

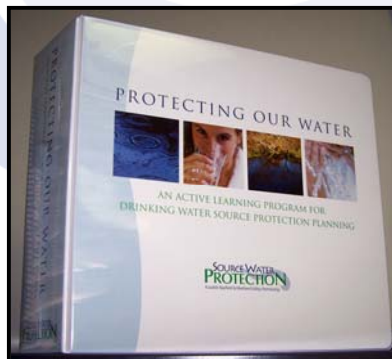
Water Quality

Module Three

Adult Learning Program

Ausable Bayfield Maitland Valley

Drinking Water Source Protection



Module Three: Water Quality

This education module relates to technical guidance:

- Watershed Characterization
- Groundwater Vulnerability Analysis
- Surface Water Vulnerability Analysis
- Water Quality Risk Assessment

Field Learning

Report back on your field learning personal field trip:

- 1) What did you learn about your watersheds?
- 2) What changes are there?
- 3) What land features exist near our watercourses?
- 4) What activities – in general terms – exist near our watercourses?

Learning Expectations

By the end of this session you will be able to:


- Understand what water quality is and its link to human health in global, national, provincial and local contexts
- Understand there are different standards for water quality (e.g., recreational compared to drinking water standards)
- Recognize types of contamination including chemicals (e.g., trace metals) and pathogens (such as *E. coli*)
- Appreciate the differences between point and non-point sources of pollution
- Understand how geology and human activity can influence surface and groundwater quality in Ausable Bayfield Maitland Valley Source Protection Region
- Identify seven key indicators used to assess groundwater quality or degradation in the planning region: nitrates, hardness, fluoride, iron, sodium, chloride, *E. coli*
- Recognize how chloride, copper, nitrate, total phosphorus, suspended sediment, fecal coliform and *E. coli* are used as indicators of surface water quality or degradation
- Understand there is a relationship between water quantity and water quality

Unit 1

– Understanding the Importance of Water Quality

- What is water quality?
- Water – What is its importance globally, nationally, provincially, locally?
- The Story of Water
- Where do you stand on water issues?

Ryan's Well



An example of what can be
done with vision,
commitment and caring.

Toxic Trivia

- How much of disease is water-related in developing nations?
 - a) 25%
 - b) 50%
 - c) 80%

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Toxic Trivia

- How many deaths are caused daily by contaminated water and poor sanitation?
 - A) 30,000
 - B) 60,000
 - C) 100,000

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 - A) More than 120
 - B) More than 360
 - C) More than 700

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 - c) 1,000 litres

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 - a) 25 litres**
 - b) 50 litres
 - c) 1,000 litres

Toxic Trivia

- How many litres of water would become unfit for drinking from one gram of lead?
 - a) 100
 - b) 1,000
 - c) 20,000

Toxic Trivia

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- Reduces risk
- Adds protective barrier
- Treatment may not rid water of all chemicals and pathogens
- Less expensive to protect water than correct a problem after the fact

Water Quality Standards

| | Official Body | Indicator | Standard |
|-----------------|---------------|-----------|----------|
| Drinking Water | | | |
| Bottled Water | | | |
| Aquatic Species | | | |
| Recreation | | | |
| Agriculture | | | |
| | | | |

Water Quality Standards

| | Official Body | Indicator | Standard |
|-----------------|---------------------|---|-----------|
| Drinking Water | Province of Ontario | <i>E. coli</i> per 100 mL | 0 |
| Drinking Water | Province of Ontario | Total coliform per 100 mL | 5 or less |
| Bottled Water | | | |
| Aquatic Species | | Many: Sediment, pathogens, metals, flow, eutrophication, species, suspended solids, abiotic, etc., etc. | |
| Recreation | Huron Health Unit | <i>E. coli</i> per 100 mL | 100 |

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ACT FOR CLEAN WATER

Test Outcomes

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| Organisms | Ontario Drinking Water Standards Interpretation | | Reason |
|---------------------------|---|---|--|
| Total coliform per 100 mL | 5 or less | no significant evidence of bacterial contamination | <ul style="list-style-type: none"> •3 samples in a row, taken 1 to 3 weeks apart, with this designation are needed to determine the stability of the water supply |
| <i>E.Coli</i> per 100 mL | 0 | | |
| Total coliform per 100 mL | more than 5 | significant evidence of bacterial contamination | <ul style="list-style-type: none"> •may be unsafe to drink •consult your local public health unit for information as soon as possible |
| <i>E.Coli</i> per 100 mL | 0 | | |
| <i>E.Coli</i> per 100 mL | > 0 | unsafe to drink – animal or human waste contamination | <ul style="list-style-type: none"> •unsafe to drink •evidence of animal or human waste contamination •consult your local public health unit for information immediately |

Where Do You Stand?

- There is a line of tape along the floor. You can position yourself along the line depending on where you feel most comfortable. At one end of the line there is a purple poster and at the other end there is an orange poster. If you tend to agree with a statement you will stand closer to the purple poster. If you tend towards disagreement then stand closer to the orange poster. There can also be a 'white' poster in the middle where you will go if you don't know or have no opinion or choose to pass.

Municipal water is safer than bottled water

- Yes (*purple*) or no (*orange*)?

Clean water provides economic benefits

- Yes (*purple*) or no (*orange*)?

‘Water quality is improving in your watershed’

- Yes (*purple*) or no (*orange*)?

Governments should put more money into water protection programs

- Yes (*purple*) or no (*orange*)?

Municipal water treatment is already doing enough to protect us from chemicals in the water

- Yes (*purple*) or no (*orange*)?

**This generation is doing more to
protect sources of water than previous
generations**

- Yes (*purple*) or no (*orange*)?

Landforms and geology can play a major role in affecting water quality

- Yes (*purple*) or no (*orange*)?

The level of iron in our drinking water is acceptable

- Yes (*purple*) or no (*orange*)?

The level of lead in our drinking water is acceptable

- Yes (*purple*) or no (*orange*)?

Landowners and businesses are already doing enough to protect drinking water sources

- Yes (*purple*) or no (*orange*)?

As an individual you can personally do more to protect water sources

- Yes (*purple*) or no (*orange*)?

Drinking water standards are too stringent

- Yes (*purple*) or no (*orange*)?

Municipal water treatment protects us from cryptosporidium

- Yes (*purple*) or no (*orange*)?

What's in your water?

What is the chemical
make-up of water?

What's in your water?

What is pure water?


Does 'pure' water exist?

What's in your water?

What things should be in
your drinking water?



What's in your water?



What things should *not*
be in your drinking
water?

What are the two main types of contaminants?

- C - - - - -
- P - - - - -

Chemicals

- Less than two years after the Walkerton tragedy, more than 1,000 boil-water advisories are active across Canada — and for good reason too. Dangerous pollutants continue to contaminate the water. For example, the pathogen cryptosporidium has seeped into the drinking water in North Battleford, Saskatchewan. The industrial **chemical** Trichloroethylene has crept into the water wells in Beckwith, Ontario. And in Liberty, Saskatchewan, the hazardous chemical trihalomethanes has seeped into the water system.
- **'Is Canada's Drinking Water Safer?', broadcast January 18, 2002, Canadian Broadcasting Corporation**

Pathogens

- “The emergence and spread of infectious disease in plant, animal and human populations is a problem in Canada and around the world. Water is a common element in the ecology of many pathogens affecting these populations. Waterborne **pathogens** can pose threats to drinking water supplies, recreational waters, source waters for agriculture and aquaculture, as well as to aquatic ecosystems and biodiversity. The World Health Organization has stated that infectious diseases are the world’s single largest source of human mortality (WHO 1996). Many of these infectious diseases are waterborne and have tremendous adverse impacts in developing countries. While developed countries have been more successful in controlling waterborne **pathogens**, water quality problems are still prevalent in Canada and the United States.”
 - from article, ‘**Waterborne Pathogens in Canada**,’ **Environment Canada (2007)**

What are 'point' and 'non-point' sources of potential contamination?



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| Point Source Pollution | Non-Point Source Pollution |
|--|--|
| <p>From pipe or drain</p> <p>Wastewater treatment plant</p> <p>Municipal landfill</p> <p>Industrial waste disposal</p> | <p>Runoff carrying pollution</p> <p>Fertilizers and pesticides</p> |

**Are there chemicals or pathogens that
municipal water treatment alone can't
eliminate?**



Cryptosporidium

- “Boiling is still considered the safest way to deal with the *Cryptosporidium parvum* (a toxic microbial life form) problem. Chlorinating the water won't kill it, nor will ozone or iodine. And there is no medicine that will clear it up once it gets into your body. You simply have to let it run its course. As well, you can get it not only from your kitchen tap, but also by swimming in a backyard pool, for example.”

Unit 2 – Geography's Relationship with Water Quality

- Landforms and geology
- Land use
- The role of sensitive landscapes
- Drainage modifications
- How water becomes contaminated

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DRINK SOURCE

ACT

When you're washing your car in the driveway, remember you're not just washing your car in the driveway.



R ON

When your pet goes on the lawn, remember it doesn't just go on the lawn.



When you're fertilizing the lawn, remember you're not just fertilizing the lawn.



When your car's leaking oil on the street, remember it's not just leaking oil on the street.



Water Quality

Pathways

- Which driveway is more likely to pass contaminants to water sources?



What are three main impacts water contamination can have?

What are three main impacts water contamination can have?

- Persistent
- Non-Persistent
- Eutrophication

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| Persistent | Non-Persistent | Eutrophication |
|--|----------------|----------------|
| | | |
| <p>Cleaning agents (residential), Cleaning agents (business and industry), Petroleum, Petroleum Products, Domestic Sewage, Metals (Lead), Metals (Mercury), Metals (Cadmium), Caffeine, Foam, Radioactive Materials, Floating Debris, Thermal Pollution, Industrial Wastes, Nutrients (Phosphorous), Nutrients (Nitrogen), Fertilizers, PCBs, Dioxins, Leachate, Chloride, Pesticides and other chemicals (Lawn), Pesticides and other chemicals (Industry), Pesticides and other chemicals (Agriculture), Septage from leaking septic systems, Road salt and sand, Factory discharges</p> | | |

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| Persistent | Non-Persistent | Eutrophication |
|--|-----------------|-----------------|
| Pesticides | Domestic sewage | Domestic sewage |
| <p>Cleaning agents (residential), Cleaning agents (business and industry), Petroleum, Petroleum Products, Domestic Sewage, Metals (Lead), Metals (Mercury), Metals (Cadmium), Caffeine, Foam, Radioactive Materials, Floating Debris, Thermal Pollution, Industrial Wastes, Nutrients (Phosphorous), Nutrients (Nitrogen), Fertilizers, PCBs, Dioxins, Leachate, Chloride, Pesticides and other chemicals (Lawn), Pesticides and other chemicals (Industry), Pesticides and other chemicals (Agriculture), Septage from leaking septic systems, Road salt and sand, Factory discharges</p> | | |

Fill in the Blanks

- _____ is the trigger for photosynthesis in plants. This results in the creation of oxygen.

Fill in the Blanks

- **Sunshine** is the trigger for photosynthesis in plants. This results in the creation of oxygen.

Fill in the Blanks

- _____ uses oxygen to break down plant and animal waste.
- This creates nutrients and _____.

Fill in the Blanks

- **Bacteria** uses oxygen to break down plant and animal waste.
- This creates nutrients and **carbon dioxide**.

+ and –



- What are ways plants and animals have a negative impact on water quality or be indicators of poor water quality?
- What are ways plants and animals can have a positive impact on water quality or be indicators of good water quality?

+ and –

- Are there positive benefits of phosphorous and nitrogen?
- What happens if there is too much phosphorous and nitrogen in our sources of water?

Unit 3 – Groundwater and Surface Water Quality in Ausable Bayfield and Maitland Valley

- Overview and assessment

Indicator

- An indicator is a certain chemical, organism or characteristic that is used to determine and monitor changes in environmental conditions.
- *Add this to your Glossary.*

Indicators in the Source Protection Region

- Name three indicators/contaminants that have been flagged for attention in the Ausable Bayfield Maitland Valley study area based on technical studies prepared for the local planning project.

1)

2)

3)

4)

Indicators in the Source Protection Region

- Name three indicators/contaminants that have been flagged for attention in the Ausable Bayfield Maitland Valley study area based on technical studies prepared for the local planning project.

1) Nitrates

2) Total Phosphorous

3) Suspended Sediment

4) Bacteria

Indicators

- Nitrates
- Hardness
- Fluoride
- Iron
- Sodium
- Chloride
- E. coli

Surface Water Indicators

- Chloride
- Copper
- Nitrate
- Total phosphorous
- Suspended sediment
- Fecal coliform and E. coli

Chloride

- Highest levels at Maitland in Goderich

Nitrate

- Concentrations increasing



Factors influencing water quality

- Pathways – Landforms and Geology (Land slope, soil, permeability)
- Land use and management
- Sensitive landscapes (e.g., sinkholes)
- Drainage modifications

Fecal coliform and E. coli

- Concentrations fluctuate
- Data incomplete
- High concentrations in some areas
- Decline in Upper Ausble

Suspended Sediment

- Can destroy aquatic and spawning habitat
- Erosion control efforts and agricultural improvements may have led to improvements
- High in Parkhill watershed

Copper

- Increasing trend at Boyle Creek.

Unit 4 – Wrapping it up

- Where do you stand now?
- Field learning
- Self-assessment on learning goals
- More help

Module Three: Water Quality

Section Two – Priming the Pump

- See Module 3

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Thank you!

- Any questions?

