



# Lake Checkups: Water Quality Tests

## A Multi-Media Communication Tool

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Indiana Watershed Leadership Academy  
Final Project  
Conference Center - Fort Harrison State Park  
May 21, 2014

# Presentation Outline

- ◆ **Background: Who is the Audience?  
What are the Objectives?**
- ◆ **How Will the Objectives Be  
Achieved?**
- ◆ **What is the Message?**
- ◆ **Summary**

# Presentation Outline

- ◆ **Background – Who is the Audience?  
What are the Objectives? (Anthony)**
- ◆ How Will the Objectives Be Achieved? (Randy)
- ◆ What is the Message? (Randy and Zac)
- ◆ Summary (Zac)

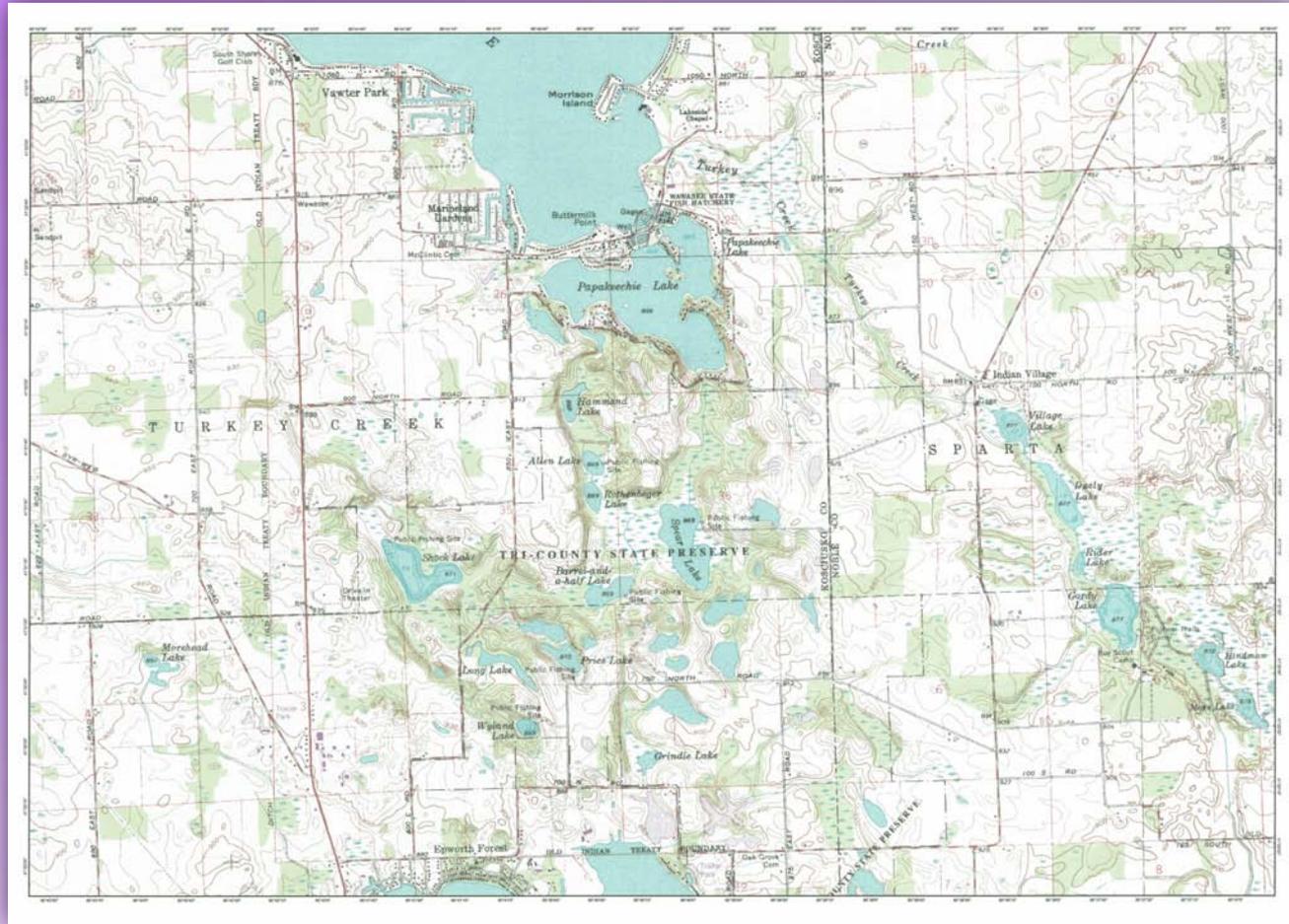
# Aerial Photograph of Lake Papakeeche (LP)

179 acre private (non-sports) lake in Syracuse, Indiana  
Part of the Wawasee Area Sub-watershed



**LP is a beautiful relatively natural lake ecosystem on which to develop, test and/or validate effective methods of lake stewardship and preservation.**

# Partial Map of the Wawasee Subwatershed Areas South of Lake Papakeeche (LP)



**LP is part of a larger watershed; LP impacts, and is impacted by, this watershed.  
Consequence: We need to pay attention not only to LP, but also to its environs.**

# Partitioning of LP into Fifty (50) GPS-Defined Test Sites Distributed in Four (4) Regions - Summer 2013



## Current Water Testing on LP

- ◆ Turbidity (Secchi disk)
- ◆ Dissolved oxygen (DO)
- ◆ Temperature
- ◆ *E. coli* levels
- ◆ Dissolved nitrogen (as nitrate)
- ◆ Dissolved phosphorus (as inorganic  $\text{PO}_4^{-3}$ )
- ◆ Acidity (pH)
- ◆ Chlorophyll a

**Project Audience:** Residents on Lake Papakeecheie;  
Leadership of the Papakeecheie  
Protective Association (PPA)

### **Project Objectives:**

- ◆ To educate and inform lake residents and leadership about modern chemical and biological methods to assess the quality of lake water;
- ◆ To motivate lake residents to become personally involved in the work of LaPSI (Lake Papakeecheie Sustainability Initiative);
- ◆ To recruit and train citizen-scientists

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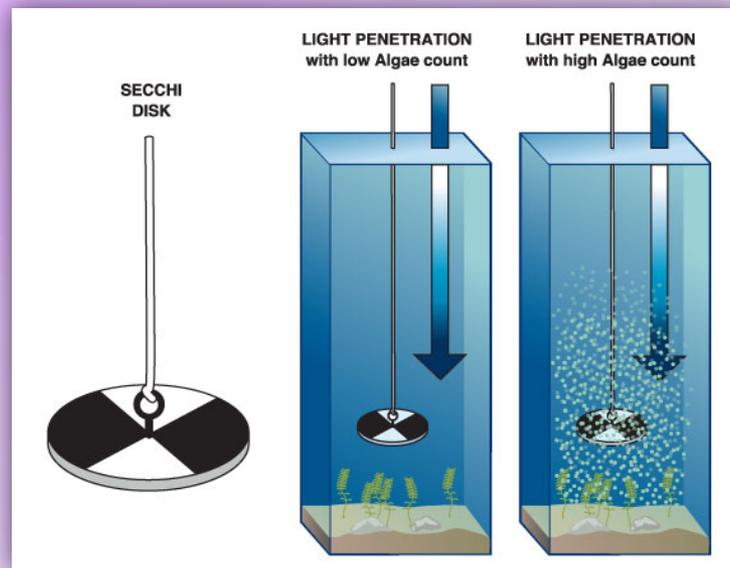
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# Complementary Multi-Media Approach

1. **Preparation of a Magnet**: Contains very basic information about lake water testing, and encourages readers to consult the PPA web site for more information.
2. **Preparation of a Tri-Fold Pamphlet**: Contains more detailed information about lake water testing in a transportable medium, and encourages readers to consult the PPA web site for more information.
3. **PPA Web Site**. Key source of detailed information about lake water testing, other lake stewardship activities, and provides information on how lake residents can become more involved with lake management.

# Turbidity - Secchi Disk

- ◆ Used to measure water clarity/ turbidity.
- ◆ 8"-diameter disk, divided into black and white quadrants (limnology investigations).
- ◆ Original is 12" and all white for ocean studies.

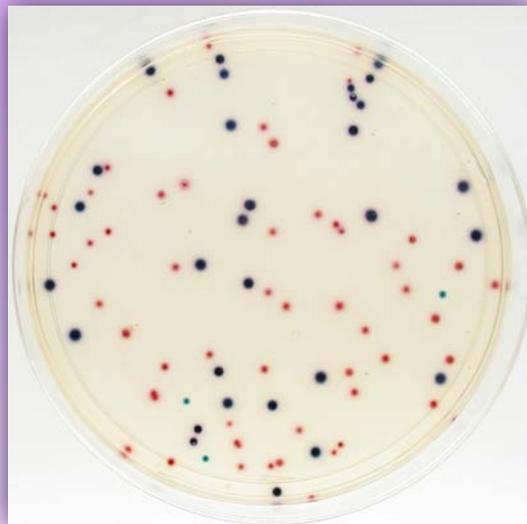


## How to Use a Secchi Disk

- ◆ Shady side of boat between 9 am and 3 pm.  
Best results are between 10 am and 2 pm.
- ◆ Same observer and same manner every time.
- ◆ Indiana Clean Lakes Program uses Secchi disks to monitor turbidity in over 80 Indiana lakes.

# *E. coli* (*Escherichia coliform*)

- ◆ Contact with humans can cause discomfort or illness.
- ◆ Lakes containing high levels of bacteria are unsafe for activities that involve significant water contact.



A Coliscan™ plate

## Sources of Contamination

- ◆ *E. coli* contamination is commonly caused by pollution from poorly functioning septic systems.
- ◆ Feces from waterfowl and other wildlife can also contribute significant amounts of *E. coli* to lakes.

# What To Do

- ◆ The state of Indiana sets standards to determine whether a lake is impaired by high levels of bacteria. Simple and convenient tests for measuring *E. coli* in lake water are available.
- ◆ ISDH has a list of certified labs. Purdue Extension has several publications related to water quality, testing, etc.



## Dissolved Oxygen and Temperature

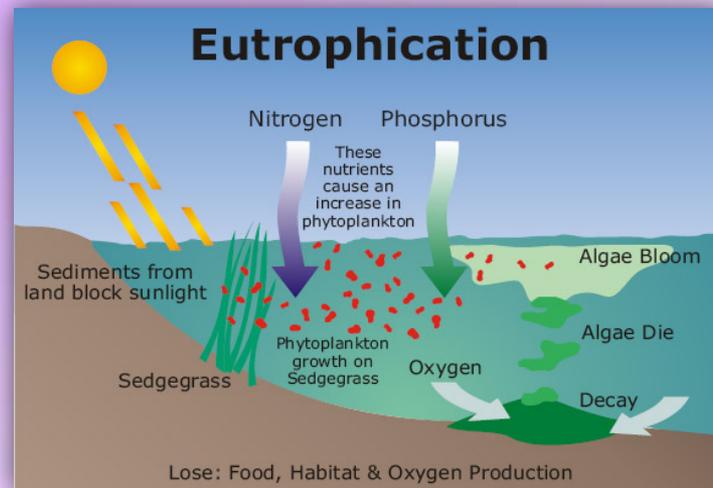
- ◆ Many organisms require oxygen to live.
- ◆ The availability of oxygen in lake water determines which organisms can exist and thrive.
- ◆ Graphs of DO or T *versus* lake depth can be strong indicators of lake health.
- ◆ DO and T are measured with a scientific meter.
- ◆ DO values can be used to calculate TSI values.

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# Nitrogen and Phosphorus

- ◆ Nitrogen (N) and phosphorus (P) are required by all living organisms.
- ◆ Excessive amounts of N and P can cause the explosive growth of certain organisms that greatly impairs water quality.



# Nitrogen and Phosphorus

- ◆ Primary sources of excess N and P include agricultural and residential use of fertilizers.
- ◆ N and P concentrations can be measured in water with pertinent equipment, and their values compared to Indiana state standards to help determine lake health.

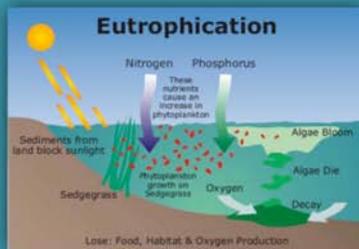


# **Project End-Products**

# Tri-Fold Pamphlet – Side 1

## Nitrogen and Phosphorus

Nitrogen (N) in the form of nitrates, and phosphorus (P) in the form of phosphates are necessary nutrients for all living organisms. However, excessive (non-natural) amounts of them in lake water can cause the explosive growth of certain organisms that can greatly impair water quality and cause eutrophication (see picture below). Primary sources of excess N and P include agricultural and residential use of fertilizers. N and P concentrations can be easily measured in water with pertinent equipment, and their values compared to Indiana state standards to help determine lake health.



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## Other Water Quality Measurements

There are additional water quality indicators such as *water acidity (pH)*, *chlorophyll a*, *photic zone*, and *conductivity*. There are also biological indicators that complement chemical and physical indicators and provide further evidence of lake health. In practice, all of these indicators are used collectively to produce a complete picture of lake health.



See the PPA website at <http://lakepapakeeche.org> for more information about these tests and how you can participate in water testing at Lake Papakeeche.

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## Lake Checkups Water Quality Tests

Lakes, like people, can be healthy or unhealthy. Monitoring lakes over time is necessary to find out what is working well and what is not. When people get medical checkups, things like heart rate, body temperature, body weight, and blood pressure are measured because they are good *indicators* of human state of health. Lakes are no different, except for the indicators used. What are the main indicators of lake health, why are they good indicators, and what do they tell us about lake health?

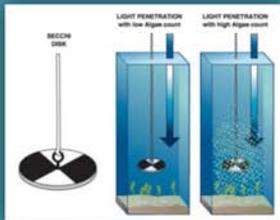


Lake Papakeeche Sustainability Initiative  
LaPSI  
Spring 2014

# Tri-Fold Pamphlet – Side 2

## Water Turbidity: Secchi Disc

Turbidity is a measurement of water clarity. We are all familiar with the sight of beautiful, clear water (low turbidity) with excellent visibility provided by "deep" light penetration. Turbidity is affected by the amount of light scattered and absorbed by particles suspended in water. Some particles are biological in origin (algae cells, microscopic organisms, and decomposing soluble organic matter) while others are geological in origin (soil sediment and soluble materials like calcium and iron). Turbidity values (usually a reading representing depth of visibility) can be used to determine the Trophic State Index (TSI) of a lake. TSI is a measure of a lake's biological productivity (concentrations of macro nutrients) and overall health (ability to support diverse life). Turbidity can be determined using a simple device called a Secchi disc that is lowered until it disappears; that depth level is used to determine turbidity.



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## Pathogens: *E. coli* Coliscan™ Testing

When pathogenic bacteria like *E. coli* and others come into contact with humans, discomfort or illness can result. Lakes containing high levels of bacteria cannot be used safely for those human activities that involve significant water contact. *E. coli* contamination is commonly caused by pollution from poorly functioning septic systems. Feces of waterfowl and other wildlife also contribute significant amounts of *E. coli* to lakes. The state of Indiana has published standards to determine whether a lake is impaired by high levels of bacteria. Simple, convenient and rapid tests for measuring *E. coli* in lake water are available.



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## Dissolved Oxygen and Temperature

Many organisms require oxygen and stable optimal temperatures to live. In lakes, the availability of oxygen dissolved in water and average temperatures determine which organisms can exist and thrive. For example, fish similar to trout require higher oxygen levels and lower temps than fish like carp. The concentration of dissolved oxygen (DO) can depend significantly on water depth. Warm surface water usually has lower DO than cooler, deeper water. However at a certain depth in a lake oxygen becomes too low to support most life despite the cool temperatures. The shape of DO *versus* lake depth graphs and temperature profile graphs can be strong indicators of lake health. DO and T profiles are measured with a scientific meter by lowering a probe into the water and recording measurements at one foot increments. DO and T curve values can be used to calculate TSI values for a lake (see "Turbidity" section above).



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# Magnet

## Lake Checkups - Water Quality Tests

Lake Papakeechee Sustainability Initiative – LaPSI – Spring 2014

Lakes, like people, can be healthy or unhealthy. When people get medical checkups, things like heart rate, body temperature, body weight, and blood pressure are measured because they are good indicators of human state of health. Lakes are no different, except for the indicators used. What are the major indicators of lake health and what do they tell us about lake health?



**Turbidity.** Turbidity is a measurement of water clarity. It is affected by the amount of particles suspended in the water. Turbidity values can be used to determine the Trophic State Index (TSI) of a lake, which is a standard measure of health.

**Nitrogen and Phosphorus.** Nitrogen (N) and phosphorus (P) are required nutrients for all living organisms. However, excessive amounts of N and P in lake water can cause the explosive growth of certain organisms that can greatly impair water quality. Primary sources of excess N and P include agricultural and residential use of fertilizers.

**Bacteria.** Lakes containing high levels of bacteria cannot be used safely for human activities. *E. coli* contamination is commonly caused by pollution from poorly functioning septic systems. The state of Indiana has standards to determine if a lake is impaired by bacteria.

**Dissolved Oxygen.** Many living organisms require oxygen to live. The availability of oxygen in lakes determines the kinds of organisms that can grow there. The shape of a DO *versus* lake depth graph is a strong indicator of lake health. DO, like turbidity, can be used to calculate TSI values.

See the PPA web site at <http://lakepapakeechee.org> for more information about these and other water tests, and how you can participate in water testing at Lake Papakeechee.

# Summary

- ◆ A tri-fold pamphlet was produced to introduce lake residents to common methods used to test lake water quality.
- ◆ A magnet containing abbreviated information from the pamphlet was produced for convenient siting in residents' homes.
- ◆ Links to the PPA website were given in the pamphlet and magnet media to entice lake residents to use the web site more regularly as a source of information on current lake management projects and practices (work in progress).
- ◆ The longer-term expectation is that these communication tools will educate lake residents and leadership about water quality and promote their active involvement in lake management.