There is only a 9 metre layer of water from 9 to 17 metres having vital cold water habitat. By September, the warm water fishery habitat is pushed into the upper 17 metres of the lake.

Blue Lake was also tested for invasive species in 2004, in particular, for zebra mussels and spiny water flea, in partnership with the Ontario Federation of Anglers and Hunters (OFAH). Blue Lake did *not* have zebra mussel veligers (larvae) and spiny water flea present. Residents and property owners need to ensure that all access points to the lake have posted signs indicating the precautions they can take to avoid the spread of invasive species into Blue Lake. Another recommendation is for residents to begin participation in the invasive species monitoring program through MVC.

Residents and users of Blue Lake cannot afford to be complacent. Every effort should be made to reduce nutrient loading into the lake from land use activities. Human sources of phosphorus include leachate from sewage disposal systems, erosion from the clearing of shorelines and the use of lawn fertilizers. The first step to achieve this is to form a Lake Association. It is recommended that a Lake Steward be appointed to undertake ongoing water quality testing and to join the Mississippi Valley Lake Stewardship Network. Monitoring over time is essential to determine long term trends and changes. Resources and information are readily available through the *Watershed Watch Program*. There are helpful tips throughout this report to help reduce your impact on Blue Lake. Additional water quality data, current and historic, is available for Blue Lake and many other lakes in the Mississippi Valley watershed. Contact MVC for more information on how you can become a good lake steward for your lake.

FIVE EASY STEPS TO IMPROVE WATER QUALITY

1. Build at least 30 metres away from the shoreline.
2. Keep your lot well treed and preserve or replant native vegetation along the shoreline.
3. Pump out your septic tank every three to five years.
4. Reduce water use and use phosphate free soaps and detergents.
5. Keep the size of your lawn to a minimum; do not use fertilizers, herbicides or pesticides.

LOW PHOSPHORUS LIFESTYLE	Amount of Phosphorus (grams)	HIGH PHOSPHORUS LIFESTYLE	Amount of Phosphorus (grams)
Human waste	535	Human waste	535
No dishwasher	0	Dishwasher using powdered detergent once per day	650
No fertilizer	0	Lawn fertilized once/year	1960
Trees not cut down	20	Lot cleared of trees	30
Uses phosphate-free products	20	Uses products with phosphate	180
TOTAL	**575 grams**	**TOTAL**	**3355 grams**

How Does Blue Lake Measure Up?

1983 – 2004 Water Quality Results

Sample Year [Various Stations]	Secchi Disk Depth [Metres]	Total Phosphorus Euphotic Zone [Micrograms/Litre]	Total Phosphorus 1 Metre off Bottom [Micrograms/Litre]	Chlorophyll a Composite [Micrograms/Litre]
**1983 Mean				0.41
1999 Mean	6.9	5.3	9.2	0.78
*2004 Mean	9.4	3.3	11.0	0.50
n	2	2	2	3
Minimum	6.9	3.3	9.2	0.41
Maximum	9.4	5.3	11.0	0.80
Mean	8.2	4.3	10.1	0.60
Standard Deviation	1.76776695	1.393000359	1.272792206	0.192959409

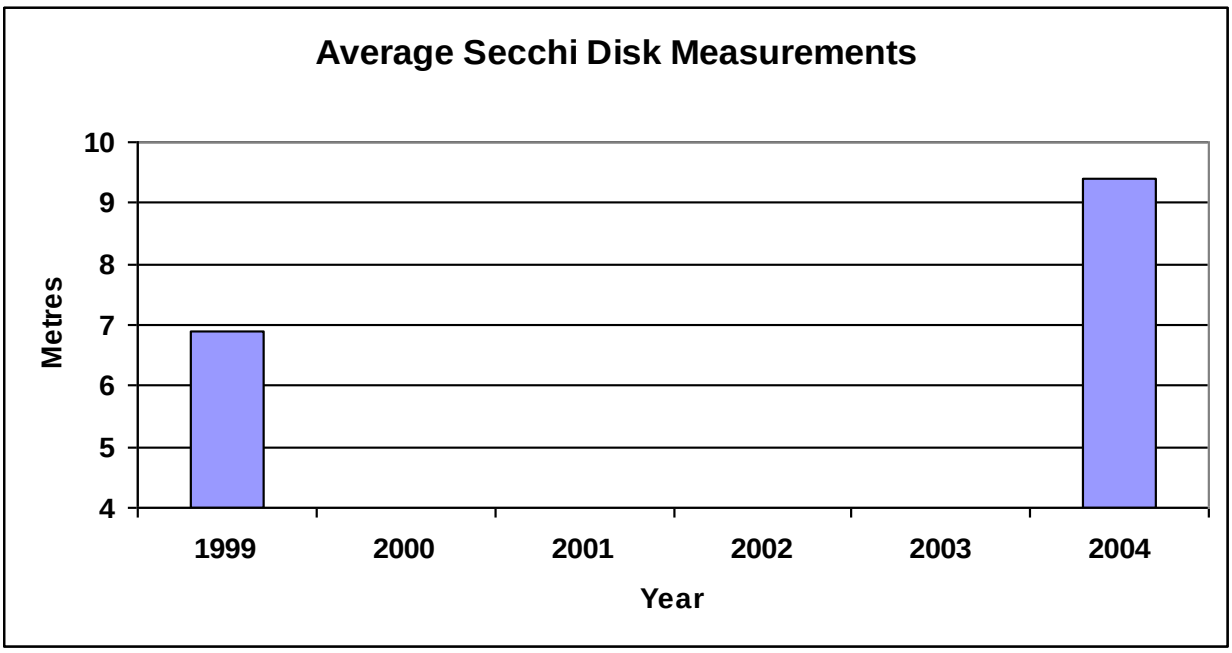
*Mean based on less than 6 measurements **Includes Recreational Lakes Program Data
Chlorophyll a data prior to 1985 has been adjusted to reflect new lab procedures
in filtering resulting in an increase in chl.a concentrations by 35%

Interpreting Secchi Disc Readings:

A Secchi disk is a black and white coloured disk used to determine water clarity. The disk is lowered into the water. The point, at which you can no longer distinguish the black and white, is called the Secchi depth.

The higher the Secchi Disk measurement the clearer your lake is.

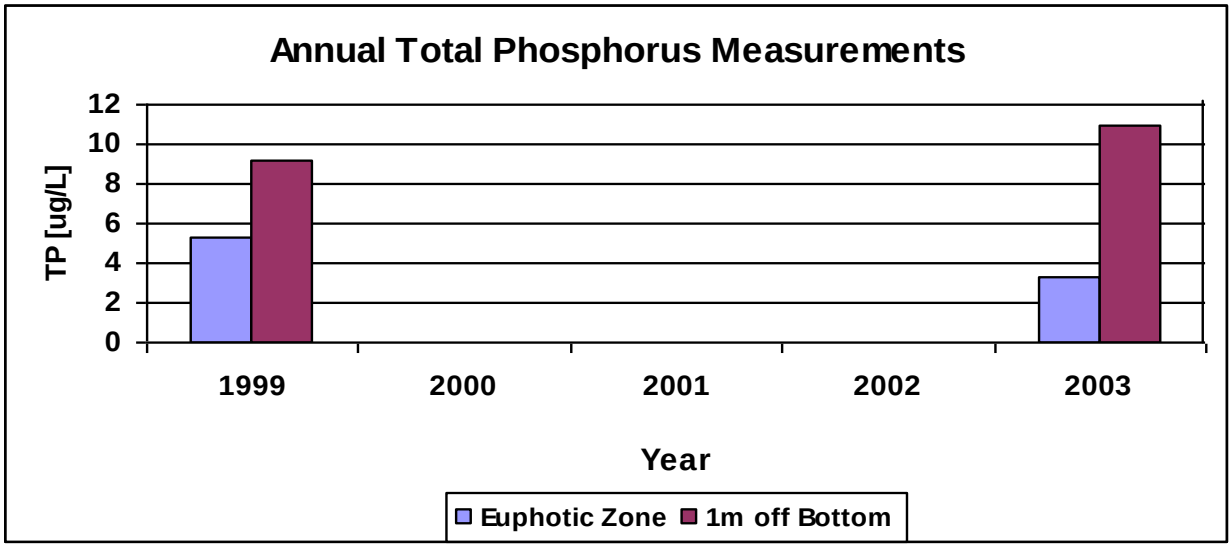
INTERPRETING YOUR SECCHI DISC RESULTS	
Secchi Reading	**Lake Nutrient Status**
Over 5 metres	Oligotrophic - unenriched, few nutrients
3.0 to 4.9 metres	Mesotrophic – moderately enriched, some nutrients
Less than 2.9 metres	Eutrophic – enriched, higher levels of nutrients



Interpreting Total Phosphorus Results:

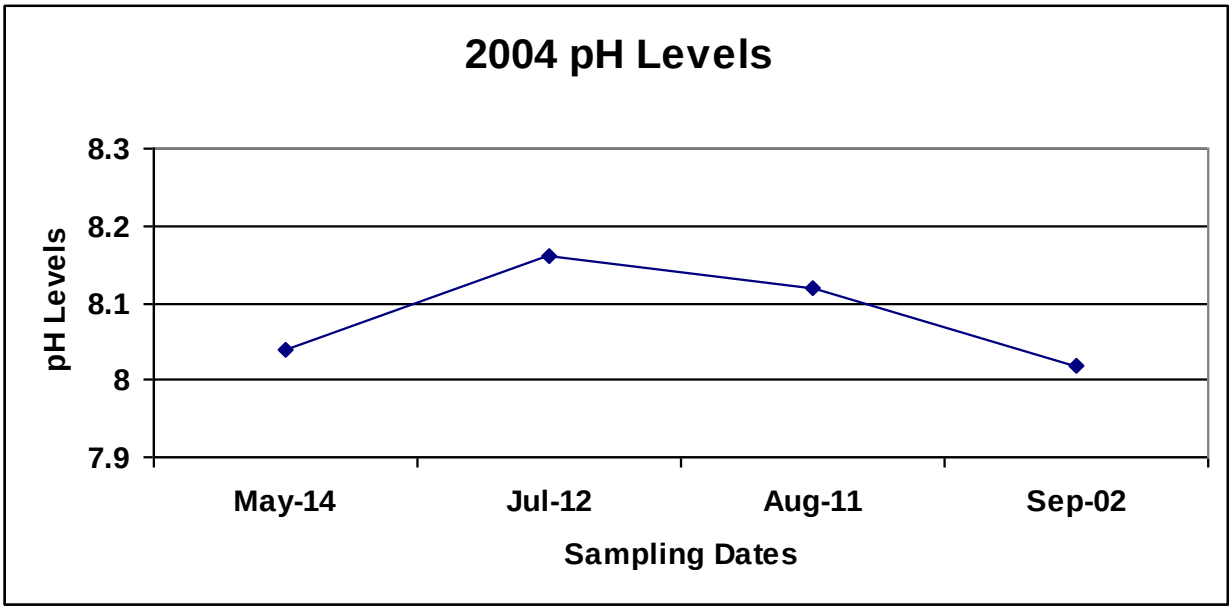
Phosphorus is the nutrient that controls the growth of algae in most Ontario lakes. For this reason any increase in phosphorus in the lake will increase the quantity of algae that can grow. High levels of phosphorus can lead to algal blooms and in some cases affect the habitat of cold water fish such as lake trout. A general guideline exists to characterize your lake based on the total phosphorus that is measured.

INTERPRETING YOUR TOTAL PHOSPHORUS RESULTS	
Total Phosphorus	**Lake Nutrient Status**
10 ug/L or less	Oligotrophic - unenriched, few nutrients
11 to 20 ug/L	Mesotrophic – moderately enriched, some nutrients
21 ug/L or more	Eutrophic – enriched, higher levels of nutrients



Evaluating your pH Results:

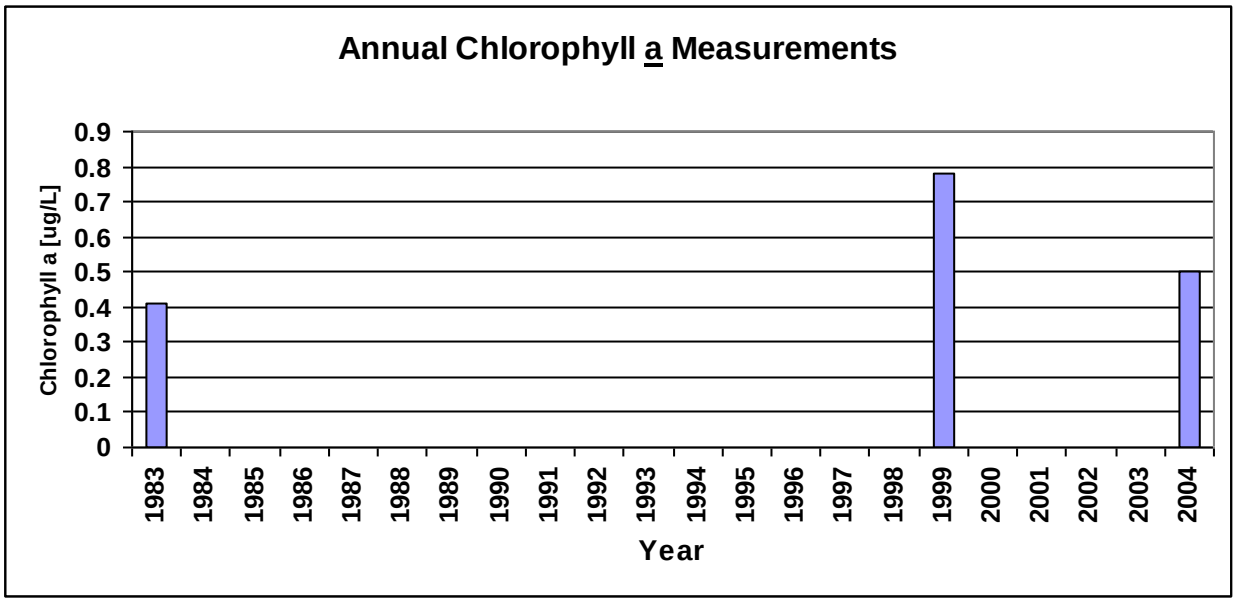
Lakes with pH levels at 7.3 or higher are vulnerable to zebra mussels invasive.



Evaluating your Chlorophyll a Results:

The lower the chlorophyll a density in your lake, the clearer your lake is. Chlorophyll a is directly affected by the amount of total phosphorus in your lake. The more phosphorus there is in the water, the more algal growth will occur.

INTERPRETING YOUR CHLOROPHYLL A RESULTS	
Chlorophyll a Reading	**Lake Nutrient Status**
Up to 2 ug/L - low algal density	Oligotrophic - unenriched, few nutrients
2-4 ug/L - moderate algal density	Mesotrophic - moderately enriched, some nutrients
More than 4 ug/L- high algal density	Eutrophic - enriched, higher levels of nutrients



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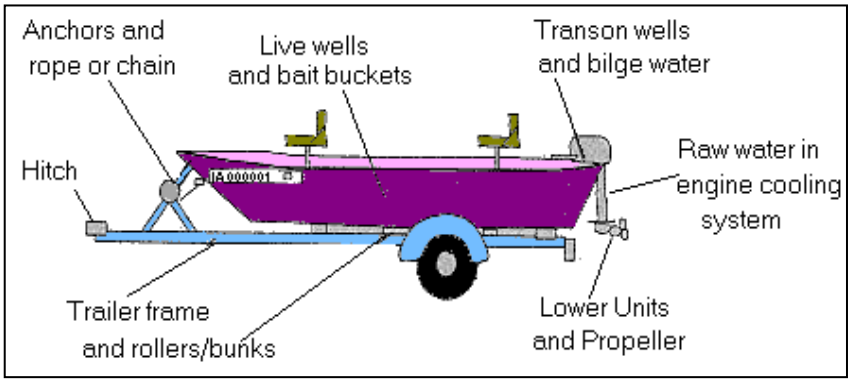
MVC and OFAH need your help to Stop the Invasion!

Check & clean your boat every time you change water bodies



Working with Lake Associations, we hope to improve signage at public launching areas to identify lakes where zebra mussels and spiny water fleas are already present. We hope to focus on an ambitious educational campaign to help reduce their spread to lakes where they are not yet present.

For more information call MVC at (613)259-2421, the Invading Species Hotline 1-800-563-7711.

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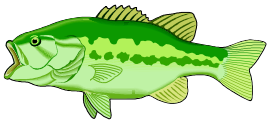
BLUE LAKE – Main Basin

DISSOLVED OXYGEN/TEMPERATURE PROFILES
MOE Rec. Lks. Station 18-3430-772-01 MVC Station # 04-17
Date: May 14, 2004
Depth: 28.0 Metres
Euphotic Zone (Penetration of Light) = 23.0 Metres

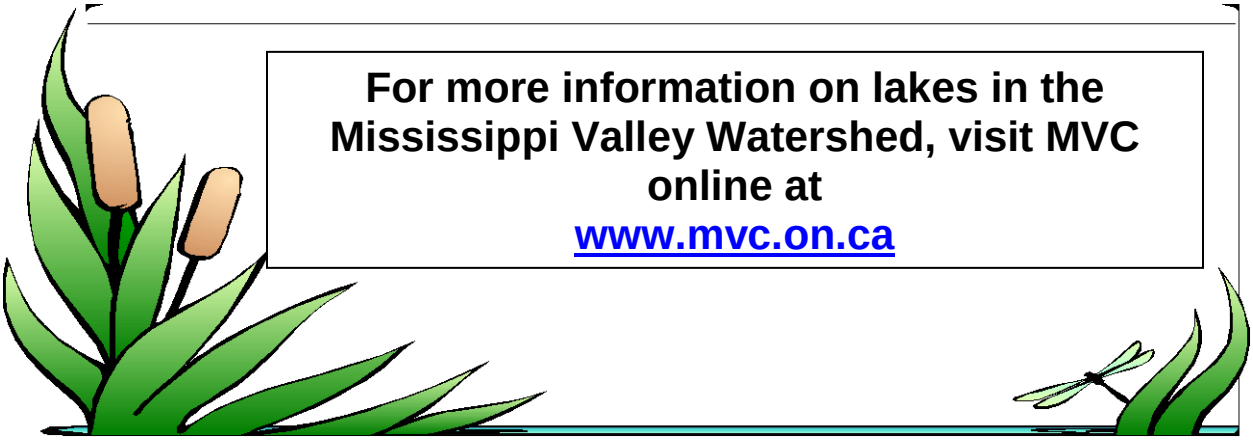


Depth [Metres]	Temperature [Degrees Celsius]	Dissolved Oxygen [Milligrams/Litre]	Percent % Saturation	Thermal Stratification
0.1	18.0	8.3	85	
1.0	17.0	8.6	85	Epilimnion
2.0	13.3	9.6	88	Metalimnion
3.0	12.3	9.7	87	or Thermocline
4.0	12.0	9.8	87	
5.0	11.7	9.9	88	
6.0	10.9	10.0	87	
7.0	9.8	10.1	85	
8.0	8.4	10.4	85	
9.0	7.4	10.8	87	
10.0	6.7	10.6	84	Hypolimnion
11.0	6.1	10.4	81	
12.0	5.6	10.1	77	
13.0	5.4	9.7	74	
14.0	5.2	9.3	70	
15.0	5.1	8.8	66	
16.0	5.0	7.6	57	
17.0	4.8	6.6	50	
18.0	4.8	5.6	42	
19.0	4.7	4.7	35	
20.0	4.6	3.7	28	
21.0	4.5	1.5	11	
22.0	4.5	1.2	8	
23.0	4.5	0.9	6	
24.0	4.5	0.6	4	
25.0	4.4	0.4	2	
26.0	4.4	0.3	2	
27.0	4.4	0.2	2	
28.0				Bottom

Optimal Habitat for Cold Water Fisheries (Trout) = DO > 6 mg/L at < 10°C.

Vital Habitat for Cold Water Fisheries (Trout) = DO > 4 mg/L at < 15.5°C.

Note: Warm Water Fisheries Habitat (Bass, Walleye, Pike, Perch) = DO > 4 mg/L at < 25°C.



For more information on lakes in the Mississippi Valley Watershed, visit MVC online at
www.mvc.on.ca

BLUE LAKE – Main Basin Continued...

Date: July 12, 2004
Depth: 27.0 Metres
Euphotic Zone (Penetration of Light) = 19.0 Metres

Depth [Metres]	Temperature [Degrees Celsius]	Dissolved Oxygen [Milligrams/Litre]	Percent % Saturation	Thermal Stratification
0.1	22.2	8.0	88	
1.0	22.0	8.0	87	
2.0	21.7	8.0	86	Epilimnion
3.0	21.6	8.1	87	
4.0	21.4	8.1	87	
5.0	20.8	8.4	88	
6.0	19.6	9.0	94	
7.0	16.1	13.1	128	Metalimnion
8.0	13.7	14.3	132	or Thermocline
9.0	11.9	15.1	134	
10.0	10.1	14.4	124	
11.0	9.2	14.1	120	
12.0	8.2	13.5	110	
13.0	7.4	12.7	100	
14.0	6.9	12.0	95	
15.0	6.2	9.0	70	
16.0	5.8	7.7	59	Hypolimnion
17.0	5.3	2.5	19	
18.0	5.1	1.6	12	
19.0	5.0	0.7	4	
20.0	5.0	0.5	3	
21.0	4.9	0.4	3	
22.0	4.9	0.4	3	
23.0	4.9	0.3	2	
24.0	4.8	0.2	2	
25.0	4.8	0.2	2	
26.0	4.8	0.2	2	
27.0				Bottom

Optimal Habitat for Cold Water Fisheries (Trout) = DO > 6 mg/L at < 10°C.

Vital Habitat for Cold Water Fisheries (Trout) = DO > 4 mg/L at < 15.5°C.

Note: Warm Water Fisheries Habitat (Bass, Walleye, Pike, Perch) = DO > 4 mg/L at < 25°C.

How to protect or restore a shoreline depends on the conditions of the site and the energy and resources of the owner.

There are four main strategies to choose from:

- **PRESERVATION –** When purchasing a lakefront property, a natural shoreline is retained and access to the lake is designed to avoid shoreline damage.
- **NATURALIZATION –** Degraded shorelines are left alone to return to their natural state.
- **ENHANCEMENT –** Native species are planted and non-native species are removed.
- **RESTORATION –** Cleared areas are planted with native species.

BLUE LAKE – Main Basin Continued…

Date: September 2, 2004
Depth: 25.0 Metres
Euphotic Zone (Penetration of Light) = 19.0 Metres

Depth [Metres]	Temperature [Degrees Celsius]	Dissolved Oxygen [Milligrams/Litre]	Percent % Saturation	Thermal Stratification
0.1	21.3	8.1	87	
1.0	21.1	8.2	87	
2.0	21.0	8.2	88	
3.0	20.9	8.3	88	Epilimnion
4.0	20.9	8.3	88	
5.0	20.9	8.3	88	
6.0	20.8	8.4	88	
7.0	20.5	8.7	92	
8.0	19.5	12.3	128	
9.0	15.0	16.6	160	
10.0	13.3	16.3	150	Metalimnion
11.0	11.4	14.9	130	or Thermocline
12.0	9.8	13.3	112	
13.0	8.7	12.9	106	
14.0	8.0	12.1	98	
15.0	7.3	11.5	92	
16.0	6.8	10.7	85	
17.0	5.9	6.0	46	
18.0	5.6	2.0	15	Hypolimnion
19.0	5.3	0.6	4	
20.0	5.3	0.3	2	
21.0	5.3	0.3	2	
22.0	5.3	0.3	2	
23.0	5.2	0.3	2	
24.0	5.2	0.3	2	
25.0				Bottom

Optimal Habitat for Cold Water Fisheries (Trout) = DO > 6 mg/L at < 10°C.

Vital Habitat for Cold Water Fisheries (Trout) = DO > 4 mg/L at < 15.5°C.

Note: Warm Water Fisheries Habitat (Bass, Walleye, Pike, Perch) = DO > 4 mg/L at < 25°C.

Mississippi Valley Conservation

The Watershed Watch program was made possible thanks to the generous support of the Ministry of Environment, Lake Associations, area Stewardship Councils, the Lake Stewardship Network and concerned citizens.

For more information regarding *Watershed Watch* or for advice on how you can help protect or enhance your lake environment, contact Melissa Dakers, Water Quality Technician, Mississippi Valley Conservation at (613) 259-2421 or mdakers@mvc.on.ca