

OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **Dorrs Pond, Manchester**, the program coordinators have made the following observations and recommendations.

Thank you for your continued hard work sampling the pond this year! Your monitoring group sampled the deep spot **three** times this year and has done so for many years! As you know, conducting multiple sampling events each year enables DES to more accurately detect water quality changes. Keep up the good work!

The New Hampshire Department of Environmental Services (DES), in conjunction with the U.S. Environmental Protection Agency (EPA) and the environmental consulting firm ENSR, conducted a Total Maximum Daily Load (TMDL) for total phosphorus for your pond. The TMDL refers to the pollutant reductions a waterbody needs to meet New Hampshire's water quality standards. Dorrs Pond was listed on the 2008 impaired waters [303(d)] list because elevated algal growth impaired the primary contact recreation (swimming) use. Phosphorus is the nutrient responsible for algal growth and is the pollutant to be reduced to control algal growth. DES is required by the Federal Clean Water Act (CWA), Section 303(d), to report every two years to the EPA on all waters not meeting state water quality standards.

The TMDL conducted at your pond identified an in-lake target phosphorus value that, when met, should result in no additional primary contact recreation impairments due to algal growth. A phosphorus budget was constructed, phosphorus sources identified and phosphorus reductions allocated to each of the sources to meet the target value. An implementation plan provides recommendations on watershed remediation activities to reduce phosphorus inputs to the pond.

The draft TMDL will be provided to your pond association, town, and watershed stakeholders for review and will also be available on the DES website at www.des.nh.gov/organization/divisions/water/wmb/tmdl/index.htm. There will be a period for public review and comment, anticipated for Summer 2009, where DES and/or ENSR will present it's findings to interested stakeholders. We anticipate a TMDL informational session in

conjunction with the annual VLAP Workshop scheduled for May 16, 2009. We encourage your pond association and/or residents to attend the workshop to learn more about TMDLs in general and the TMDL for your pond. Phosphorus load reductions can only occur with the knowledge, participation and action of watershed residents, businesses and stakeholders. If you are interested in participating in an informational session at the VLAP Workshop please contact the VLAP Coordinator at sara.steiner@des.nh.gov or 603-271-2658. If you are interested in learning more about the TMDL Program, or attending additional informational sessions, please contact Peg Foss, TMDL Coordinator, at Margaret.foss@des.nh.gov or 603-271-5448.

FIGURE INTERPRETATION

CHLOROPHYLL-A

- **Figure 1 and Table 1:** Figure 1 in Appendix A shows the historical and current year chlorophyll-a concentration in the water column. Table 1 in Appendix B lists the maximum, minimum, and mean concentration for each sampling year that the pond has been monitored through VLAP.

Chlorophyll-a, a pigment found in plants, is an indicator of the algal abundance. Algae (also known as phytoplankton) are typically microscopic, chlorophyll producing plants that naturally occur in lake ecosystems. The chlorophyll-a concentration measured in the water gives biologists an estimation of the algal concentration or lake productivity. **The median summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 4.58 mg/m³.**

The current year data (the top graph) show that the chlorophyll-a concentration **decreased** from **June** to **July**, and then **increased** from **July** to **August**.

The historical data (the bottom graph) show that the **2008** chlorophyll-a mean is ***much greater than*** the state and similar lake medians. For more information on the similar lake median, refer to Appendix F.

Overall, visual inspection of the historical data trend line (the bottom graph) shows a ***variable*** in-lake chlorophyll-a trend since monitoring began. Specifically the mean chlorophyll concentration has ***fluctuated between approximately 3.86 and 33.18 mg/m³*** since **1996**.

Please keep in mind that this trend is based on limited data. As your group expands its sampling program to include additional events each year, we will be able to determine trends with more accuracy and confidence.

After 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

While algae are naturally present in all ponds, an excessive or increasing amount of any type is not welcomed. In freshwater ponds, phosphorus is the nutrient that algae typically depend upon for growth in New Hampshire lakes. Algal concentrations may increase as nonpoint sources of phosphorus from the watershed increase, or as in-lake phosphorus sources increase. Therefore, it is extremely important for volunteer monitors to continually educate all watershed residents about management practices that can be implemented to minimize phosphorus loading to surface waters.

TRANSPARENCY

- **Figure 2 and Tables 3a and 3b:** Figure 2 in Appendix A shows the historical and current year data for transparency with and without the use of a viewscope. Table 3a in Appendix B lists the maximum, minimum and mean transparency data without the use of a viewscope and Table 3b lists the maximum, minimum and mean transparency data with the use of a viewscope for each year that the pond has been monitored through VLAP.

Volunteer monitors use the Secchi disk, a 20 cm disk with alternating black and white quadrants, to measure how far a person can see into the water. Transparency, a measure of water clarity, can be affected by the amount of algae and sediment in the water, as well as the natural color of the water. **The median summer transparency for New Hampshire's lakes and ponds is 3.2 meters.**

The current year data (the top graph) show that the non-viewscope in-lake transparency **remained stable** from **June** to **July**, and then **increased** from **July** to **August**.

The historical data (the bottom graph) show that the **2008** mean non-viewscope transparency is **less than** the state and similar lake medians. Please refer to Appendix F for more information about the similar lake median.

The current year data (the top graph) show that the viewscope in-lake transparency **increased** from **June** to **August**. The transparency measured with the viewscope was generally **greater than** the transparency measured without the viewscope this summer. As discussed previously, a comparison of the transparency readings taken with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. We recommend that your group measure Secchi disk transparency with and without the viewscope on each sampling event.

It is important to note that viewscope transparency data are not compared to a New Hampshire median or similar lake median. This is because lake transparency with the use of a viewscope has not been historically measured by DES. At some point in the future, the New Hampshire and similar lake medians for viewscope transparency will be calculated and added to the appropriate graphs.

Overall, visual inspection of the historical data trend line (the bottom graph) shows an **increasing** trend for in-lake non-viewscope transparency, meaning that the transparency has **improved** since monitoring began in **2000**.

Please keep in mind that this trend is based on limited data. As your group expands its sampling program to include additional events each year, we will be able to determine trends with more accuracy and confidence.

Again, please keep in mind that this trend is based on only **nine** years of data. As previously discussed, after 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historical data to objectively determine if there has been a significant change in the annual mean transparency since monitoring began.

Typically, high intensity rainfall causes sediment-laden stormwater runoff to flow into surface waters, thus increasing turbidity and decreasing clarity. Efforts should continually be made to stabilize stream banks, pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the pond. Guides to best management practices that can be implemented to reduce, and possibly even eliminate, nonpoint source pollutants, are available from DES upon request.

TOTAL PHOSPHORUS

- **Figure 3 and Table 8:** The graphs in Figure 3 in Appendix A show the amount of epilimnetic (upper layer) phosphorus and hypolimnetic (lower layer) phosphorus; the inset graphs show current year data. Table 8 in Appendix B lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the pond has been sampled through VLAP.

Phosphorus is typically the limiting nutrient for vascular plant and algae growth in New Hampshire's lakes and ponds. Excessive phosphorus in a lake/pond can lead to increased plant and algal growth over time. **The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 12 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.**

The current year data for the epilimnion (the top inset graph) show that the phosphorus concentration **remained stable** from **June** through **August**.

The historical data show that the **2008** mean epilimnetic phosphorus concentration is **greater than** the state and similar lake medians. Refer to Appendix F for more information about the similar lake median.

The hypolimnetic phosphorus concentration was not measured in 2008. The pond is shallow and does not thermally stratify into lake layers; therefore it is not necessary to collect a hypolimnion sample.

Overall, visual inspection of the historical data trend line for the epilimnion shows a **relatively stable** phosphorus trend. Specifically, the mean annual epilimnetic phosphorus concentration has **remained approximately the same** since **2001**.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about the watershed sources of phosphorus and how excessive phosphorus loading can negatively affect the ecology and the recreational, economical, and ecological value of lakes and ponds.

TABLE INTERPRETATION

- **Table 2: Phytoplankton**
Table 2 in Appendix B lists the current and historical phytoplankton and/or cyanobacteria observed in the pond. Specifically, this table

lists the three most dominant phytoplankton and/or cyanobacteria observed in the sample and their relative abundance in the sample.

The dominant phytoplankton and/or cyanobacteria observed in the **June** sample were ***Dinobryon* (Golden-Brown)**, ***Mallomonas/Ceratium* (Golden-Brown/Dinoflagellate)**, and ***Synura* (Golden-Brown)**.

The dominant phytoplankton and/or cyanobacteria observed in the **July** sample were ***Dinobryon* (Golden-Brown)**, ***Fragilaria* (Diatom)**, and ***Coelosphaerium* (Cyanobacteria)**.

The dominant phytoplankton and/or cyanobacteria observed in the **August** sample were ***Dinobryon* (Golden-Brown)**, and ***Synura* (Golden-Brown)**.

Phytoplankton populations undergo a natural succession during the growing season. Please refer to the “Biological Monitoring Parameters” section of this report for a more detailed explanation regarding seasonal plankton succession. Diatoms and golden-brown algae populations are typical in New Hampshire’s less productive lakes and ponds.

➤ **Table 4: pH**

Table 4 in Appendix B presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 typically limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal for fish. The median pH value for the epilimnion (upper layer) in New Hampshire’s lakes and ponds is **6.6**, which indicates that the state surface waters are slightly acidic. For a more detailed explanation regarding pH, please refer to the “Chemical Monitoring Parameters” section of this report.

The mean pH at the deep spot this year was **6.74** in the epilimnion, which means that the water is ***slightly acidic***.

Due to the state’s abundance of granite bedrock and acid deposition received from snowmelt, rainfall, and atmospheric particulates, there is little that can be feasibly done to effectively increase pond pH.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 in Appendix B presents the current year and historical epilimnetic ANC for each year the pond has been monitored through VLAP.

Buffering capacity (ANC) describes the ability of a solution to resist changes in pH by neutralizing the acidic input. The median ANC value for New Hampshire's lakes and ponds is **4.8 mg/L**, which indicates that many lakes and ponds in the state are at least "moderately vulnerable" to acidic inputs. For a more detailed explanation about ANC, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean acid neutralizing capacity (ANC) of the epilimnion (upper layer) was **6.87 mg/L**, which is ***slightly greater than*** the state median. In addition, this indicates that the pond is ***moderately vulnerable*** to acidic inputs.

➤ **Table 6: Conductivity**

Table 6 in Appendix B presents the current and historical conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current, which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column. The median conductivity value for New Hampshire's lakes and ponds is **38.4 uMhos/cm**. For a more detailed explanation, please refer to the "Chemical Monitoring Parameters" section of this report.

The mean annual epilimnetic conductivity at the deep spot this year was **512.33 uMhos/cm**, which is ***much greater than*** the state median.

The conductivity continued to remain ***much greater than*** the state median in the pond and tributaries this year and is likely the result of the urbanized watershed. However, conductivity levels in **East II Inlet** and **Lessard Inlet** ***decreased*** greatly this year. This was likely a result of the significant wetfall events throughout the summer flushing the tributary systems leading to a decreased nutrient and salt content.

➤ **Table 8: Total Phosphorus**

Table 8 in Appendix B presents the current year and historical total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae's ability to grow and reproduce. Please refer to the "Chemical Monitoring Parameters" section of this report for a more detailed explanation.

The total phosphorus concentration remains **elevated** in **East II Inlet** and **Lessard Inlet**. These stations have had a history of **elevated** and **fluctuating** phosphorus concentrations. We recommend that your monitoring group conduct a stream survey and rain event sampling along this tributary so that we can determine what may be causing the elevated concentrations.

For a detailed explanation on how to conduct rain event sampling and stream surveys, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at <http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm>, or contact the VLAP Coordinator.

➤ **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**

Table 9 in Appendix B shows the dissolved oxygen/temperature profile(s) collected during **2008**. Table 10 in Appendix B shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of sufficient amounts of dissolved oxygen in the water column is vital to fish and amphibians and bottom-dwelling organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The dissolved oxygen concentration was greater than **100 percent** saturation at **one** meter at the deep spot on the **August** sampling event. Wave action from wind can also dissolve atmospheric oxygen into the upper layers of the water column. Layers of algae can also increase the dissolved oxygen in the water column, since oxygen is a by-product of photosynthesis. Considering that the depth of sunlight penetration into the water column was approximately **1.5** meters on this sampling event, as shown by the Secchi disk transparency depth, we suspect that an abundance of algae at this depth caused the oxygen super-saturation.

The dissolved oxygen concentration was **lower off the pond bottom than in the epilimnion (upper layer)** at the deep spot throughout the summer. As ponds age, and as the summer progresses, oxygen typically becomes **depleted** by bacterial decomposition. Specifically, the reduction of oxygen is primarily a result of biological organisms using oxygen to break down organic matter, both in the water column and particularly at the bottom of the pond where the water meets the sediment. When the oxygen concentration is depleted to less than 1 mg/L, the phosphorus that is normally bound up in the sediment may be re-released into the water column, a process referred to as **internal phosphorus loading**.

➤ **Table 11: Turbidity**

Table 11 in Appendix B lists the current year and historical data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to the “Other Monitoring Parameters” section of this report for a more detailed explanation.

The tributary and deep spot turbidity was **relatively low** this year, which is good news.

However, we recommend that your group sample the pond and any surface water runoff areas during significant rain events to determine if stormwater runoff contributes turbidity and phosphorus to the pond.

For a detailed explanation on how to conduct rain event sampling, please refer to the 2002 VLAP Annual Report special topic article, which is posted on the VLAP website at

<http://www.des.nh.gov/organization/divisions/water/wmb/vlap/categories/publications.htm>, or contact the VLAP Coordinator.

➤ **Table 12: Bacteria (*E.coli*)**

Table 12 in Appendix B lists the current year and historical data for bacteria (*E.coli*) testing. *E. coli* is a normal bacterium found in the large intestine of humans and other warm-blooded animals. *E.coli* is used as an indicator organism because it is easily cultured and its presence in the water, in defined amounts, indicates that sewage **may** be present. If sewage is present in the water, potentially harmful disease-causing organisms **may** also be present.

Bacteria sampling was not conducted this year. If residents are concerned about sources of bacteria such as failing septic systems, animal waste, or waterfowl waste, it is best to conduct *E. coli* testing when the water table is high, when beach use is heavy, or immediately after rain events.

➤ **Table 13: Chloride**

Table 13 in Appendix B lists the current year and the historical data for chloride sampling. The chloride ion (Cl⁻) is found naturally in some surfacewaters and groundwaters and in high concentrations in seawater. Research has shown that elevated chloride levels can be toxic to freshwater aquatic life. In order to protect freshwater aquatic life in New Hampshire, the state has adopted **acute and chronic** chloride criteria of **860 and 230 mg/L** respectively. The chloride content in New Hampshire lakes is naturally low, generally less than

2 mg/L in surface waters located in remote areas away from habitation. The median epilimnetic chloride value for New Hampshire lakes and ponds is **5 mg/L**. Higher values are generally associated with salted highways and, to a lesser extent, with septic inputs. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

Chloride sampling was **not** conducted during **2008**.

➤ **Table 14: Current Year Biological and Chemical Raw Data**

Table 14 in Appendix B lists the most current sampling year results. Since the maximum, minimum, and annual mean values for each parameter are not shown on this table, this table displays the current year “raw,” meaning unprocessed, data. The results are sorted by station, depth, and then parameter.

➤ **Table 15: Station Table**

As of the spring of 2004, all historical and current year VLAP data are included in the DES Environmental Monitoring Database (EMD). To facilitate the transfer of VLAP data into the EMD, a new station identification system had to be developed. While volunteer monitoring groups can still use the sampling station names that they have used in the past and are most familiar with, an EMD station name also exists for each VLAP sampling location. Table 15 in Appendix B identifies what EMD station name corresponds to the station names you have used in the past and will continue to use in the future.

DATA QUALITY ASSURANCE AND CONTROL

Annual Assessment Audit:

An annual assessment audit was not conducted in 2008.

Please contact the VLAP Coordinator during the spring of 2009 to schedule an annual biologist visit.

Sample Receipt Checklist:

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if your group followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did an **excellent** job when collecting samples and submitting them to the laboratory this year! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the laboratory staff to contact your group with questions, and no samples were rejected for analysis.

USEFUL RESOURCES

Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms, DES fact sheet WMB-10, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-10.pdf.

Erosion Control for Construction in the Protected Shoreland Buffer Zone, DES fact sheet WD-SP-1, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-1.pdf.

Impacts of Development Upon Stormwater Runoff, DES fact sheet WD-WQE-7, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/aot/documents/wqe-7.pdf.

Low Impact Development Hydrologic Analysis. Manual prepared by Prince George's County, Maryland, Department of Environmental Resources. July 1999. To access this document, visit www.epa.gov/owow/nps/lid_hydr.pdf or call the EPA Water Resource Center at (202) 566-1736.

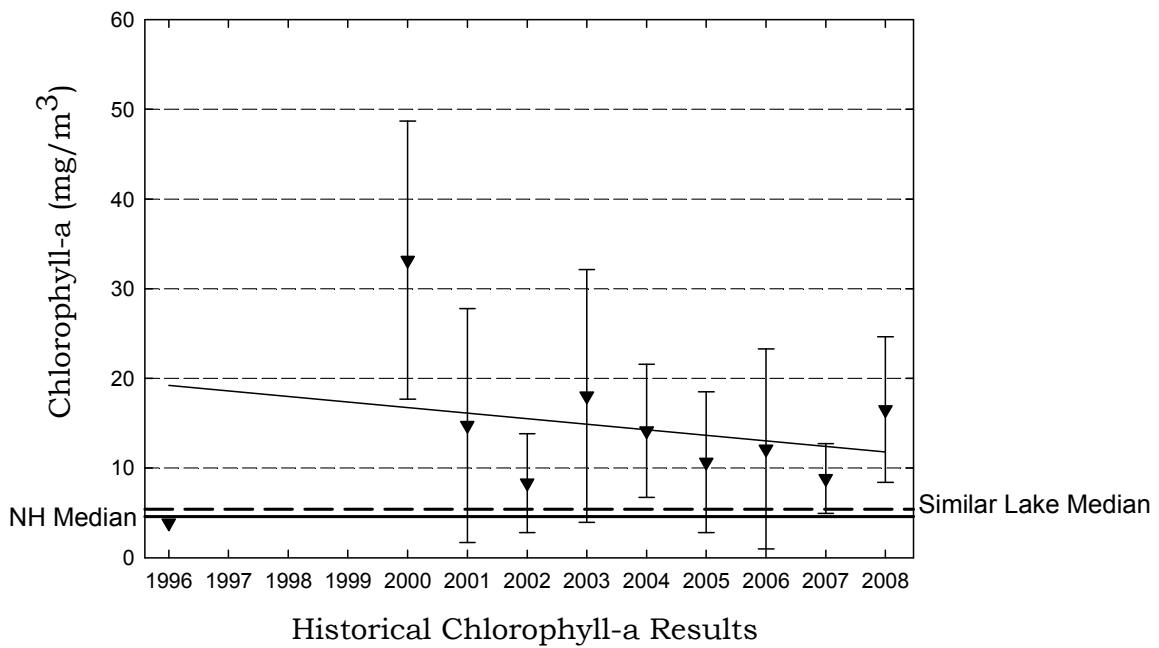
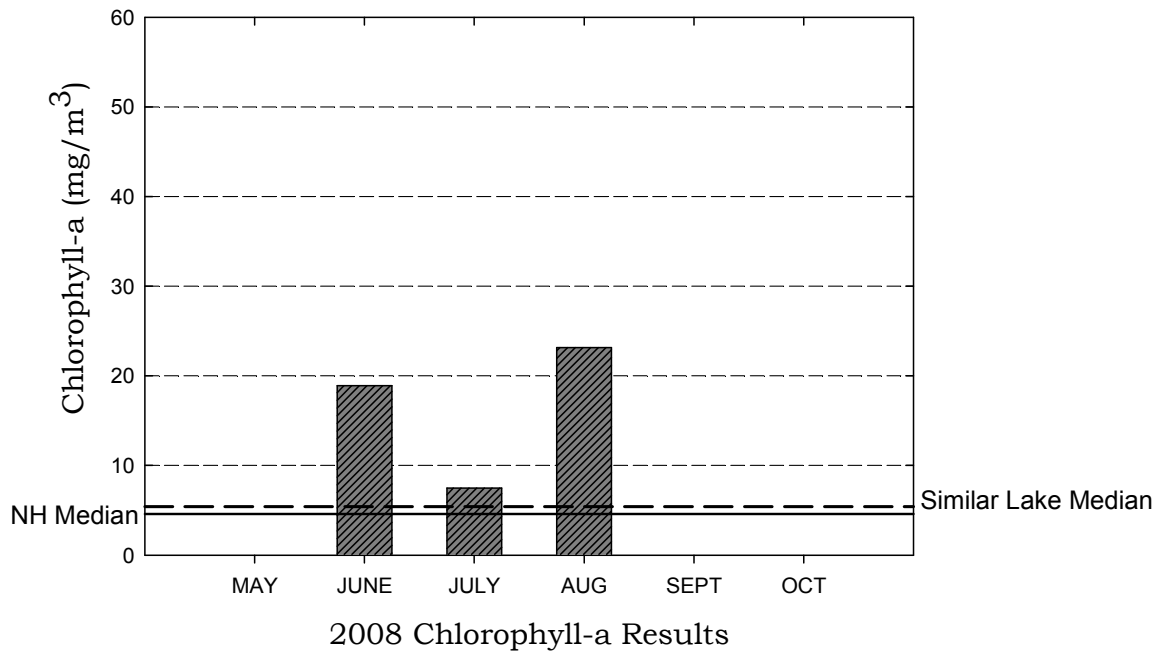
Low Impact Development: Taking Steps to Protect New Hampshire's Surface Waters, DES fact sheet WD-WMB-17, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-17.pdf.

Road Salt and Water Quality, DES fact sheet WD-WMB-4, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf.

Shorelands Under the Jurisdiction of the Comprehensive Shoreland Protection Act, DES fact sheet SP-4, (603) 271-2975 or www.des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-4.pdf.

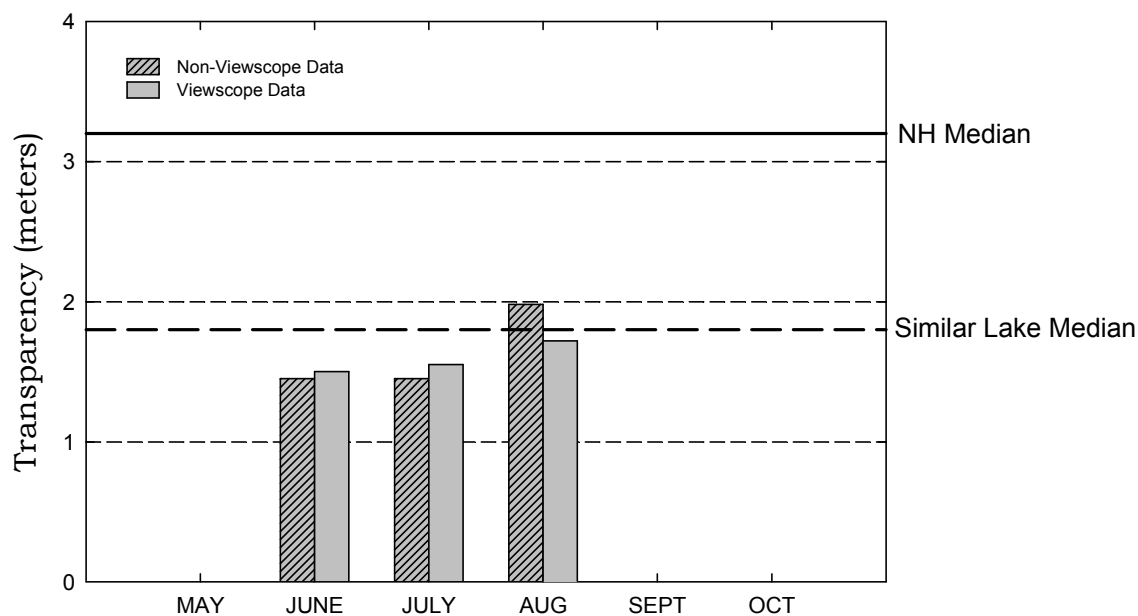
Dorrs Pond, Manchester

Figure 1. Monthly and Historical Chlorophyll-a Results

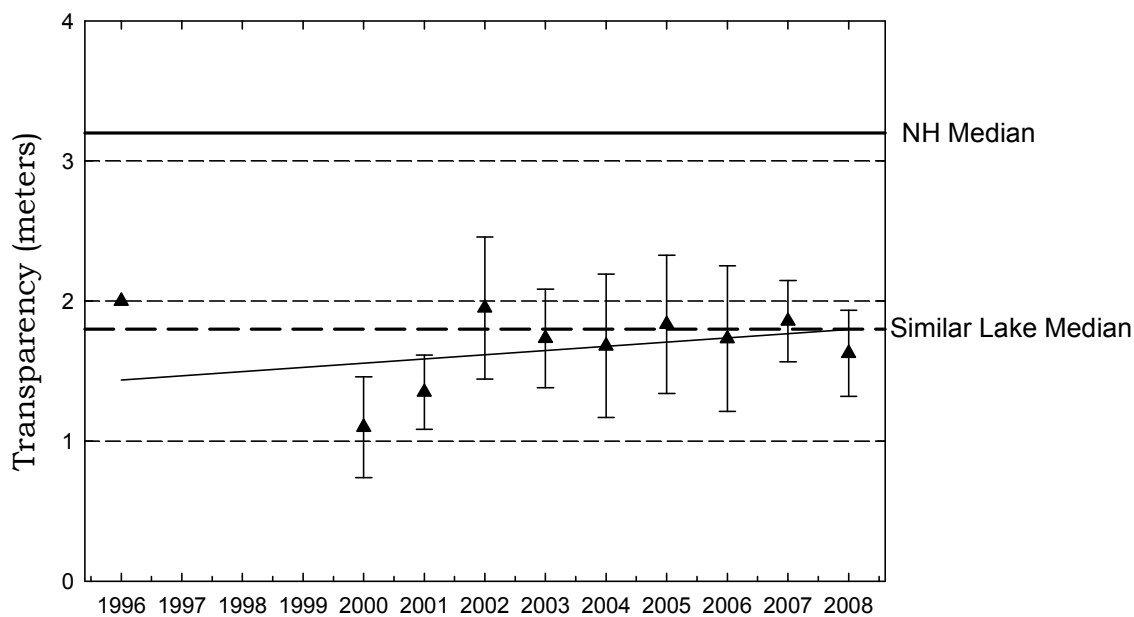


Dorrs Pond, Manchester

Figure 2. Monthly and Historical Transparency Results



2008 Transparency Viewscope and Non-Viewscape Results



Historical Transparency Non-Viewscape Results

Dorrs Pond, Manchester

Figure 3. Monthly and Historical Total Phosphorus Data.

