

Water Quality Sampling  
Presentation  
Ministry of the Environment

Presented by Dana  
Cruikshank  
Surface Water Specialist  
October 2009



## 5W's of Water Quality Sampling

- WHY
- WHAT
- WHERE
- WHEN
- WHO

Sampling is an activity that produces a set of samples representative of the source being investigated and is suitable for analysis



# 5W's of Water Quality Sampling

## WHY we Sample!

- Research Projects
- Routine Monitoring
- Environmental Site Assessment
- Site Characterization
- Environmental Response/Investigation



## 5W's of Water Quality Sampling

- Decide the objectives of the sampling.
- If it's a long-term project then a Mission Statement may be useful to keep you on track.
- PLAN, PLAN, PLAN.



# 5W's of Water Quality Sampling

## PLANNING

- Check bathymetry maps to find deep basins. MNR usually has local lakes on file. MOE has some.
- Check weather beforehand. No water sample is worth injury or worst. Think SAFETY always.
- Communicate with lab when they can receive samples so they don't sit around for several days.
- Explore shipping options.
- Does the objective require background samples for comparison. What would be an appropriate background.
- Does the objective require a specific sampling methodology approach such as random chance, systematic use of a grid system or judgemental which relies on the experience of the sampler along with information to determine sampling locations.



# W5's of Water Quality Sampling

## Sampling Equipment

- Make a checklist
  - Personal protective equipment
  - Bottles, sampling gear
  - cooler, ice,
  - Notebook,
  - GPS, camera, cell phone

***Remember the importance of being properly prepared for sampling!***



# 5W's of Water Quality Sampling

## COST

- BOD \$30.00 per sample
- TS, TSS, TDS \$36.00 per sample
- pH, Alkalinity, conductivity \$24.00 per sample
- Nitrate, nitrite, ammonia \$60.00 per sample
- Total phosphorus, TKN \$44.00 per sample



## W5's of Water Quality Sampling

<http://waterontheweb.org/under/index.html>



# 5W's of Water Quality Sampling

Consider the importance of building strong and positive relationships with others!

# 5W's of Water Quality Sampling

## WHAT

- What chemical and/or field samples are taken depends on your objective and budget.
- If you are interested in algae blooms then you would likely want to sample for nutrients (total phosphorus, ammonia, nitrate, nitrite) and collect representative algae samples for identification.
- If you are interested in long-term monitoring of lake water quality; nutrients are likely the group of parameters that would affect your lake the most.
- Other parameters should only be added if there is a reason to.



# 5W's of Water Quality Sampling

- If there are large farms, such as hog operations with runoff to streams or lakes, then bacteria likely would be added to your list.
- If an industry discharges effluent then you might add metals or organics relating to that specific industry.
- If fisheries management was an objective, then nutrients and dissolved oxygen profiles would be important.



# 5W's of Water Quality Sampling

PARAMETER	WHY
<b>Key Parameters</b>	
GPS or map	So you know where the samples were taken.
Temperature	Temperature affects the oxygen content of the water (oxygen levels become lower as temperature increases); the rate of photosynthesis by aquatic plants; the metabolic rates of aquatic organisms; and the sensitivity of organisms to toxic wastes, parasites, and diseases
Secchi Disk depth	Provides general water clarity measurements
Total Phosphorus	Limiting Nutrient for algae growth, indicator of lake productivity
Total Ammonia	Excess ammonia contributes to eutrophication of lakes through algal growth. In high concentrations it is toxic.
Nitrate	Important Nutrient for algae and lake productivity. Together with phosphorus, nitrates in excess amounts can accelerate eutrophication, causing dramatic increases in aquatic plant grow. Excess nitrates can cause hypoxia (low levels of dissolved oxygen) and can become toxic to warm-blooded animals at higher concentrations (10 mg/L) or higher) under certain conditions.
Nitrite	Usually not present in surfaces waters. Presence an indicator of potential sewage leaks. Toxic to aquatic life at low concentrations.
Dissolved Oxygen	Essential for respiration by most aquatic organisms. Low DO facilitates release of nutrients. Impacts on metabolic rates that can affect predator prey relationships.

# 5W's of Water Quality Sampling

PARAMETER	WHY
<b>Secondary Parameters</b>	
Total Dissolved Solids (TDS)	Indicator of potential dissolved parameters like metals.
Total Suspended Sediment (TSS)	Important if water body is receiving effluent discharges from sewage or industrial plants or nearby construction sites. TSS impacts on spawning grounds and gills of fish. Higher concentrations of suspended solids can serve as carriers of toxics, which readily cling to suspended particles.
pH and alkalinity	Indicator of lake acidity and ability to assimilate acid rain. pH can also impact on biological activities like egg hatches, larvae growth. Metals and other chemical tend to leach out at lower pH's.
Bacteria	Need at least 5 samples from area. Has to be analyzed frequently to be useful. Can be very misleading as even a passing seagull dropping would throw off your result.
Hardness	Soft water has corrosive effect on metal plumbing while hard water produces scaling.
Biological Oxygen Demand (BOD)	Is a measure of organic pollution. It indicates the amount of oxygen consumed to oxidize organic matter but does not identify the pollutant. The higher the concentrations the worst the WQ. Usually measured for sewage treatment discharges
Total organic Carbon (TOC) Dissolved Organic carbon (DOC) Total Inorganic Carbon (TIC) Total Organic Carbon (DIC)	Carbon is a nutrient required for biological processes. High DOC usually coincides with lower DO and can indicate wetland influences on lake WQ. The carbon cycle lake is important and the carbon dioxide produced is used in photosynthesis.

# 5W's of Water Quality Sampling

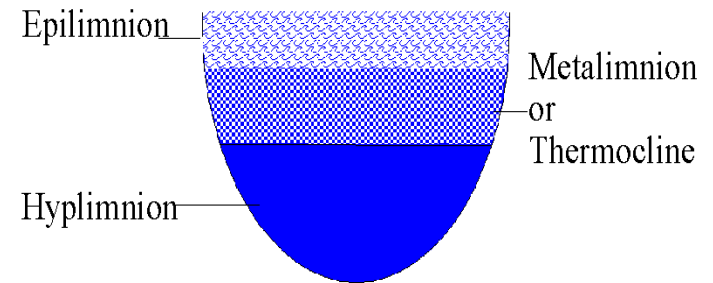
## WHERE

- Where you sample is based on the sampling objective.
- If you want to know what is coming into the lake then all the inflows need to be sampled.
- If downstream Water Quality (WQ) is important then outflows need to be sampled. If budget is a problem you can assume your lake sample WQ is the same as the outflow.



# 5W's of Water Quality Sampling

- Long-term monitoring programs based on samples from the deepest basin or basins.
- Studies on lake water movements have shown that lakes tend to mix fairly evenly in the epilimnion.
- Samples taken from this layer are fairly representative of general WQ in the lake.
- Conducting shoreline sampling worst case WQ scenarios because of shoreline development, runoff, septic system discharge, spills, road impacts etc.



# 5W's of Water Quality Sampling

## WHEN

- Frequency of sampling.
- Usually based on the objective and the reason why you are sampling.
- The value of your data increases the more often you sample because you reduce the influence of natural variation.
- Usually budget constraints dictate what you can afford.
- Basic monitoring spring and summer.





## 5W's of Water Quality Sampling

- Samples should be collected annually at roughly the same time each year.
- .
- This provides some inter-year comparisons



# W5's of Water Quality Sampling

## WHO

- Again depends on objective.
  - If baseline monitoring with grab samples then anyone (volunteers) can do it with a short amount of protocol training.
  - If research level or environmental impact level sampling you would want qualified personnel as some equipment requires constant calibration etc.
- Need a coordinator (go to person) that is accessible.
- Volunteers should be committed, dependable and organized.
- Some projects with have multiple partners; private citizens, agencies, government. Brings extra levels of complexity to the project.



# Ministry of the Environment Eastern Region District Boundaries



**Legend**

Waterbodies	<b>Municipalities</b>
MCE Districts	Simcoe County
<b>Roads</b>	Halton Hills
<b>Road Type</b>	Hamilton
Expressway	Kawartha Lakes
Principal Highway	London
Secondary Highway	London and District
Major Road	London and Hamilton
Trail	Northumberland
<b>Railway Lines</b>	St. Catharines
Railway, Not in Use	Wellington and Waterloo
Railway, Active	Windsor
	Windsor-Essex and Kent

1:495,500

General Map Information:  
Projection: GCS North American  
Datum: NAD 1983

Abstract: This map was produced for the District and Regional offices of Eastern Region within the Ministry of Environment, Ontario  
© Queen's Printer for Ontario



The maps shown here are for illustrative purposes only and are not suitable for site-specific use or applications. Ministry of the Environment provides the information with the understanding that it is not guaranteed to be accurate, current or complete and disclaims any and all liability for the consequences of its use. It does not warrant that the data reflected in the maps, or copies of such, is released in full scope. These products are intended for reference purposes only, and the Ministry of the Environment will accept no liability for consequences and further damages arising from the use of these maps. These maps are distributed "as is" without representation or warranty, either expressed or implied, including but not limited to, representation of availability for a particular purpose or use.



Information provided by the Ministry of the Environment, Ministry of Natural Resources, Ministry of Municipal Affairs and Housing, Ministry of Health and Long Term Care, and © 2007 DMTI Spatial, Inc.

Produced April, 2008  
Ministry of Environment  
Eastern Region, Kingston, ON

Protecting our environment.



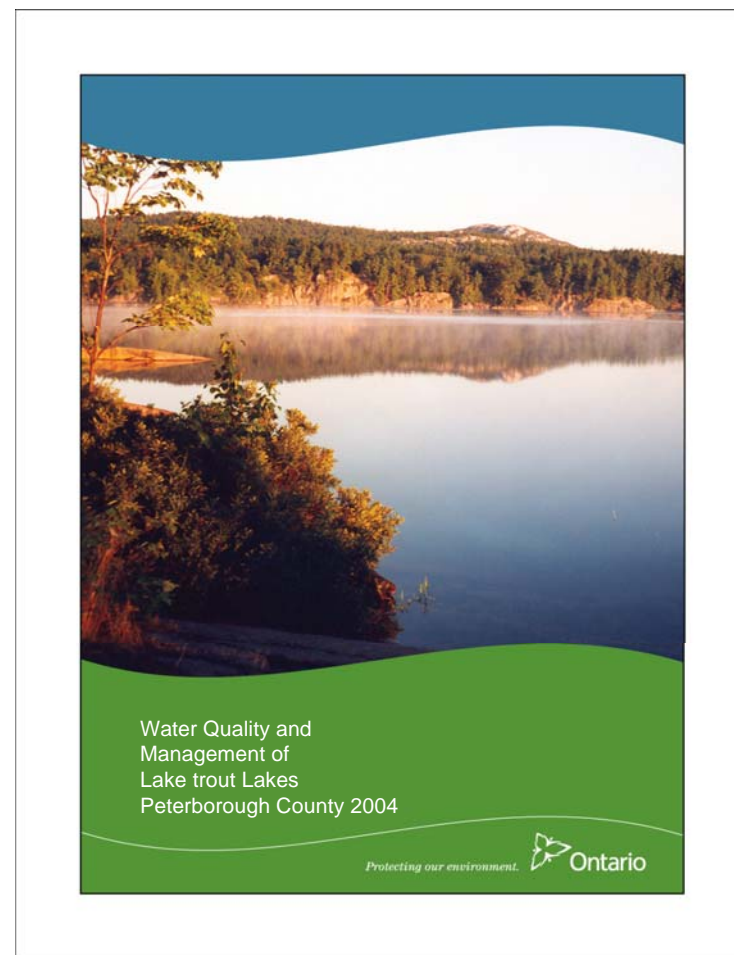
# 5W's of Water Quality Sampling

## What is the ministry's role?

- Primary goal is to sample lake trout lakes in Eastern Ontario.
- Why Lake Trout Lakes?
  - Lake trout are a natural heritage feature under the Provincial Policy Statement.
  - Severance applications for At-capacity lakes are forwarded to MOE for approval.
  - Dissolved oxygen profile data is required to assess applications.
- Other coldwater and warm water lakes are sampled as staffing and timing permit.
- These lakes are determined by consultation with MNR to aid in fisheries management programs, update historical data.
- Lake data information is available from Kingston office.
- MOE Lake Partners Program.

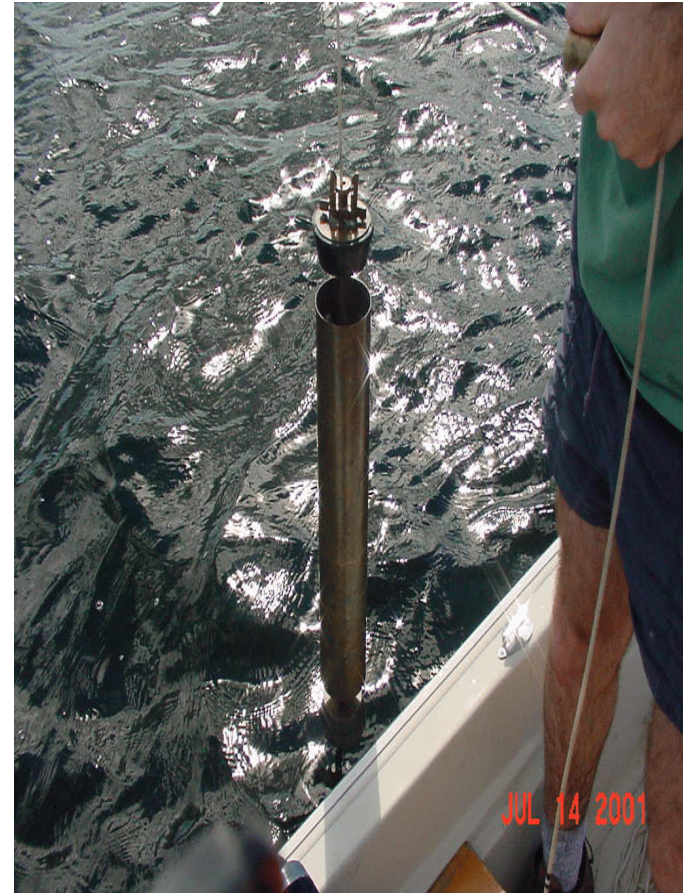
# 5W's of Water Quality Sampling

	# LT	Years	Projected
County	Lakes	Sampled	Sampling
Frontenac	21	2005	2011
Peterborough	17	2004	2010
Halliburton	99	2001;2002;2007; 2008;2009	2013-2015
Hastings	30	2000, 2006	2012
Lennox Addington	9	2005	2011
Leeds Grenville	2	2005	2012
Renfrew	19	2003	2010



# 5W's of Water Quality Sampling

- MOE Eastern Region lakes studies usually consist of a composite of the epilimnion and a discrete sample a metre above the bottom.
- We analyze for Total phosphorus, ammonia, nitrate, nitrite, TSS, TDS, hardness, conductivity, alkalinity, pH, TKN, DOC, DIC, dissolved oxygen and Secchi disk.



# Lake Partner Program

---

**Main Goal:** *to protect the water quality of Ontario's inland lakes by involving the public in a volunteer-based water quality monitoring program*

**Goal #2:** *Establish long-term data set of nutrients (total phosphorus) and water clarity (Secchi) on many lakes*

# Lake Partner Program

---

## Total Phosphorus (TP)

- Controls the growth of algae in Ontario Lakes



## Secchi transparency

- Estimation of water clarity
- Effects of invading species
- Climate change





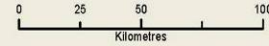
# The Lake Partner Program

---

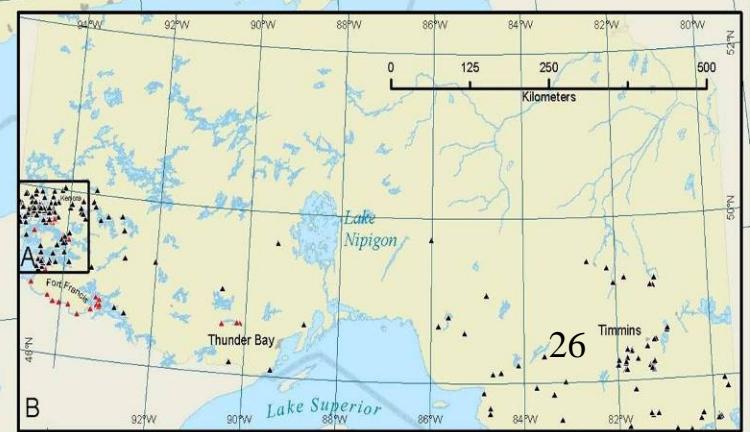
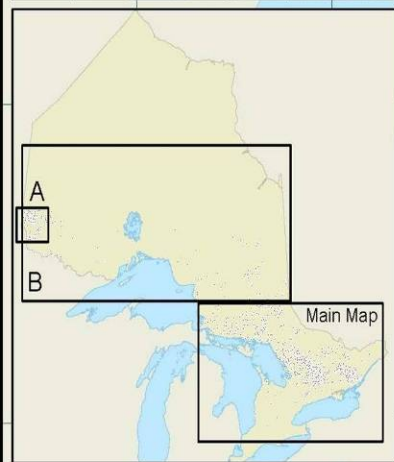
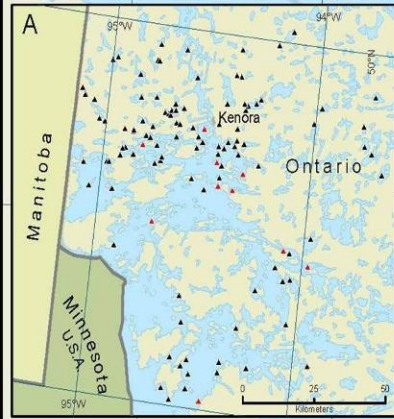
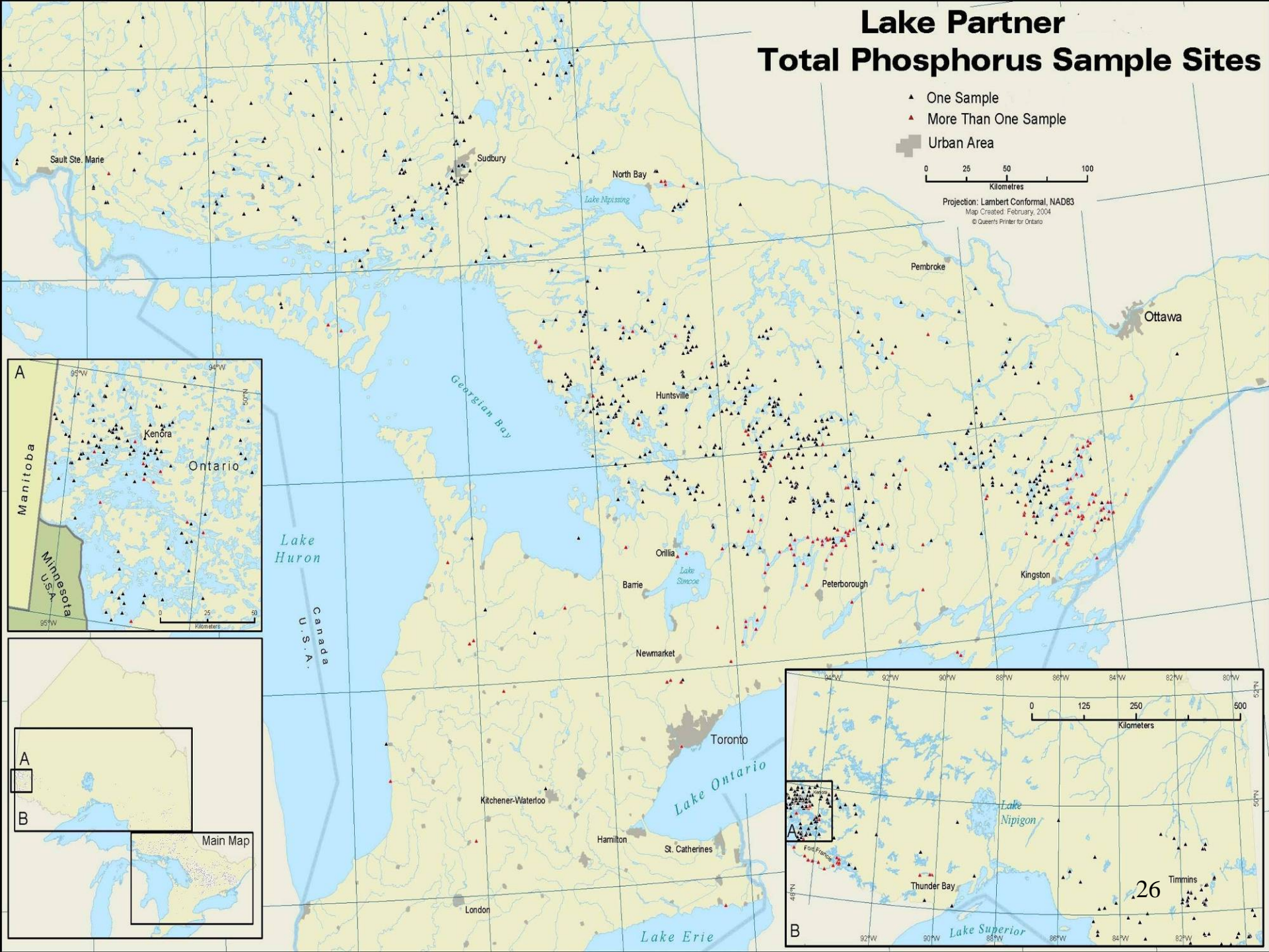
- **Monitoring TP and water clarity at over 800 locations (monthly and spring) – Keep doing this!**
- **What else can you do: build and maintain tertiary treatment plants, maintain septic systems, maintain natural shorelines, manage residential, agricultural and urban growth**

# Lake Partner Total Phosphorus Sample Sites

- ▲ One Sample
- ▲ More Than One Sample
- Urban Area



Projection: Lambert Conformal, NAD83  
Map Created: February, 2004  
© Queen's Printer for Ontario



# Join the Ministry of Environment's Lake Partner Program!

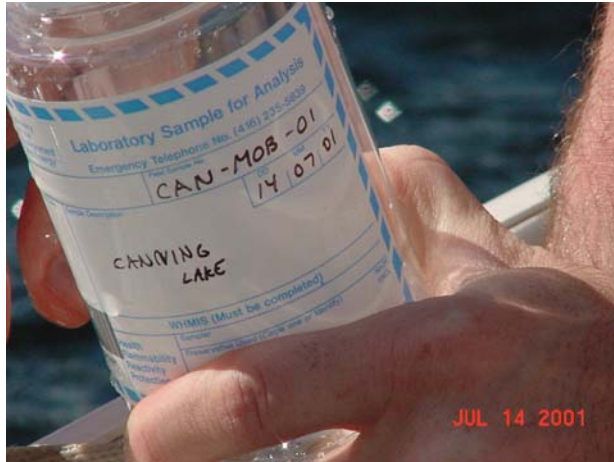
**Web:** [www.ontario.ca/lakepartner](http://www.ontario.ca/lakepartner)

**Email:** [lakepartner@ontario.ca](mailto:lakepartner@ontario.ca)

**Phone:** 1-800-470-8322



# 5W's of Water Quality Sampling



MOE/LIMS Routine Sample Submission

Sample X = Sample Y

8.3.6.1.0.1.3 008 21.08 N/N x-y

surface water from lakes

Victor Castro MOB Kingston 623 219-3020 x2847 205-5186  
153 Oulton Ave Kingston K7L 4X66  
Your Name Your Unit #

Sample Information	Sample No.	MOE/LIMS ID
LWS xxx - EUP - #		
WV Lake	78.77.21	MAIN BASIN
UTM COORDINATES		
DISNUT 3364		DCS1 3370
TOT NUT 3367		HARD 3171
PHAKO 3378		
LWS yw - yw-mob - #		
WV Lake	78.77.21	MAIN BASIN
UTM COORDINATES		
DISNUT 3364		DCS1 3370
TOT NUT 3367		HARD 3171
PHAKO 3378		

