# REPORT ON THE PETENWELL/CASTLE ROCK FLOWAGES PROJECTS--2010

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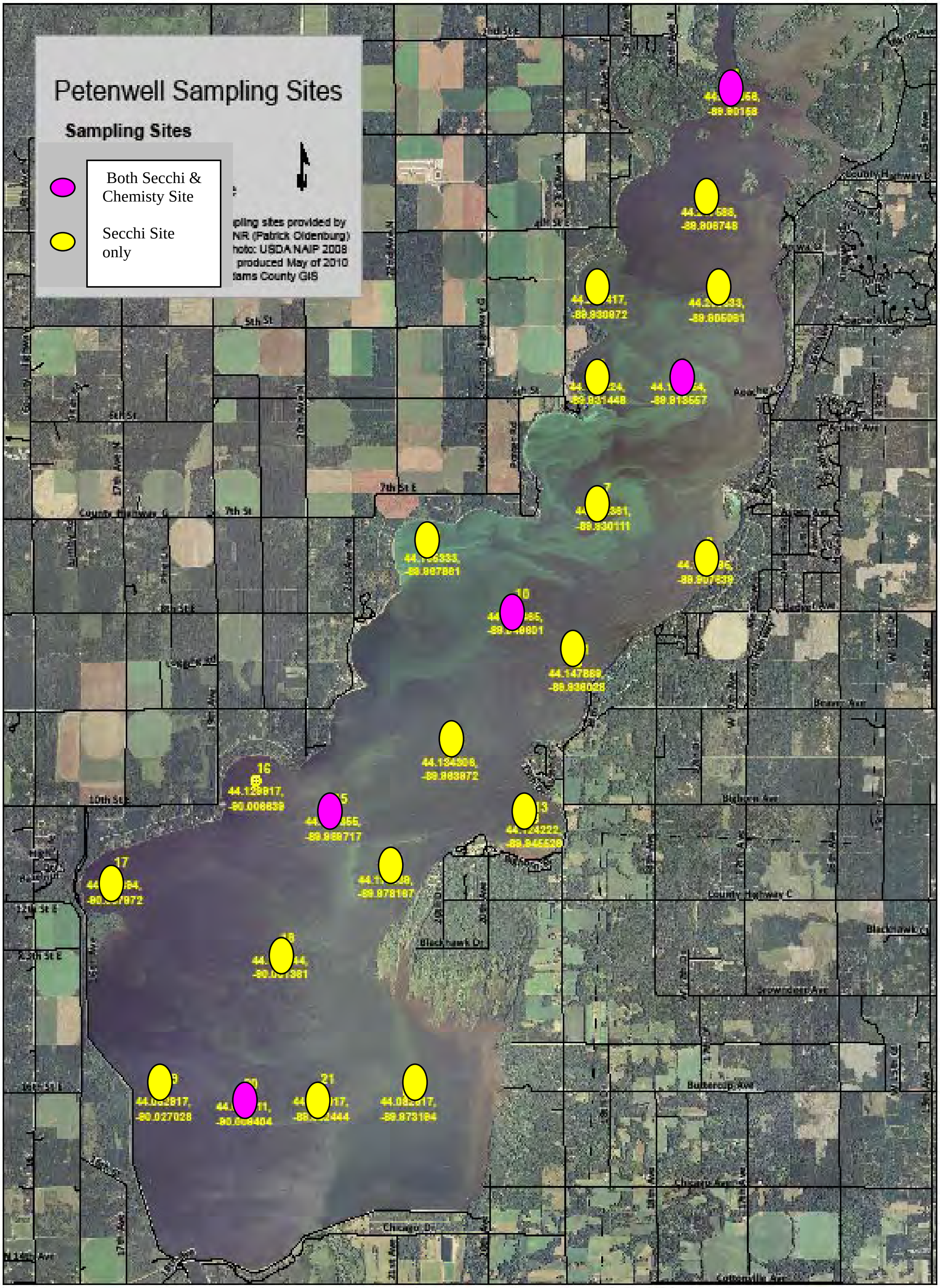
**PROJECT: WISCONSIN RIVER TOTAL MAXIMUM DAILY LOAD SAMPLING**

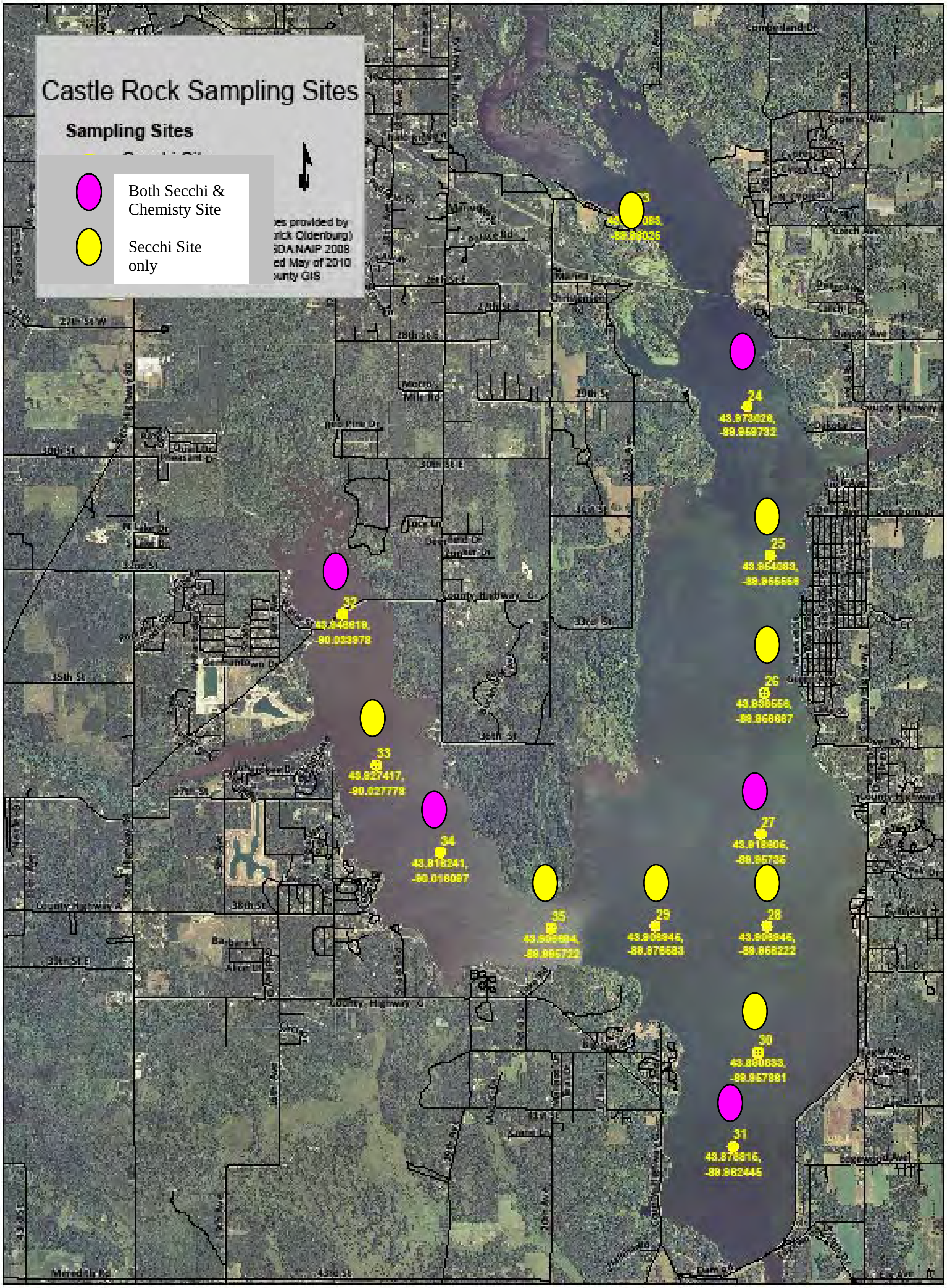
Starting this year, Secchi disk readings were taken on Petenwell and Castle Rock Lakes every 2 weeks at 22 sites on Petenwell Lake and 13 sites on Castle Rock Lake by volunteers. These readings were taken roughly every 2 weeks from late May through the end of September 2010. In addition, students from UW-Stevens Point College of Natural Resources took Secchi disk and water chemistry samples at 5 sites on Petenwell Lake and 5 sites on Castle Rock Lake, starting in April 2010 and continuing into the first part of September 2010.

The maps on pages 3 and 4 show the location of the 2010 sampling sites. Secchi sampling was done at all 35 sites (shown with both solid yellow are open yellow dotes). Sites with solid yellow dots were sites at which water chemistry samples were taken in addition to the Secchi sampling.

Both types of field sampling are expected to continue through 2013. Results from these samplings will be combined with other data, such as point source pollution, stream monitoring results, and other information. At that point, data will be gathered and used for analysis and in several modeling programs to come up with TMDL (Total Maximum Daily Load) figures for this river system.

This report will deal with the results of the 2010 testing year for the Secchi disk sampling, total phosphorus sampling, chlorophyll-a sampling, and the algae collection results. It is important to recognize that one year’s sampling results is of limited use in drawing any conclusions about the health of Petenwell and Castle Rock Lakes. Instead, these results are meant to provide general information on where we were in 2010 only. Only further data collection, combined with the 2010 results, will provide sufficient data for conclusions.


Petenwell Sampling Sites
Sampling Sites
Both Secchi & Chemisty Site
Secchi Site only
44.147889,
-89.938028
44.134308,
-89.983872
44.128917,
-90.008639
44.082917,
-90.027028
44.082917,
-89.873184



Castle Rock Sampling Sites
Sampling Sites
Both Secchi & Chemisty Site
Secchi Site only
24
25
26
27
28
29
30
31
32
33
34
35

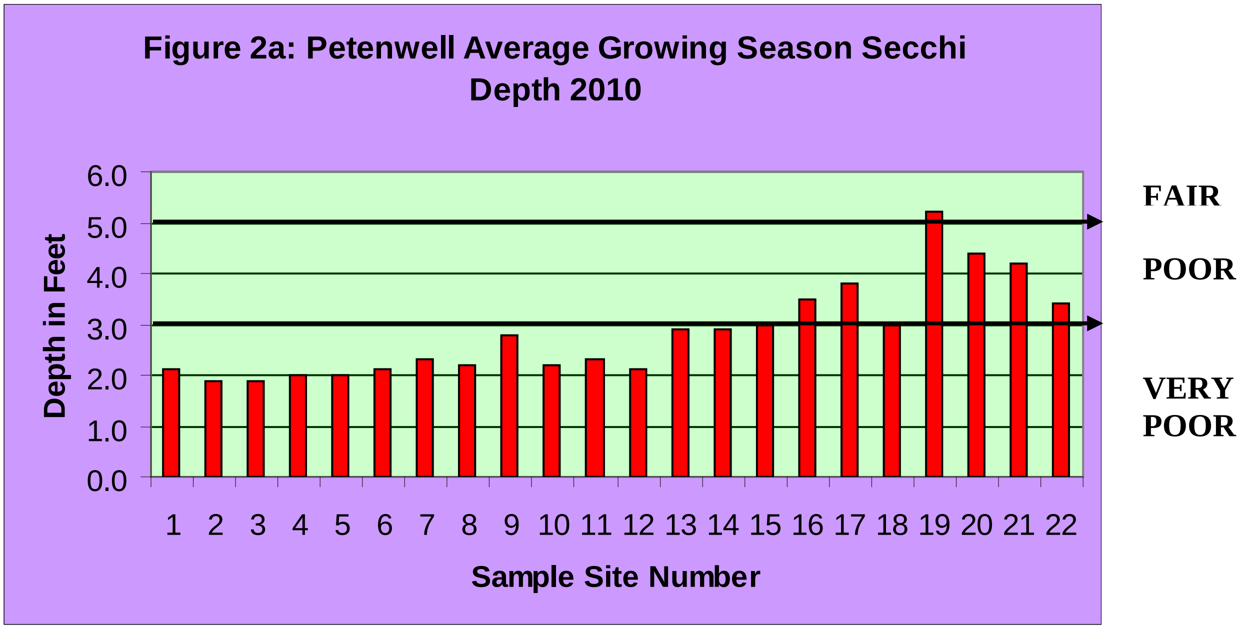
Figure 1 outlines general guidelines for three parameters that were tested in 2010: Secchi disk readings; Total Phosphorus levels in the surface water; and chlorophyll-a in the surface water.

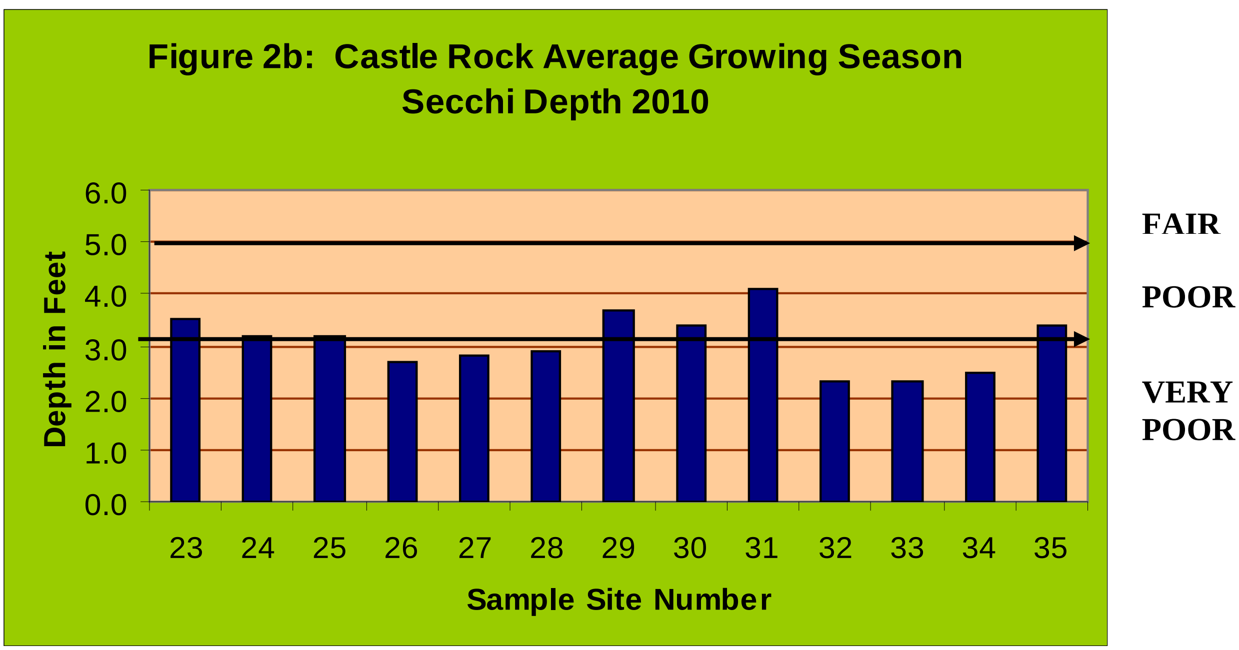
| FIGURE 1 | Value | Phosphorus ug/l | Chlorophyll ug/l | Secchi Disc ft. |
|---|---|---|---|---|
| Oligotrophic | Excellent | less than 1 | less than 1 | over 19 |
| | Very Good | 1 to 10 | 1 to 5 | 8 to 19 |
| Mesotrophic | Good | 10 to 30 | 5 to 10 | 6 to 8 |
| | Fair | 30 to 50 | 10 to 15 | 5 to 6 |
| Eutrophic | Poor | 50 to 150 | 15 to 30 | 3 to 4 |
| Hypereutrophic | Very Poor | over 150 | over 30 | less than 3 |

**Secchi Disk Readings**

The Secchi disk, an 8” diameter weighted disk painted with black and white triangles, is used to measure water clarity. The two main components of water clarity are water color (from materials dissolved in the water) and turbidity (from materials suspended in the water). Water clarity can be used as an indicator of a lake’s overall health. It is common for Secchi disk readings to vary throughout the summer, depending on factors such as water color, wind, rain, boat traffic, water and air temperatures, amount of sunlight, presence of aquatic animals, and other disturbances. Figures 2a and 2b show the average growing season Secchi disk readings for each of the thirty-five sample sites. In general, the “growing season” runs from May through September.

The average overall Secchi disk reading for Petenwell Lake during the 2010 growing season was 2.8 feet. Castle Rock Lake’s average was slightly higher at 3.1 feet. As the above figures show, these figures are in the “poor” or “very poor” range for water clarity.




Specifics of each site can be seen in the chart in Figures 3a & 3b. The lowest Secchi reading on Petenwell Lake was 0.5 feet on September 3, 2010, at site #10. The highest Secchi reading on Petenwell Lake was 7.8 feet on May 27, 2010, at site #9. The lowest Secchi reading on Castle Rock Lake was 1.2 feet on July 7, 2010, at sites #27 and #28. The highest Secchi reading on Castle Rock Lake was 10.0 feet on May 27, 2010, at site #29.

## Figure 3a: Summary Table of Secchi Readings on Petenwell Lake 2010

| PETENWELL | LAKE | | | | | | | | | | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Site No | wk of 5/24 | wk of 6/7 | wk of 6/21 | wk of 7/5 | wk of 7/19 | wk of 8/2 | wk of 8/16 | wk of 8/30 | wk of 9/13 | wk of 9/27 | Average |
| 1 | 2.5 | 3.5 | 2.5 | 2.0 | 1.5 | 2.0 | 2.5 | 2.0 | 1.9 | 1.0 | 2.1 |
| 2 | 2.3 | 2.5 | 2.5 | 2.0 | 1.5 | 1.5 | 2.0 | 1.8 | 2.0 | 1.0 | 1.9 |
| 3 | 2.5 | 2.5 | 2.5 | 2.0 | 1.8 | 1.5 | 2.0 | 1.5 | 2.0 | 1.0 | 1.9 |
| 4 | 3.5 | 2.5 | 2.5 | 2.0 | 1.5 | 1.8 | 2.0 | 1.5 | 2.0 | 1.0 | 2.0 |
| 5 | 3.5 | 2.5 | 2.5 | 2.0 | 1.5 | 1.5 | 2.0 | 1.8 | 2.0 | 1.0 | 2.0 |
| 6 | 4.0 | 2.5 | 3.0 | 2.5 | 1.5 | 1.0 | 1.0 | 1.8 | 1.8 | 1.5 | 2.1 |
| 7 | 6.5 | 2.5 | 2.5 | 2.5 | 1.5 | 1.0 | 1.5 | 2.0 | 1.8 | 1.5 | 2.3 |
| 8 | 5.7 | 2.0 | 1.5 | 1.5 | 1.5 | 2.0 | 1.5 | 2.5 | 1.5 | 2.0 | 2.2 |
| 9 | 7.8 | 2.3 | 3.5 | 2.0 | 2.5 | 1.5 | 1.5 | 2.5 | 2.0 | 2.5 | 2.8 |
| 10 | 4.5 | 3.0 | 4.5 | 1.8 | 2.0 | 0.5 | 1.5 | 0.5 | 2.0 | 1.8 | 2.2 |
| 11 | 4.9 | 2.3 | 1.5 | 3.3 | 2.0 | 2.0 | 1.3 | 2.0 | 2.0 | 1.5 | 2.3 |
| 12 | 4.5 | 2.0 | 3.8 | 5.0 | 2.0 | 1.8 | 1.5 | 1.0 | 1.5 | not done | 2.6 |
| 13 | 5.5 | 3.9 | 2.3 | 5.0 | 2.0 | 3.0 | 1.5 | 2.5 | 2.0 | 1.5 | 2.9 |
| 14 | 6.8 | 3.2 | 2.9 | 3.0 | 2.0 | 1.1 | 2.4 | 3.1 | 2.9 | 1.5 | 2.9 |
| 15 | 6.8 | 3.4 | 5.1 | 2.9 | 2.0 | 1.1 | 2.0 | 2.7 | 2.6 | 1.5 | 3.0 |
| 16 | 7.7 | 3.0 | 6.6 | 6.0 | 2.5 | 1.0 | 2.1 | 2.1 | 2.1 | 1.9 | 5.4 |
| 17 | 7.2 | 4.1 | 6.5 | 5.9 | 3.0 | 2.1 | 2.3 | 2.1 | 2.8 | 1.9 | 4.8 |
| 18 | 5.8 | 4.8 | 1.0 | 4.0 | 3.0 | 2.2 | 2.5 | 3.0 | 2.0 | 1.5 | 3.0 |
| 19 | 6.5 | 6.5 | 6.6 | 8.5 | 4.5 | 2.5 | 2.5 | 3.0 | 2.5 | 2.0 | 4.5 |
| 20 | 7.5 | 5.0 | 7.5 | 6.5 | 4.0 | 3.2 | 2.8 | 2.5 | 3.0 | 1.8 | 4.4 |
| 21 | 5.9 | 5.3 | 9.5 | 3.0 | 4.0 | 4.0 | 2.5 | 3.0 | 2.8 | 1.5 | 4.2 |
| 22 | 4.7 | 3.8 | 4.5 | 3.5 | 3.0 | 3.2 | 4.0 | 3.0 | 2.0 | 2.0 | 3.4 |
| **average** | 5.3 | 3.3 | 3.9 | 3.5 | 2.3 | 1.9 | 2.0 | 2.2 | 2.1 | 1.5 | 3.0 |

## Figure 3b: Summary Table of Secchi Readings on Castle Rock Lake 2010

| CASTLE | ROCK | LAKE | | | | | | | | | Site |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Site No | wk of 5/24 | wk of 6/7 | wk of 6/21 | wk of 7/5 | wk of 7/19 | wk of 8/2 | wk of 8/16 | wk of 8/30 | wk of 9/13 | wk of 9/27 | Average |
| 23 | 3.0 | 3.5 | 4.0 | 4.5 | 5.5 | 3.3 | 3.0 | 3.8 | 2.8 | 3.0 | 3.5 |
| 24 | 4.3 | 3.4 | 2.5 | 4.0 | 4.3 | 3.3 | 2.3 | 3.5 | 3.0 | 2.5 | 3.2 |
| 25 | 4.3 | 4.0 | 2.5 | 3.5 | 6.0 | 2.5 | 3.3 | 2.8 | 3.0 | 3.0 | 3.3 |
| 26 | 4.9 | 3.5 | 1.5 | 1.8 | 3.5 | 2.8 | 2.8 | 2.3 | 2.5 | 2.5 | 2.7 |
| 27 | 6.3 | 3.5 | 2.5 | 1.2 | 3.6 | 2.5 | 2.3 | 2.3 | 2.5 | 2.7 | 2.9 |
| 28 | 6.6 | 4.5 | 3.4 | 1.2 | 3.3 | 2.3 | 2.3 | 2.0 | 2.3 | 2.2 | 2.9 |
| 29 | 10.0 | 6.2 | 2.9 | 4.5 | 3.5 | 2.1 | 2.8 | 2.0 | 2.8 | 2.0 | 3.7 |
| 30 | 7.8 | 5.0 | 2.5 | 2.0 | 3.8 | 2.1 | 2.8 | 2.3 | 2.5 | 3.0 | 3.4 |
| 31 | 9.0 | 6.0 | 7.5 | 3.3 | 3.3 | 2.0 | 2.8 | 2.5 | 2.5 | 2.2 | 4.1 |
| 32 | 2.8 | 3.5 | 1.8 | 2.0 | 2.0 | 2.3 | 2.5 | 2.0 | 2.3 | 1.8 | 2.3 |
| 33 | 4.3 | 2.1 | 1.8 | 1.8 | 2.3 | 2.0 | 2.5 | 2.0 | 2.0 | 1.8 | 2.3 |
| 34 | 5.0 | 3.5 | 2.5 | 3.0 | 2.5 | 2.0 | 0.7 | 2.0 | 2.3 | 1.8 | 2.5 |
| 35 | 7.0 | 3.5 | 4.8 | 3.0 | 2.8 | 3.0 | 2.5 | 3.0 | 2.3 | 1.5 | 3.3 |
| **average** | 5.8 | 4.0 | 3.1 | 2.8 | 3.6 | 2.5 | 2.5 | 2.5 | 2.5 | 2.3 | 3.1 |

Besides the water clarity depth readings, each Secchi sampling involved accessing the color of the water, whether the water was murky or clear, presence of weather conditions, presence of algae and overall perception of the quality of the water. Color is affected by the chemicals and other items dissolved in the water. Color can affect light penetration, which in turn affects algae and aquatic plant production. These factors also impact on the murkiness of the water and perception of quality.

219 Secchi samples were taken by the volunteers on Petenwell Lake during the summer 2010 growing season. The water color was classified as “brown” 72% of the time, “yellow” 18% of the time, and “green” 10% of the time. The water was called “murky” 67% of the time and “clear” 33% of the time. These determinations were made visually using the white triangles of the Secchi disks, which were lowered 1 foot below the water’s surface.

Water quality perceptions were based on a 5-point scale:

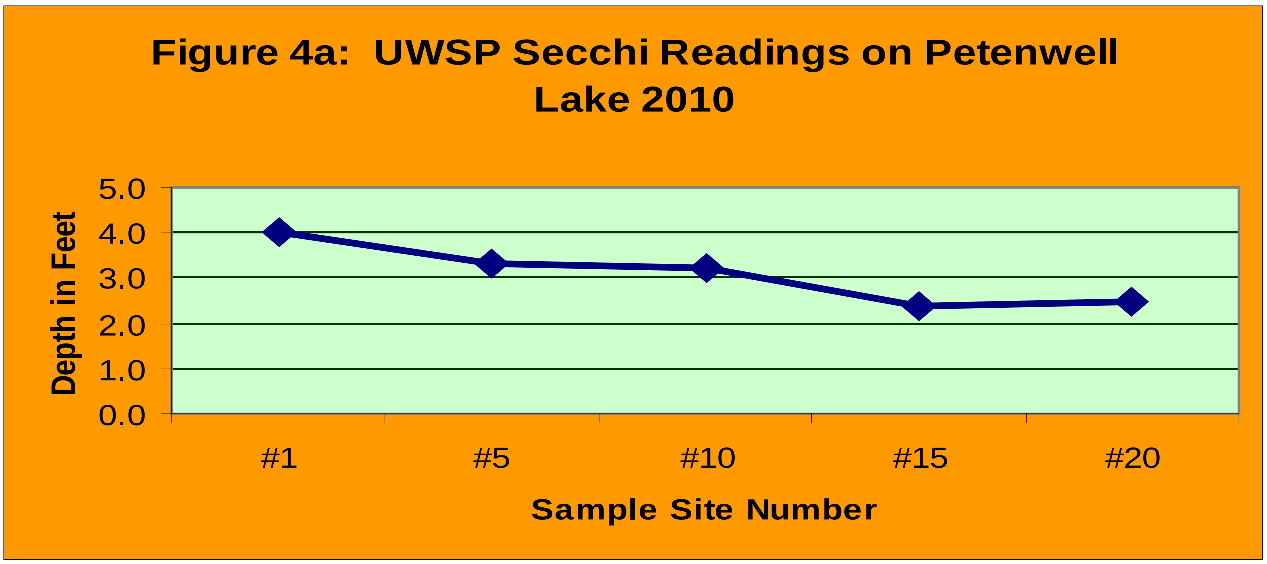
1 - Beautiful, could not be any nicer.
2 - Very minor aesthetic problems, excellent for swimming & boating.
3 - Swimming and aesthetic enjoyment of lake slightly impaired.
4 - Desire to swim and level of enjoyment of lake substantially reduced because of algae (would not swim, but boating is okay).
5 - Swimming and aesthetic enjoyment of the lake substantially reduced because of algal levels.

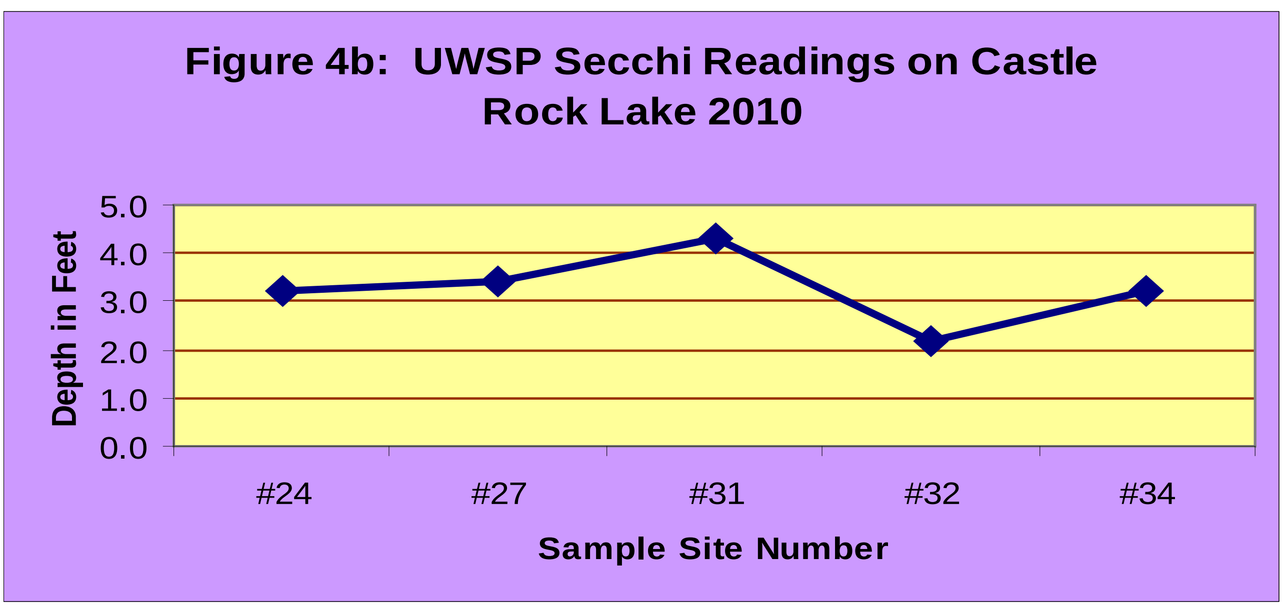
During the summer of 2010, volunteers gave a perception ranking each time they performed the Secchi sampling. The most common perception on Petenwell Lake was #3 at 55.7%. Second most common was #2 at 28.3%. Perceptions #4 and #5 garnered 16%.

Similar evaluations were performed by volunteers on Castle Rock Lake. Again, “brown” was the most common water color noted, with 69.2% of the samples so classified. “Yellow” was second with 21.0%, and “green” came third with 9.8%. 75.9% of the time, Castle Rock sampling were classified as “clear”, leaving 24.1% being called “murky.”

Perception rankings for Castle Rock Lake ranged from #1 to #4. #2 was the most common ranking on Castle Rock Lake, with a report of 45.1%. #3 was the second most common perception at 39.1%. #1 was reported 13.9% of the time. The least common perception reported on Castle Rock Lake in 2010 was #4, with 2.3%.

62 samples were taken by students and staff of UW-Stevens Point during 2010, starting in April and concluding in early September. The growing season samples were taken in alternate weeks to those of the volunteers, i.e., the volunteers took a sample, the next week UWSP took a sample, then the volunteers, and so on. These samples were taken at 5 points each on Petenwell & Castle Rock Lakes. Figures 4a and 4b show not only the results for these points from the UWSP sampling, but also the volunteer averages for these sites, and the overall average for that point.

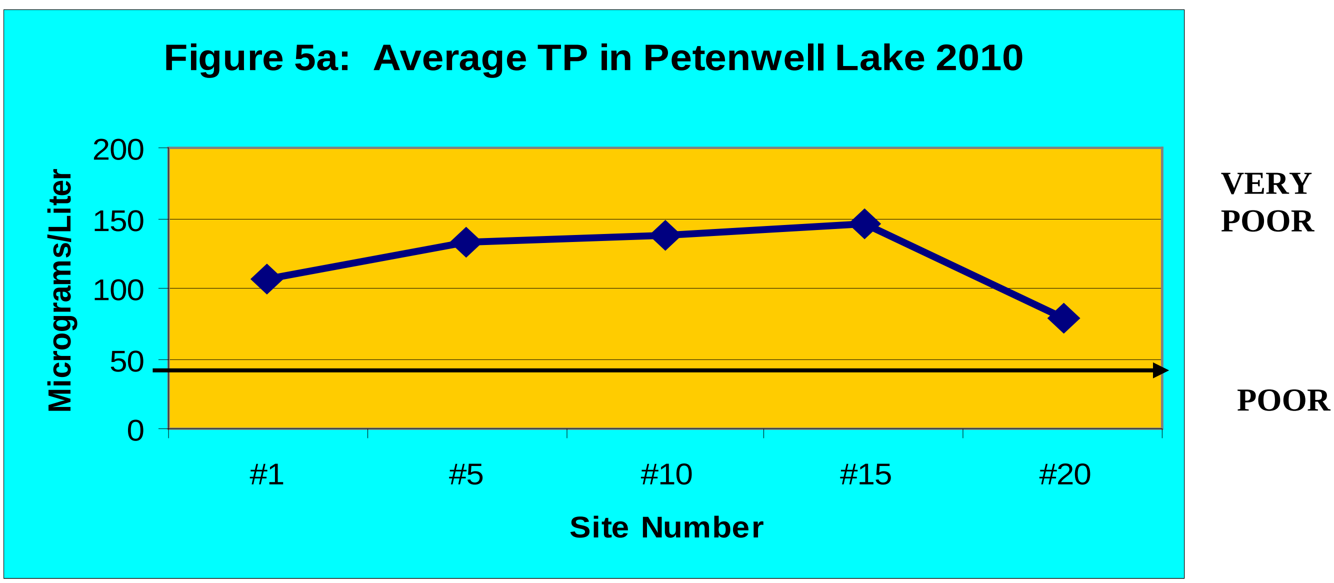


**Phosphorus Sampling by UWSP**

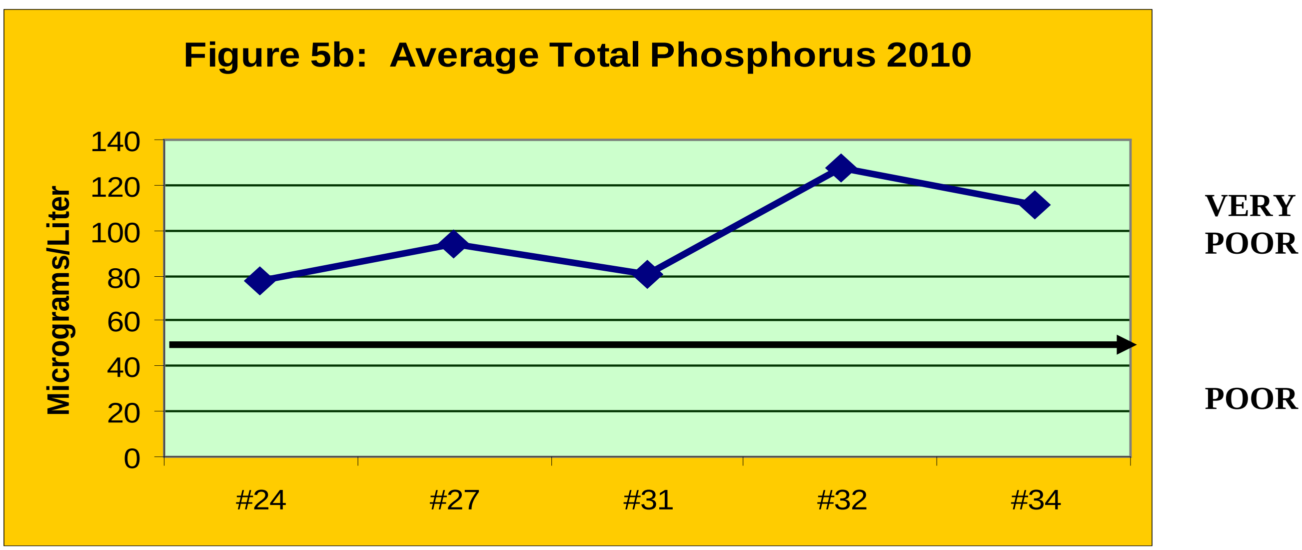
UWSP students and staff also took water samples that were submitted to a certified lab to test for total phosphorus. Phosphorus promotes excessive aquatic plant and/or algae growth. In most of Wisconsin, it is the key nutrient affect algal and nuisance plant growth. It can enter the water from a variety of sources, including human and animal wastes, soil erosion, detergents, septic systems, runoff from farms or lawns, and flooded wetland areas. Total phosphorus is considered a reasonable indicator of a lake's nutrient levels because its levels remain more stable than several other types of phosphorus.

All the 2010 levels in Petenwell Lake were in the "very poor" category for total phosphorus, with a range of averages for the 5 sites from 76.5 micrograms/liter (on the south end of Petenwell Lake) to 160.3 micrograms/liter (midway in the river between each shores and the entry from and exist to the Wisconsin River).




Generally, such high levels of total phosphorus might be associated with nuisance aquatic plant growth. However, this is not the case in Petenwell Lake. Aquatic vegetation is actually scarce in the lake—what little aquatic vegetation there is very spotty. A check of all 35 sites in June with a plant rake revealed aquatic vegetation at only one spot: one piece of *Myriophyllum sibiricum* (Northern watermilfoil). Checks in late August showed a few more spots with aquatic vegetation, mostly with plants fairly tolerant of disturbance. This is not surprising considering that the Secchi disk readings are poor or very poor, suggesting that light is not likely to reach aquatic plants at depths more than 4 or 5 feet. None of the 22 sites on Petenwell Lake have a depth that low. Perhaps shallower sites should be sampled, at least for aquatic vegetation.

In 2010, all the total phosphorus levels from samples taken in Castle Rock Lake were in the "very poor" category, with the lowest average being 78.1 micrograms/liter (at the north end of Castle Rock Lake) and the highest level being 127.7 micrograms/liter (at just south of where the Yellow River empties into Castle Rock Lake). Aquatic vegetation was sparse in Castle Rock Lake, just as it was in Petenwell Lake.




It is not uncommon for man-made lakes such as Petenwell and Castle Rock Lakes, to have higher total phosphorus levels than are usually found in natural lakes. According to Understanding Lake Data (Shaw et al, 2002), the average total phosphorus level for impoundments in Wisconsin is 65 micrograms/liter—all of the site total phosphorus averages in Petenwell and Castle Rock Lakes in 2010 were above that, often considerably above that figure.

**Figure 6a: Table of Total Phophorus Results in Petenwell Lake 2010**

| Site # | 5/3/2010 | 5/18/2010 | 6/1/2010 | 6/16/2010 | 6/30/2010 | 7/13/2010 | 8/3/2010 | 8/11/2010 | 8/24/2010 | 9/9/2010 | 9/22/2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| #1 | 80 | 92 | 72 | 99 | 96 | 122 | 142 | 161 | 119 | 113 | 108 |
| #5 | 84 | 72 | 108 | 91 | 112 | 111 | 150 | 133 | 143 | 116 | 98 |
| #10 | 103 | 84 | 92 | 102 | 98 | 245 | 177 | 129 | 150 | 243 | 100 |
| #15 | 50 | 74 | 65 | 113 | 80 | 88 | 110 | 125 | 127 | 827 | 104 |
| #20 | 42 | 63 | 42 | 50 | 46 | 33 | 127 | 87 | 103 | 118 | 130 |

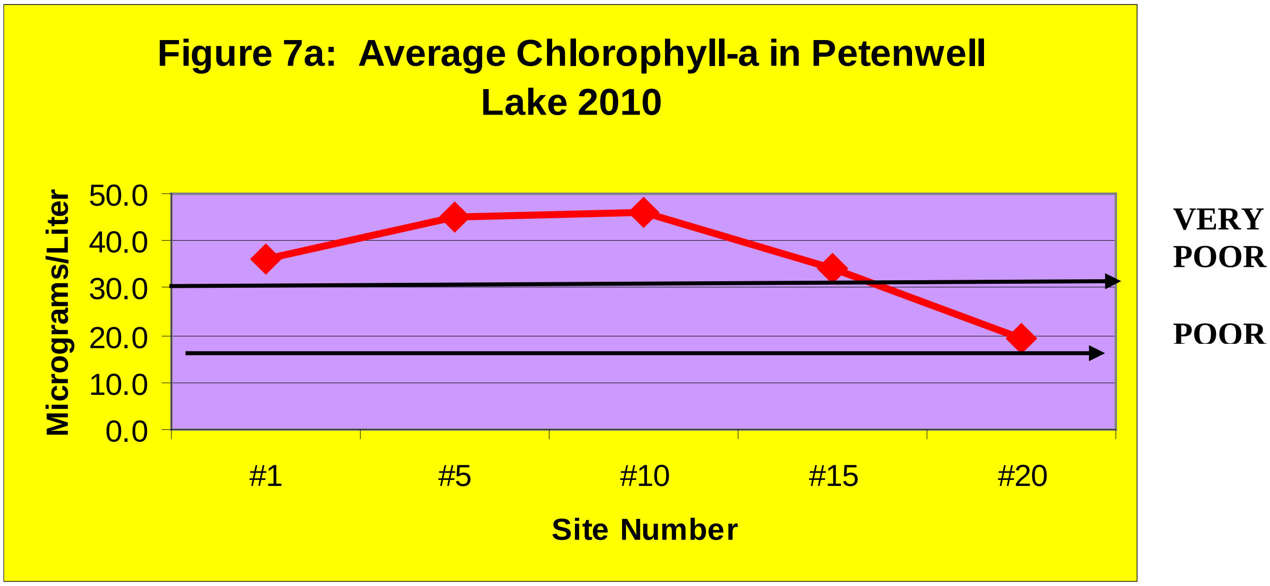
**Figure 6b: Table of Total Phosphorus Results in Castle Rock Lake 2010**

| Site # | 5/6/2010 | 5/19/2010 | 6/2/2010 | 6/17/2010 | 6/29/2010 | 7/12/2010 | 7/27/2010 | 8/10/2010 | 8/25/2010 | 9/8/2010 | 9/20/2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| #24 | 59 | 62 | 77 | 70 | 56 | 47 | 81 | 114 | 90 | 94 | 109 |
| #27 | 52 | 55 | 38 | 76 | 76 | 79 | 121 | 166 | 127 | 145 | 97 |
| #31 | 45 | 59 | 41 | 81 | 75 | 70 | 73 | 99 | 113 | 112 | 113 |
| #32 | 81 | 66 | 80 | 119 | 136 | 147 | 181 | 157 | 164 | 147 | 127 |
| #34 | 68 | 51 | 52 | 90 | 112 | 102 | 150 | 180 | 177 | 126 | not done |

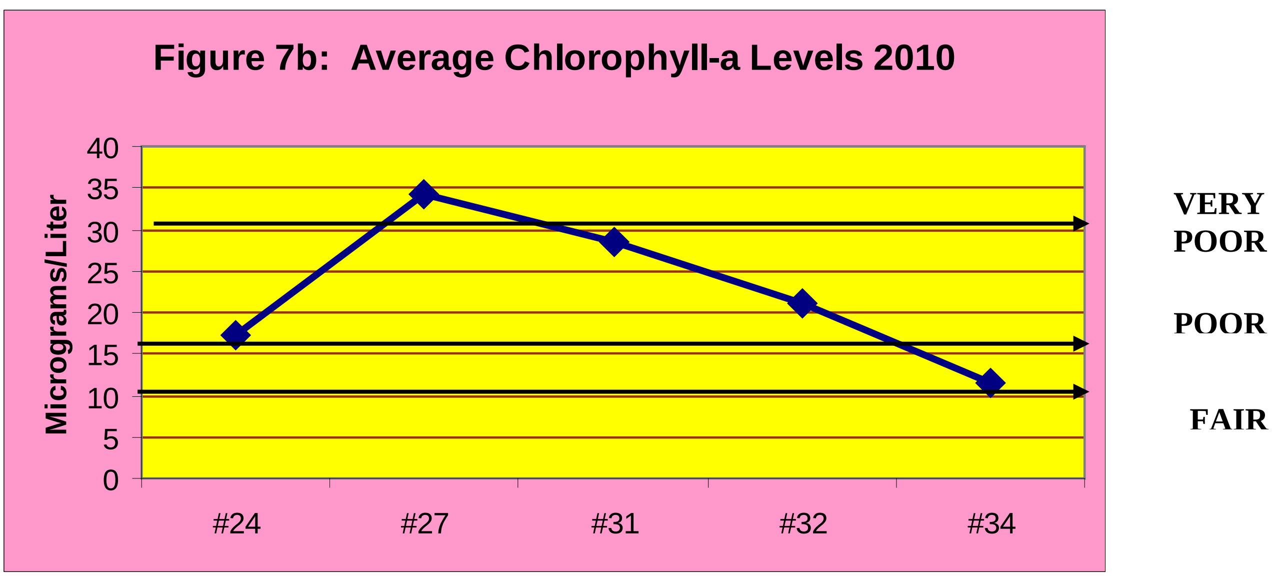
## Chlorophyll-a Testing Results

Samples taken by UWSP were also tested for chlorophyll-a. This is a green pigment found in all plant life, used for photosynthesis. Studies have shown that the amount of chlorophyll-a in lake water is a reliable indicator for the amount of algae in that water. These test results only show the level of algae present—they do not distinguish between types or concentration levels of particular species. Algae populations, and therefore chlorophyll a concentrations, vary greatly with lake depth. Algae must stay within the top portion of the lake where there is sunlight to be able to photosynthesize and stay alive.

UWSP test results on Petenwell Lake showed a range of average chlorophyll-a levels at the 5 sites between 17.7 micrograms/liter (at the south end of the lake) to 47.2 micrograms/liter (middle of the lake). The 19.1 micrograms/liter is in the "poor" category for chlorophyll-a levels, while the high of 45.9 micrograms/liter is in the "very poor" category. Overall, Site #20 was in the "poor" category; the other five sites on Petenwell Lake were in the "very poor" category.




Chlorophyll-a levels in Castle Rock Lake ranged from 11.4 micrograms/liter (near the "V" in Castle Rock Lake) to 34.3 micrograms/liter (in the middle of the lake). Site #34 was in the "fair" category for chlorophyll-a levels; sites #24 and #32 were in the "poor" category; sites #27 and #31 were in the "very poor" category.




Generally, levels below 30 micrograms/liter are recommended to avoid frequent algal blooms in impoundments. Both Petenwell and Castle Rock are plagued by frequent algal blooms, but as the numbers suggest, these may be localized. Observations noted by volunteers during the summer of

2010 showed that a site might have significant suspended algae visible one time, but be very clear the next time…i.e., the blooms seemed to move around. However, visual inspection of the lake shores and bays show that many of the shores and bays have on-going blooms nearly all summer. Again, perhaps some chlorophyll-a testing in some of these areas would be an appropriate action.

Figures 8a & 8b shows a chart of chlorophyll-a testing during the growing season (May-September) of 2010 according to sample site number and date of sampling.

**Figure 8a: Chlorophyll-a Testing Results on Petenwell Lake 2010**

| Site # | 5/3/2010 | 5/18/2010 | 6/1/2010 | 6/16/2010 | 6/30/2010 | 7/13/2010 | 8/3/2010 | 8/11/2010 | 8/24/2010 | 9/9/2010 | 9/22/2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| #1 | 50.4 | 27.3 | 28.5 | 33.2 | 42.6 | 47 | 43 | 26 | 20 | 20 | 17 |
| #5 | 10 | 23.5 | 11.7 | 30.9 | 61.3 | 61 | 63 | 35 | 46 | 30 | 18 |
| #10 | 17.6 | 3 | 11.8 | 17 | 22.2 | 206 | 97.5 | 26.5 | 35.5 | 54.5 | 27.5 |
| #15 | 10.4 | 0.7 | 2.4 | 17.4 | 18.4 | 63.9 | 21.5 | 35.5 | 18.5 | 157 | 23.5 |
| #20 | 1.1 | 1 | 4.1 | 11.9 | 16.9 | 28 | 49.5 | 19.5 | 6 | 38.5 | 18 |

**Figure 8b: Chlorophyll-a Testing Results on Castle Rock Lake 2010**

| Site # | 5/6/2010 | 5/19/2010 | 6/2/2010 | 6/17/2010 | 6/29/2010 | 7/12/2010 | 7/27/2010 | 8/10/2010 | 8/25/2010 | 9/8/2010 | 9/20/2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| #24 | 7.3 | 11 | 6 | not done | 12 | 32.2 | 29.4 | 20 | 9 | 9 | 37 |
| #27 | 1.8 | 10.3 | 5.9 | not done | 39.4 | 53 | 53 | 87.7 | 54 | 26.5 | 11 |
| #31 | 1.3 | 8.3 | 2.7 | not done | 66.1 | 62 | 21 | 32 | 31.5 | 30.4 | not done |
| #32 | 21.2 | 19.9 | 30 | not done | 37.8 | 17 | 3 | 41 | 12.9 | 11 | 18 |
| #34 | 5 | 2.2 | 17.1 | not done | 11.4 | 11 | 12.5 | 5.5 | 23 | 15 | not done |

**PROJECT: BLUE-GREEN ALGAE TESTING & IDENTIFICATION**

Blue-green algae, also known as Cyanobacteria, are a group of photosynthetic bacteria that many people refer to as "pond scum." Blue-green algae can be blue, green, reddish-purple, or brown. In Wisconsin, blue-green algae blooms generally occur between mid-June and late September. Concerns associated with blue-green algae include discolored water, reduced light penetration, taste and odor problems, dissolved oxygen depletions during die-off, and toxin production. When blue-green algae reach bloom densities, they can actually reduce light penetration, which can adversely affect other aquatic organisms both directly (e.g., other phytoplankton and aquatic plants) and indirectly (e.g., zooplankton and fish that depend on phytoplankton and plants). Blue-green algae blooms can be quite smelly. When a blue-green algae bloom dies off, the blue-green algae cells sink and are broken down by microbes. This breakdown process requires oxygen and can create a biological oxygen demand. Increases in biological oxygen demand result in decreases in oxygen concentration in the water, and this can adversely affect fish and other aquatic life, and can even result in fish kills.

Blue-green algal toxins are naturally produced chemical compounds that sometimes are produced inside the cells of certain species of blue-green algae. These chemicals are not produced all of the time and there is no easy way to tell when blue-green algae are producing them and when they are not. When the cells are broken open, the toxins may be released. Sometimes this occurs when the cells die off naturally and they break open as they sink and decay in a lake or pond. Cells may also be broken open when the water is treated with chemicals meant to kill algae, and when cells are swallowed and mixed with digestive acids in the stomachs of people or animals.

Blue-green algae may call illness in people and animals, since many are capable of producing various toxins. People/animals can be exposed to the toxins through skin contact, inhalation, or by swallowing contaminated water. Toxic effects include allergy-type reactions like rashes, eye/nose/throat irritation, asthma, headaches, fever, nausea, stomach cramping, vomiting and diarrhea. These symptoms may develop after only a short contact with the toxin. Other blue-green algae toxins can affect various body organs and the nervous system, causing tissue damage, muscle weakness, paralysis, respiratory failure, cardiac arrest, tumors and cancer. These usually require a long-term exposure. In rare instances, death of a human or animal can result from exposure to these toxins.

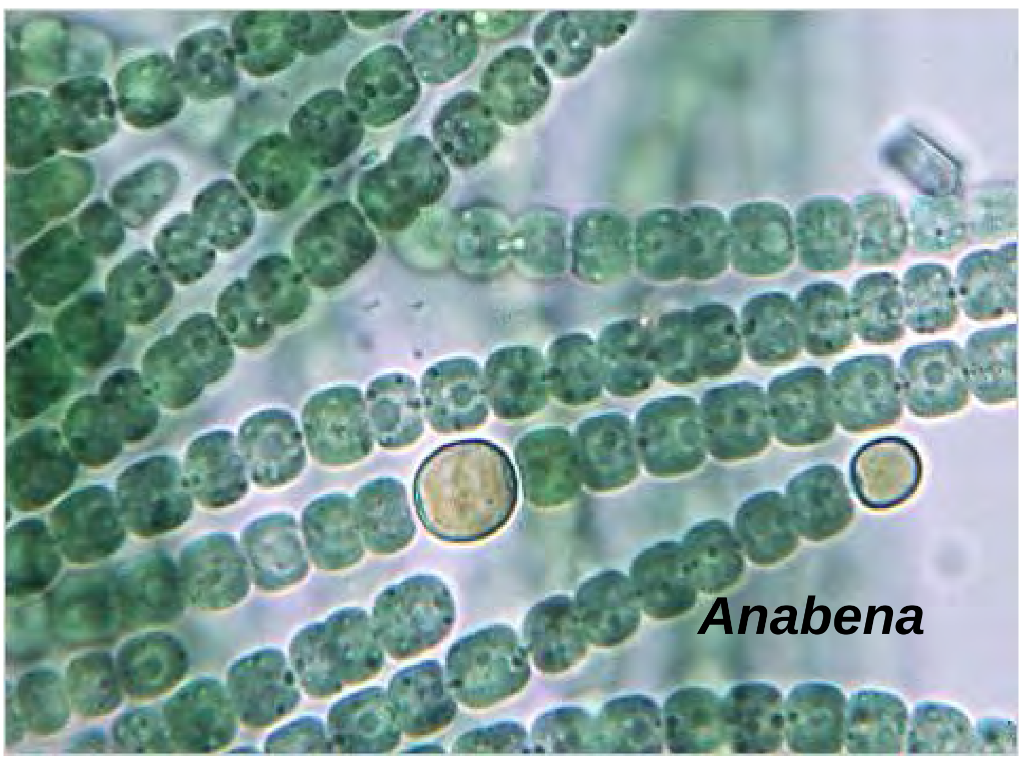
As part of a pilot project with the National Oceanic and Atmospheric Association and the Center for Disease Control, volunteers on Castle Rock and Petenwell lakes were trained to take samples and identify six types of algae. Microscopes with the capacity to take digital photos and interface with the internet were loaned by the federal agencies. This first year has served as a basic training year, familiarizing volunteers with sampling protocol, presence/absence and identification. Presence or absence was verified, without quantifying amounts. It is anticipated that more sites will be added in the next two years and that volunteers will also begin to categorize the size of blue-green algae blooms (i.e., present, common, abundant, etc.).

The data collected will help provide detailed information for an analysis of potentially harmful algal blooms on Petenwell and Castle Rock Lakes to try to pinpoint areas of potential harm to users of these two lakes. Sites to be added in the next two years for algae testing will likely cover commonly-used beach and marina areas to determine potential danger at these heavily-used sites. The information will also be used to develop a management plan to reduce the bloom intensity and frequency.

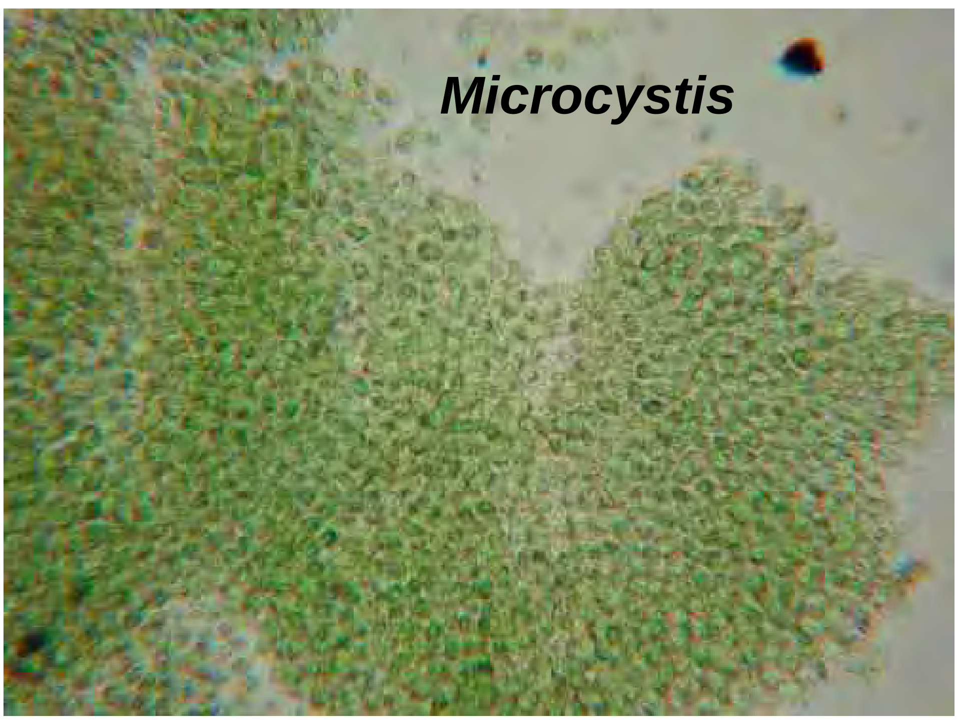
The six algae types being sought were: *Aphanizomenon; Anabena; Cylindrospermosis; Microcystis; Oscillatoria;* and *Eulgena.* These blue-green algae were chosen by the CDC and NOAA because they are the most common blue-green algae associated with human and animal toxicity.

64 samples were taken on the lakes between June and September 2010. 10 sites on Petenwell Lake were chosen and 5 on Castle Rock Lake. No *Eugena* was found in any of the samples reviewed. The most commonly-found blue-green algae were *Microcystis*, which was found in 46.9% of the samples. Next most common were *Oscillatoria*, found in 32.8% of the samples. *Anabena* were reported in 12.5 % of the samples, with *Aphanizomenon* found in 25.0% of the samples. *Cylindrospermosis*, which is a blue-green algae not native to Wisconsin, was found in 6.25% of the samples. In most of the samples, the algae were merely present, but not found in common or abundant numbers. One sample had common *Microcystis* and one had more than just present of *Oscillatoria.*


Aphanizomenon


Anabena


10 microns
Cylindrospermosis

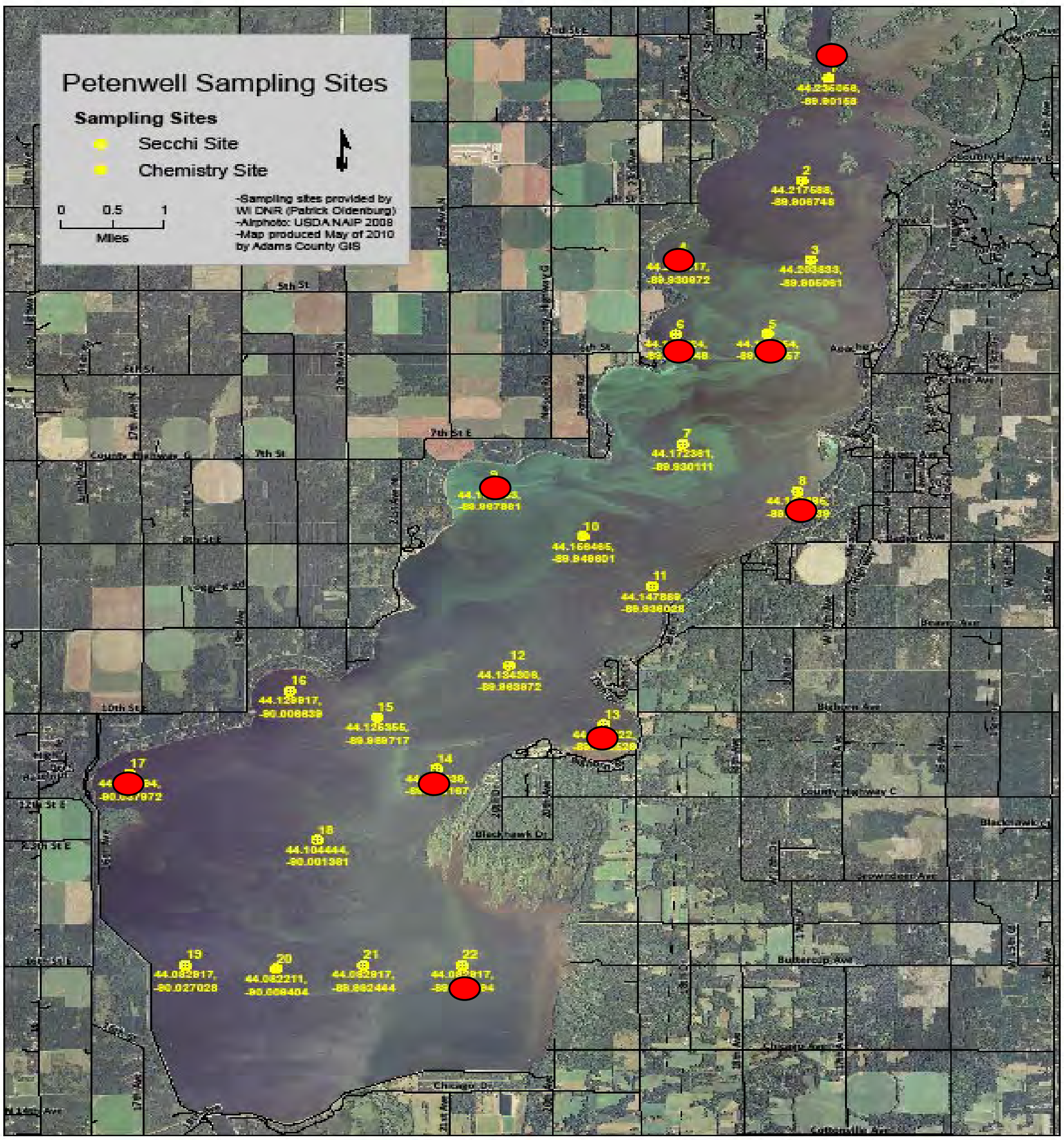

Microcystis


Oscillatoria
Oscillatoria
© A.J. Silverside


Eulgena

On Petenwell Lake, of the 58 samples taken, no samples had no blue-green algae reported. Sites #1, #13 and #17 had only two collection samples with blue-green algae found. At the other end of the scale, Site #22, found at the bottom of Petenwell Lake, just before it enters the Wisconsin River, had 8 samples taken and all 8 samples had *Microcystis;* 6 samples had *Oscillatoria; Aphanizomenon* was found 2 times; and *Anabena* was found once. Site #14 was similar, with *Aphanizomenon* found in all 7 samples and *Microcystis* found in 4 samples. The other sites on Petenwell Lake had blue-green algae found in 3 or 4 samples.

**Figure 9: Petenwell Algae Sampling Sites 2010 in red**



Specific dates and sites where blue-green algae were present on Petenwell Lake are shown in the chart in Figure 10. All samples taken on other dates showed no blue-green algae present.

**Figure 10: Chart of Presence/Absence Blue Green Algae—Petenwell 2010**

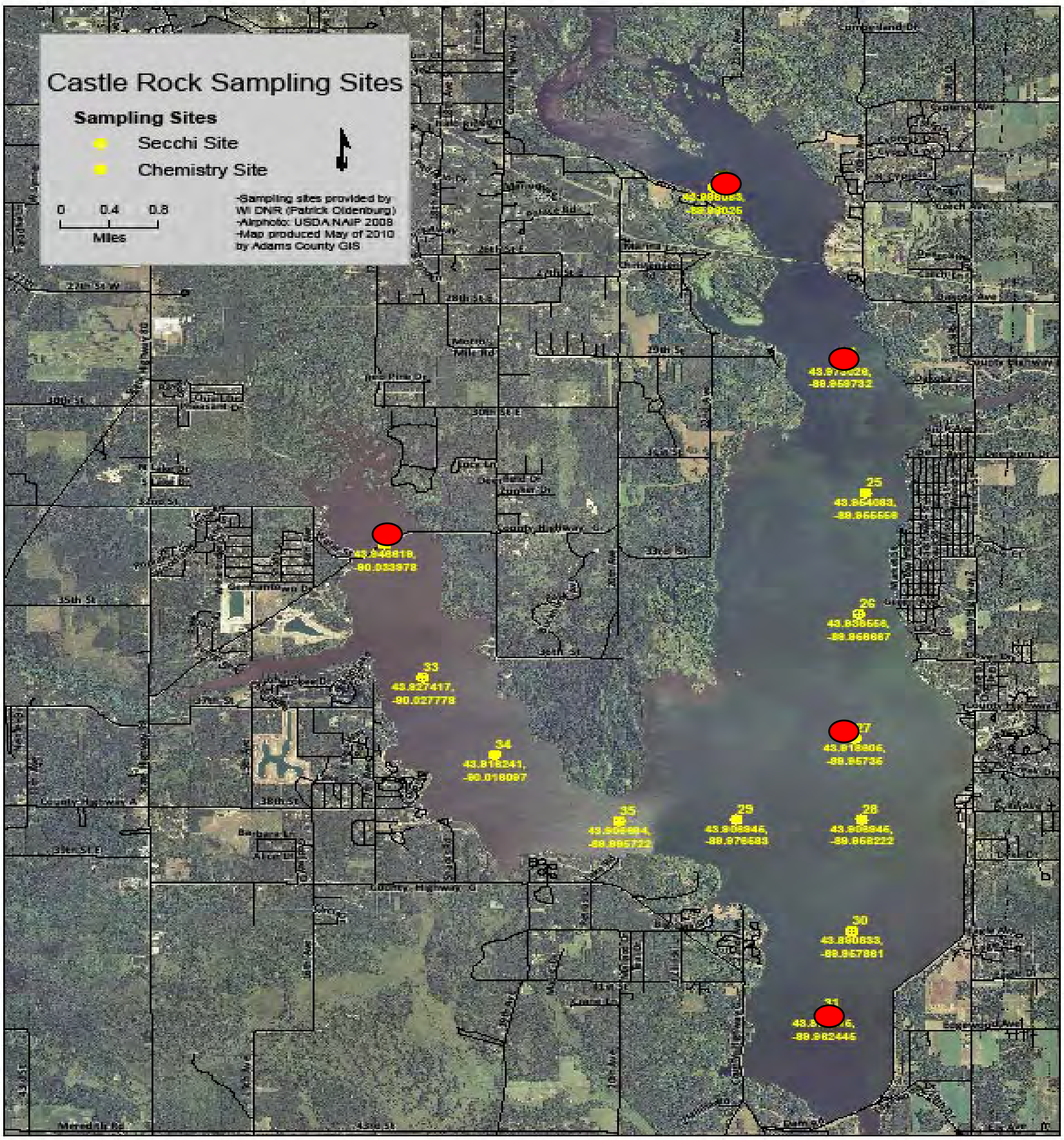
| Site # | Date | *Aphanizomenon* | *Anabena* | *Cylindrospermopsis* | *Microcystis* | *Oscillatoria* |
|---|---|---|---|---|---|---|
| 1 | 7/8/2010 | x | | | x | x |
| | 7/23/2010 | | | | x | x |
| | 9/28/2010 | | | | x | |
| 4 | 7/8/2010 | x | x | | x | x |
| | 7/23/2010 | | | | x | |
| | 9/2/2010 | x | | | | x |
| | 9/29/2010 | | | x | x | |
| 5 | 7/8/2010 | | x | | | x |
| | 7/23/2010 | | | | | x |
| | 9/29/2010 | | x | | x | x |
| 6 | 7/8/2010 | x | x | | x | x |
| | 7/23/2010 | | | | x | x |
| | 9/29/2010 | | | | x | x |
| 8 | 7/8/2010 | | | | | x |
| | 7/23/2010 | | x | | x | x |
| | 9/2/2010 | | | | | x |
| | 9/29/2010 | | | | | x |
| 9 | 6/23/2010 | | x | | | |
| | 8/4/2010 | | | | x | |
| | 9/2/2010 | | | | x | |
| 13 | 6/23/2010 | | | x | | |
| | 9/2/2010 | | | | x | |
| 14 | 6/24/2010 | x | | | | |
| | 7/10/2010 | x | | | | |
| | 7/23/2010 | x | | | x | |
| | 8/18/2010 | x | | | | |
| | 8/31/2010 | x | | | x | |
| | 9/15/2010 | x | | | x | |
| | 9/23/2010 | x | | | x | |
| 17 | 9/15/2010 | x | | | x | |
| | 9/23/2010 | x | | | x | |
| 22 | 6/22/2010 | | | | | x |
| | 7/8/2010 | | | | | x |
| | 7/22/2010 | | x | | x | x |
| | 8/4/2010 | x | | | x | x |
| | 8/17/2010 | x | | | x | x |
| | 9/1/2010 | | | | x | |
| | 9/14/2010 | | | | x | x |
| | 10/1/2010 | | | | x | |

**Figure 11a: Volunteers Examining Algae Samples**

**Figure 11b: LCD Screen on Computer Showing Algae**

On Castle Rock Lake, of the 11 samples taken, one site had no samples with blue-green algae present: #27.  Two sites, #23 and #24, had 2 samples showing blue-green algae present (*Microsystis* and *Cylindrospermosis* respectively).  The other two sites on Castle Rock Lake, #32 and #34, had multiple reports of the presence of blue-green algae:  *Aphanizomeno; Anabena, Cylindrospermosis* and *Oscillatoria* each one report; and *Microcystis* 3 times.

**Figure 12:  Algae Sampling Sites on Castle Rock Lake 2010 in red**



Algae sampling sites and dates for Castle Rock Lake and the presence/absence of blue-green algae are shown on the chart in Figure 13.

**Figure 13: Blue-Green Algae Presence/Absence Castle Rock 2010**

| Site # | Date | *Aphanizomenon* | *Anabena* | *Cylindrospermopsis* | *Microcystis* | *Oscillatoria* |
|---|---|---|---|---|---|---|
| 23 | 9/22/2010 | | | | x | |
| 24 | 9/29/2010 | | | x | | |
| | | | | | | |
| 27 | 9/22/2010 | | | | | |
| | 9/29/2010 | | | | | |
| 32 | 9/2/2010 | | | x | x | |
| | 9/14/2010 | | | | x | |
| | 9/29/2010 | | | | | |
| 34 | 9/2/2010 | | | | | |
| | 9/14/2010 | x | x | | x | x |
| | 9/29/2010 | | | | | |

There was also a "blue-green paint-like" substance reported as covering part of the boat basin at Castle Rock Lake Park on the Adams County side. Samples taken of that bloom revealed a significant *Microcystis* bloom. Park personnel then blocked off that part of the boat basin to avoid entry by humans and pets. In August, a sample was taken at the boat basin on the Adams County side of Petenwell Lake located at The Lure restaurant. This, too, showed a significant bloom of *Microcystis.*

**Figure 14: Photo of *Microcystis* bloom on at Castle Rock County Park (Adams) 2010**

## CONCLUSION FOR WISCONSIN RIVER PROJECTS 2010

This is only the first year of this project, so no conclusions can actually be drawn as to what this information reflects about Petenwell and Castle Rock Lakes. However, these results do provide a one-year snapshot as to what was going on in 2010. The continuation of this project will produce more results, providing a more accurate picture of the conditions of these two lakes.

Results from these samplings and future sampling will be combined with other data, such as point source pollution, stream monitoring results, and other information. At that point, data will be gathered and used for analysis and in several modeling programs to come up with TMDL (Total Daily Maximum Load) figures for this river system. The algae data collected will help provide detailed information for an analysis of potentially harmful algal blooms on Petenwell and Castle Rock Lakes. It will also be used locally to try to help pinpoint areas of potential harm to users of these two lakes and to try to predict when and where harmful blooms might occur, so that preventive action can be taken. The information will also be used to develop a management plan to reduce the bloom intensity and frequency.

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