

# Bills Lake Association



# Lake Testing Report

March, 2008

# Results of Bills Lake's Annual Physical Exam

## Introduction

If you are wise, you see the doctor at least once a year for a check-up even if you are healthy. He/She runs tests, looks them over, discusses them with you, and then — even if you are healthy — says: “Looks good, *see you next year.*”

Over the past five years, three tests have been conducted on Bills Lake waters periodically each summer.\* The results are translated into what is known as the Carlson Trophic Index, a scale that seeks to measure the productivity of a lake. The higher the number, the more the lake is able to produce algae and weeds, not a particularly bad thing if you happen to be a fisherman but a very bad thing, most agree, if our productivity borders on swamp-like conditions.

Instead of grading the lake in terms of a scale of A-E or 100-0 as in our school days, scientists categorize lakes using the terms oligotrophic, mesotrophic, and eutrophic. An extensive description of these terms can be found at <http://www.mlswa.org/lkclassif1.htm>.

Suffice it to say here that the lower the number, the clearer and purer the water. Using the Carlson numbers, dividing lines are roughly: oligotrophic: 20-37, mesotrophic: 38-53, and eutrophic: 54-65. The various Carlson charts presented in the next few pages illustrate this.

**“Looks good,  
*see you next year.*”**

Over the past five years, our results have been stable and consistent, despite one bad year when we endured a bout of microcystis, green pond scum that came from the initial onslaught of zebra mussels. In terms of average scores, we are at the top of the mesotrophic category or at the bottom of the oligotrophic category, depending on how you want to look at it.

A graph of our transparency readings, taken since 1981, shows a gradual decline in lake clarity (see page 6). However, our phosphorous and chlorophyll scores are not only consistently good but put us in the bottom of the oligotrophic category. It is only the transparency that suffers throughout the summer, the result of warm temperatures that produce algae and increased boat traffic that stirs up sediment such as marl.

Good health can be defined as taking care of yourself *before* you get sick. To be sure, the lake ecology will continue to be hit with the results of increased population and development, i.e. the increase of paved surfaces which promote run-off of impurities into the lake, poorly maintained septic systems which deposit impurities of a different sort into the lake, and motorized boat traffic that sometimes leaks gas and oil into the lake.

But for the most part, we are fortunate to have an educated populace that takes precautions to avoid these consequences, and reminds neighbors and guests to do the same. There is an awareness on the part of most people that, in one form or another, Mother Nature bats last, either by rewarding us with an esthetically pleasing environment or by punishing us with a visually ugly result of our neglect.

\* Actually, the phosphorous test has been administered for the past six years and the transparency test has been conducted since 1981. The purpose of this discussion is to use the results of *all three tests administered during the same summer* to form a composite average. This has occurred from 2003-2007.

# 2007 Lake Testing Results

**Secchi Disk** -- During the summer of 2007, an eight-inch disk the circumference of which consists of alternating black and white quadrants attached to a tape measure was placed in the deep basin of Bills Lake once per week. The average depth at which the disk disappeared (actually drawn back up until it could be barely seen) was 10.4 feet. This gave us a Carlson Trophic Index score of 43 which places Bills Lake squarely between the mesotrophic and oligotrophic categories in terms of transparency. The best reading during the sample period -- May through September -- was a whopping 24 feet. The worst was 3.5 feet.

**Chlorophyll** -- From approximately the middle of the month from May through September, a sample of water was taken from the deep basin of Bills Lake, filtered for algae, and frozen for transport to the DEQ in Grand Rapids. The results of the testing is in parts per billion: 1.4, 1.2, 2.5, 2.1, 1.8. This 1.8 parts per billion average gave Bills Lake a Carlson score of 36 which puts us toward the top of the oligotrophic category.

**Phosphorous:** Two samples were taken, one on approximately April 15th and the other on approximately September 15th. Each was frozen for transport to the DEQ office in Grand Rapids. Lab results: Spring: 8 parts per billion; Fall, 7 parts per billion. Carlson Score is 32 which puts us in the middle of the oligotrophic category.

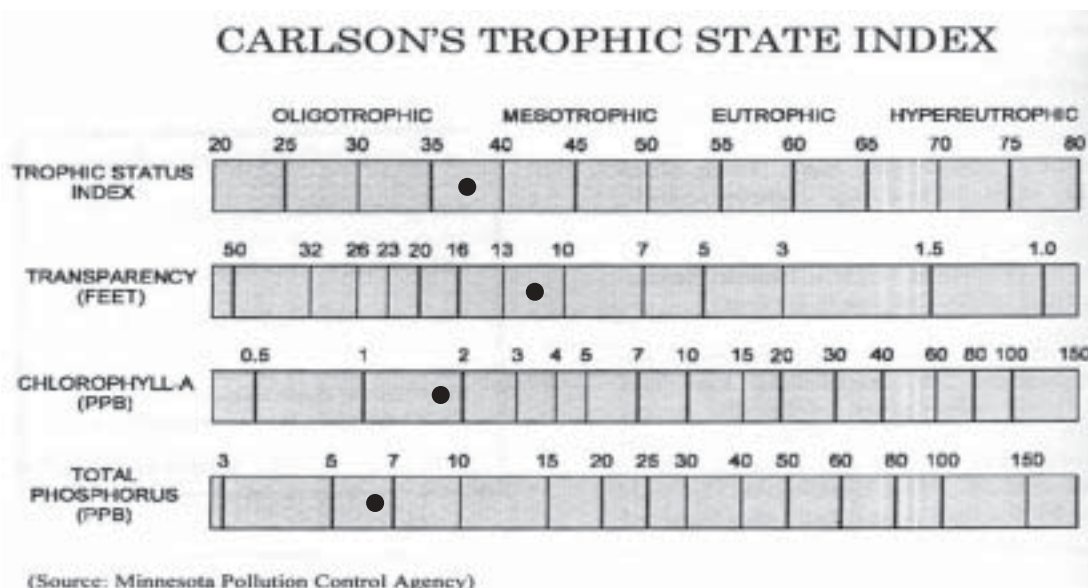
**Composite Score:** Because we perform these three tests, the averages of the Carlson scores can be taken together to produce a Composite Result. In 2007, our lake received a score of 38 which puts us between the mesotrophic and oligotrophic categories.

Composite Score: Carlson score of 37

Secchi Disk: 17 readings, 10.4 feet average = Carlson score of 43

Chlorophyll: Five samples, 1.8 parts per billion average = Carlson score of 36

Phosphorous: Two samples, average of 7.5 parts per billion = Carlson score of 32



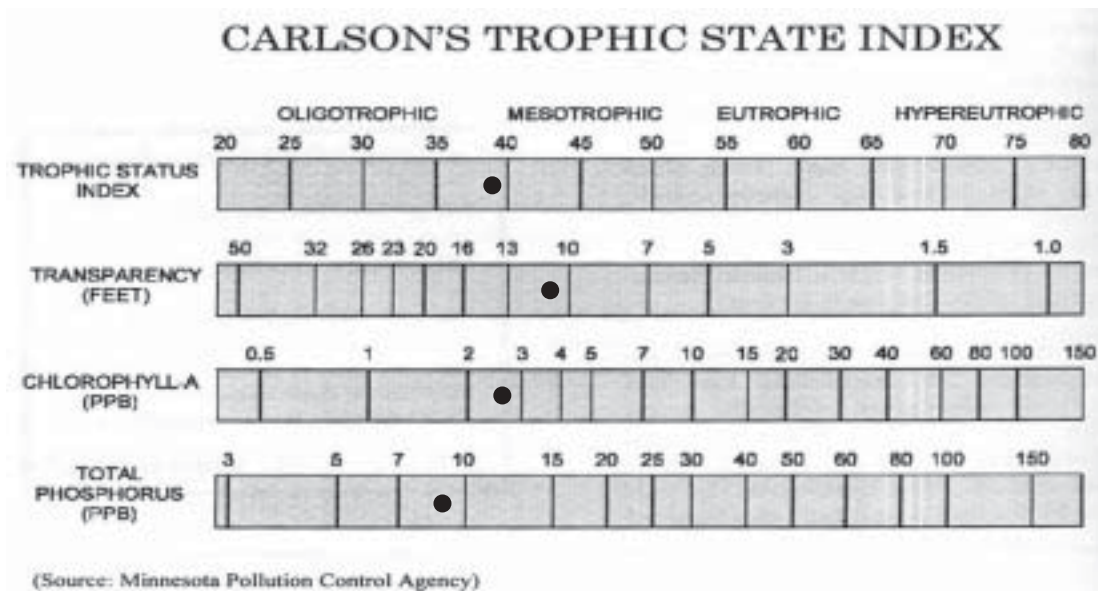
# Lake Testing Scores Over the Past Five Years

The purpose of data over time is to assess trends. Because we have been conducting the three tests over half a decade, we have been able to produce Carlson data that enables us to make comparisons.

The chart below gives us the Carlson results for years 2003 through last summer. We can see that the scores are remarkably consistent. We have a good (not great, but not horrible) lake in terms of water clarity and purity.

Year	Composite	Transparency	Chlorophyll	Phosphorous
2003	40	45	41	34
2004	38	42	38	34
2005	41	46	43	34
2006	39	42	39	36
2007	37	43	36	32
<b>Average</b>	<b>39</b>	<b>44</b>	<b>39</b>	<b>34</b>

A Carlson Trophic Index chart of Bills Lake average scores over the past five years



The Carlson composite average over five years is **39** which puts Bills Lake at the bottom of the mesotrophic category. A description of what a mesotrophic lake looks like can be found at <http://www.mlswa.org/lkclassif1.htm>.

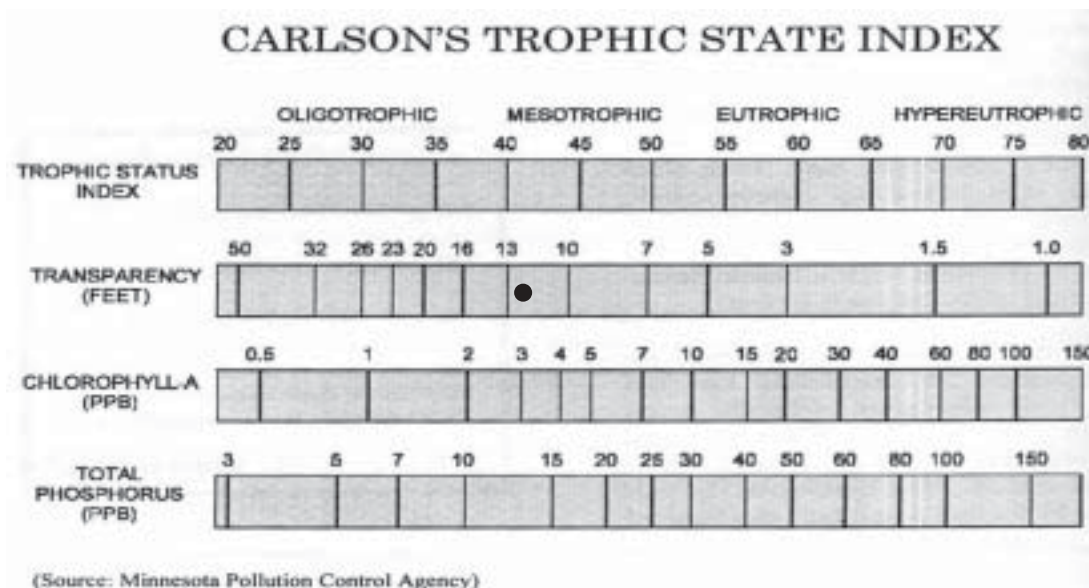
# Bills Lake transparency over nine years

Each spring, the Michigan Lake and Stream Associations, Inc provides a CLMP Annual Summary Report which provides data derived from information submitted by the volunteers. In terms of transparency, this includes the number of readings, the maximum reading, the minimum reading, and an average. The data is then translated into a Carlson score.

Data from 1994 through 1997 was provided at our request from the ML&SA. The rest can be found online in that the various Annual Reports from 1998 - 2007 can be obtained at [www.mlswa.org](http://www.mlswa.org) Click on the CLMP link and then go to the bottom of the ensuing page.

Below are results of the data that we have obtained. If someone asks you how clear the water is in Bills Lake, the most accurate answer is, on average, 11.3 feet. However, our water is much more transparent than this in the early spring and late fall. Our Carlson score of 42 puts us at the top of the middle category but be reminded that transparency is only one test of three. It just happens to be the one conducted over the greatest number of years.

Year	Sechi Avg.	Carlson
2007	10.4	43
2006	13.0	40
2005	9.8	44
2004	11.2	42
2003	10.0	44
2002	12.7	40
2001	9.2	45
2000	13.0	40
1999	9.9	44
1998	12.4	41
1997	13.1	40
1996	11.3	42
1995	9.7	44
1994	12.4	41
	<b>11.3</b>	<b>42</b>



# Bills Lake transparency over 27 years



Over the past 25 years, Bills Lake has been tested to ascertain the clarity of its water using a device which has become standard throughout the state. A Sechi Disk is simply an eight-inch disk — the circumference consisting of alternating black and white quadrants — which is attached to a tape measure. The person who does the testing goes to the deep basin of the lake (in our case the 90-foot area just off the tip of Deer Point), slides the disk into the water, and lets out enough measuring tape until he can't see the disk. Then he brings it back until he can barely see it. He records that measurement.

A Sechi disk reading, therefore, is the distance into the lake that you can see this disk just before it disappears from view. The disk is standardized so that clarity of lake water can be compared to that of other lakes whose testers use the same device.

Everyone in the Co-operative Lakes Monitoring Program (CLMP) tests at the same time of the year. Each season, nine to 18 equally spaced readings (once per week or once per two weeks) are taken from mid-May to mid-September to gather sufficient data for an overall perspective. After all, algal species composition in lakes can change significantly during the summer months. Increased temperature can dramatically alter the transparency of the water

Primarily due to the efforts of the Reinhardt family, we at Bills Lake have been fortunate to have Sechi disk results ranging from 1981 to the present and annually, the Michigan Lakes and Streams Association distributes an updated graph showing these findings.

The top of the graph on the next page (turned sideways to make it fit) represents the surface of the water. The dots represent the average depth per summer that a Sechi disk could be seen when dipped into the deep basin of the lake.

The dotted line on the graph indicates that the waters of Bills Lake have diminished slightly in clarity over the past 27 years. Of course, it would be truly fascinating to know what the Sechi disk readings would have been, say, 50 years ago.

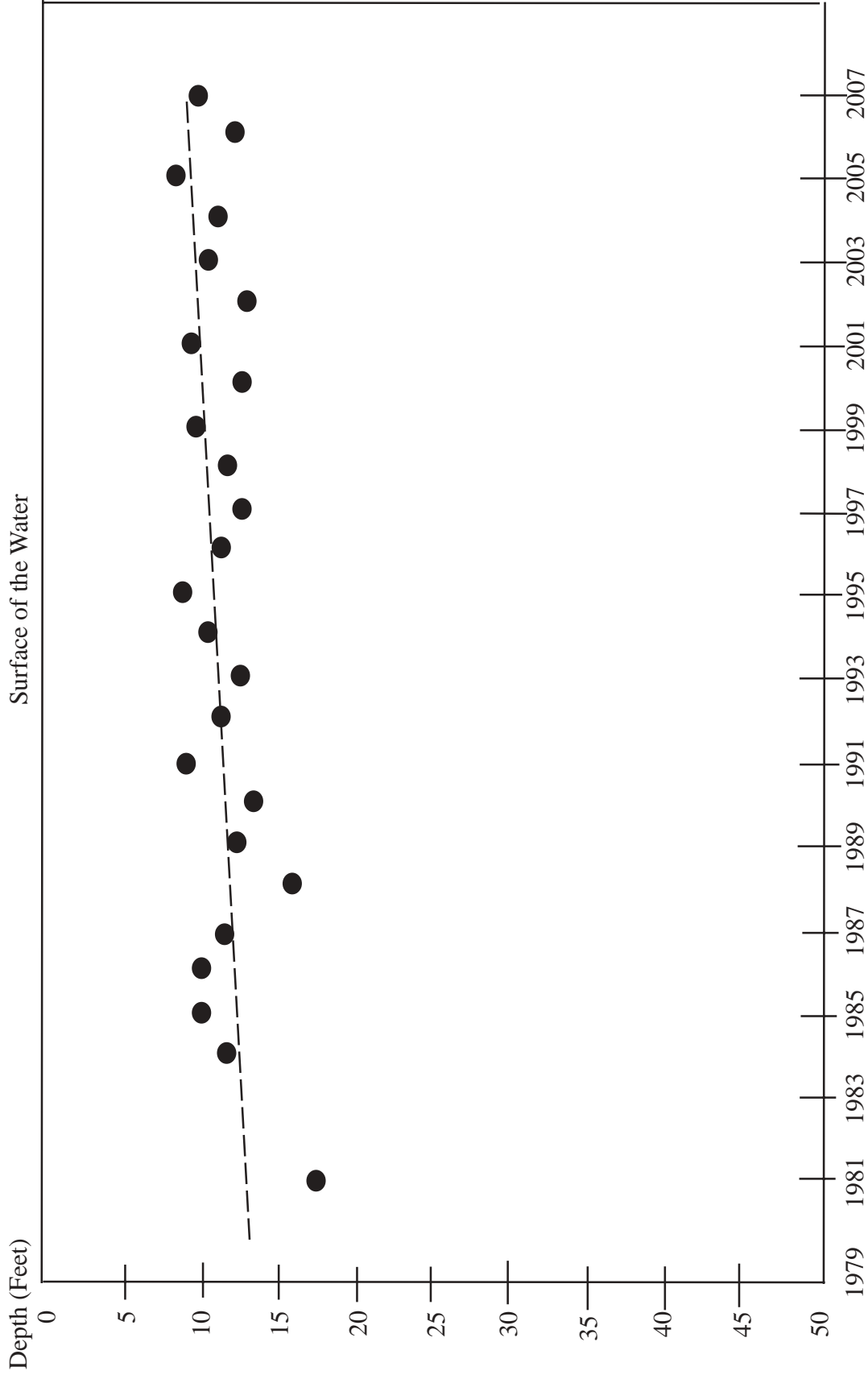
Using Carlson's Trophic State Index, Bills Lake is classified as a mesotrophic lake in terms of lake clarity. But the oligotrophic-mesotrophic-eutrophic hierarchy is a measurement not merely of clarity but instead of productivity, i.e. a lake's ability to support plant and animal life. Given that the Bills Lake phosphorous and chlorophyll readings are always in the oligotrophic category and given that Bills Lake is a marl lake wherein bits of calcium carbonate are easily stirred up and suspended in the water during the summertime — thus impeding clarity — it can be concluded that the waters of Bills Lake are in between the mesotrophic and oligotrophic categories in terms of productivity potential.

A more complete discussion of lake classification can be found at

<http://www.mlswa.org/lkclassif1.htm>

Cooperative Lakes Monitoring Program  
Summer Mean Transparency

**Bills Lake (Newaygo County)**



# Phosphorous readings over the years

A lake's clarity is influenced by several factors. In the case of Bills Lake, marl comes into play, but there are many other factors as well. There may be suspended particles in the water because of boat activity. Rough waves on certain days make it difficult to see the Secchi Disk. The angle of the sun, the eyesight of the tester, and the weather conditions (cloudy, sunny, rainy) all come into play. Consequently, taken by themselves the Secchi disk readings should only be a very general indicator of algae levels. Fortunately, there are other tests.

For most lakes, the amount of algae in the water is a major cause of reduced lake transparency. As more nutrients enter the lake, more algae are produced. As more algae are produced, the less the clarity. As a result, the Secchi disk disappears at a reduced depth.

This doesn't seem to be the case for Bills Lake. Although our Secchi disk readings place our lake in the mesotrophic portion of the Carlson Trophic Index scale, our phosphorous readings have been remarkably good.

The test is very simple to administer. On approximately April 15, the volunteer goes to the Deep Basin of the lake (for us, the 90 feet area just off Deer Point), and dips a sample bottle elbow-deep into the water. The bottle is placed in a cooler and after arriving back on shore, into a freezer. Shortly after (this year, April 18), it is taken to the DEQ office in Grand Rapids where it is shipped to a lab in Lansing for testing. The same procedure is performed on approximately Sept. 20<sup>th</sup>.

There should be a difference in readings between the spring and summer tests. In the spring, the lake is well-mixed, i.e. the water at the top is the same as at the bottom. Thus, a phosphorous sample taken from elbow-depth will produce the same reading as that taken from the middle and bottom of a water column. Not so at the end of the summer when the water has stratified because of temperature (warm on top with predictably more algae as a result).

Taken year after year, we can spot a trend. Fortunately for Bills Lake, there hasn't been much of one. Phosphorous tests come back as part per billion (ppb). Although we have not done the phosphorous test long enough to generate a graph (it takes eight years of testing before the CLMP will give us one), the numbers are low, indicating very little productivity.

<b>Year</b>	<b>Spring</b>	<b>Late Summer</b>	<b>Carlson Score</b>
2002	7	10	34
2003	4	8	34
2004	11	8	34
2005	6	8	34
2006	6	9	36
2007	8	7	32

Trend? What trend? Phosphorous readings over the past six years have been remarkably consistent. Moreover, a Carlson score of 34 puts us in the highest, cleanest category.

# Chlorophyll readings over the years

Chlorophyll is the green photosynthetic pigment in the cells of plants. The amount of algae in a lake can be estimated by measuring the chlorophyll a concentration in the water. As an algal productivity indicator, it can be used to measure how nutrient-filled a lake is.

Technically, the chlorophyll test is the hardest to administer. The volunteer has to go to the Deep Basin (the 90' area just off Deer Point), take a Secchi Disk reading, and double it to determine the extent of the sample depth. He then collects a sample using a specially-prepared jar that takes in water slowly and steadily as it is drawn up. This means that once it reaches the surface, the jar contains water from a column that goes twice as deep as you can see with a Secchi disk that day.

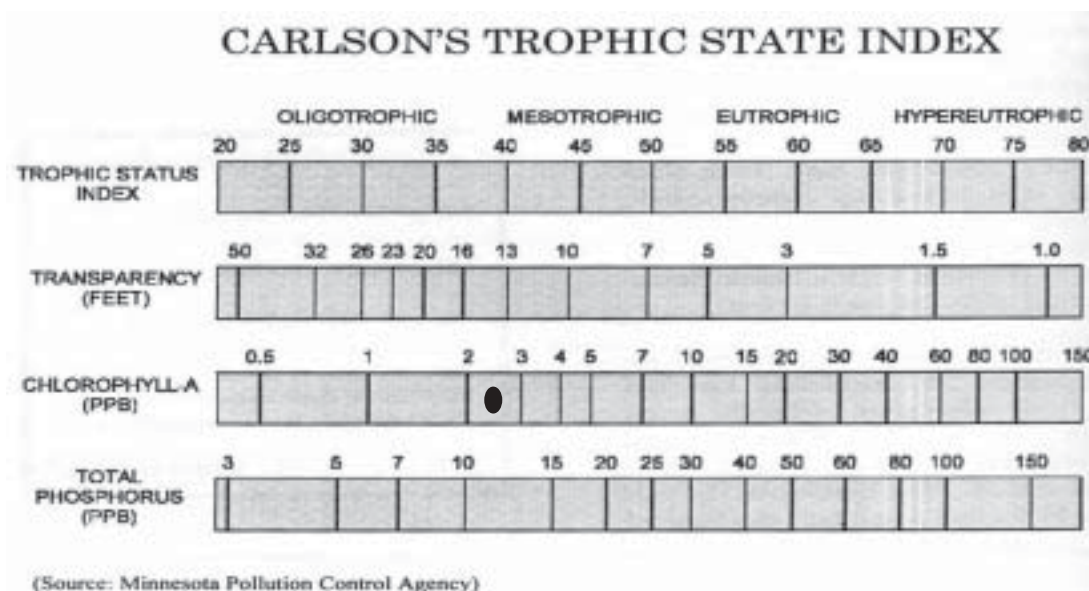
The sample is put into dark brown jars so that light doesn't affect it, stabilized with a few drops of magnesium chloride, and placed in a cooler. The volunteer immediately takes the sample back to his "lab," usually a basement sink where he filters 50cc of the water through a filter using a special tube. What comes off onto the filter is algae cells. This filter is then placed in another tube, labeled, and frozen.

Five chlorophyll samples per summer are taken, one each in the approximate middle of the months May through September. Three of the frozen samples are transported to the DEQ office on or about July 20. The last two are turned in with the final phosphorous test on or about Sept. 20. All samples go to a Lansing lab for analysis.

As with the phosphorous test, measurements are in parts per billion. Results of five tests per year:

Year	Average	Carlson Score
2003	3.5	41
2004	2.3	38
2005	3.0	43
2006	2.1	39
2007	1.8	36
<b>Average</b>	<b>2.5</b>	<b>39</b>

Bills Lake scores are good. An average score of 39 over five years puts us in the top of the mesotrophic category on the Carlson Scale.



# Comparison with area lakes

Approximately 200 lakes take part in the Co-operative Lake Monitoring Program (CLMP), an effort initiated by the Michigan Lake and Stream Associations, Inc in 1973. But many of them only do the Sechi Disk testing. Below are results of Newaygo County lakes which participated in the transparency/clarity test during summer, 2007.

Diamond	15.5
Pickerel	12.3
<b>Bills</b>	<b>10.4</b>
Fremont	10.2
Robinson	8.5
Kimball	7.9
Webinguaw	3.8
Hess	2.0