TEACHER NOTES

Section 01: The Issue Harmful Algal Blooms

The Toledo Water Crisis

HAB is short for ____ Harmful Algae Bloom ___.

In 2014 __ 400 000 __ people were without drinking water for 3 days, because of the HAB's in Lake Erie.

Doug Wagner Interview

The process to clean the water from start to finish is approximately ___ 18 __ hours.

The toxin that shut down the water supply was ___ microcystin ____.

The city of Toledo demand was unusually ___ high ___ during that time of year, and the water was moving through the treatment plant more quickly not allowing the ___ treatment__ time to work.

They decided to add __ozone__ to the process after the Toledo shutdown.

Lake Erie History

Which Great Lake is most shallow? ____ Lake Erie___

List ways humans have impacted Lake Erie and what impact they have had: Students can list several answers about the land being developed causing changes that impacted the lake.

Three invasive species that have entered Lake Erie are: lamprey, zebra mussels and alewife

How do farmers scientifically know which fertilizers to use and how much to apply to their field? __soil testing ___

Review

What is one of the challenges facing Lake Erie today?

Who or what is affected by this challenge?

Section 2: Science of Harmful Algal Blooms

H2Know Podcast: Part 1- Tom Bruulsema

What nutrient is a limiting factor for algal growth? Phosphorus

Why is the western basin of Lake Erie prone to algal blooms? Shallow and warm water

What are two sources of phosphorus mentioned in the podcast? Farmland and Waste Water Treatment

What is the correlation between the amount of precipitation/water run off between March and July and the size/severity of algal bloom in summer and fall? The more precipitation and runoff the larger the algal bloom in summer/fall.

Algal Bloom Images

What do you notice is similar in each photo?

Why is knowing the depth of the lake important?

H2Know Podcast: Part 2- Tom Bruulsema

What were some sources of phosphorus prior to 1970's? Detergents, waste water, farmland

By the 1980's, algal blooms occurred less often and with less severity. What steps had been taken to achieve that success? Preventing soil erosion, making detergents phosphate free, improving waste water treatment

Although phosphorus loads entering the watersheds was lower, Lake Erie started experiencing severe algal blooms again beginning in 2010. What is the cause? Dissolved phosphorus from agricultural land.

What did **Edge of Field** research discover and based on these discoveries what were their recommendations? Phosphorus was coming off the fields. They recommended the use of 4R Nutrient Stewardship practices (Right Source, Right Rate, Right Place and Right Time). Example: Right Place – applying fertilizer into the soil instead of broadcasting on top of the soil.

Review

What makes Lake Erie an ideal environment for HABS?

What is the primary nutrient that create an algae bloom?

Section 3: Western Lake Erie basin Watershed Dynamics

Watershed Lesson

A watershed is a land area that drains into a specific __stream ____, ___river__, __lake__ or ___ other body of water___.

If a watershed is in an urban area, the impacts come from ___ traffic streets ___, ___lawn care___ and ____ industrial sites ____.

If a watershed is in a rural area, the impacts come from __ manure___ , ___septic___ and __ farming___.

Which area has the highest amount of runoff? Urban, Suburban or Rural (circle one)

Topography is the __shape__ of the ground.

What impact does topography have on runoff? _____
_____

Review

Using the Ontario Flow Assessment Tool explore the Canadian side of Lake Erie to identify watersheds and the direction of water flow.

Make a comparison with the land use and phosphorous loading map and answer the following questions:

1. What are some possible areas of concern in the region? Why? (Include water flow direction, land use, phosphorous loads) Answers may vary.

2. What other substances may travel with the water as it moves through the watershed? Answers may vary.

3. Although the Thames River does not directly flow into Lake Erie, how does it contribute to nutrient loading in Lake Erie? It flows into Lake St. Clair which flows into Lake Erie.

Section 4: Agricultural Research and Management Practices

Overview of the 4R Nutrient Stewardship

What are the 4R's of nutrient stewardship? Right source, right rate, right time, and right place

Right Source –

Right Rate -

Right Time –

Right Place –

Farmers are NOT losing a lot of nutrients they are only losing on average__ 2 – 3 _%

That means farmers have a __95% __% efficiency rate.

Agricultural Use of Fertilizer and the 4R Strategies- Colin Elgie

What are the 3 macronutrients? __nitrogen__, __phosphorus__ and __potassium__

Why is soil sampling important? It ensures that farmers utilize the right rate (amounts) of specific nutrients. Enough to ensure proper plant growth, not too much that it enters the watershed.

How does the application of nutrients at the **right time** prevent nutrients from being lost?

Applying nutrients at the right time ensures they are present when the plant can utilize it and when there is less chance the nutrients will get washed away with spring melt/runoff.

How do 4R Nutrient Stewardship practices help food production, the environment, and farmers?
Higher yields on a smaller footprint of land, less nutrients entering watersheds and higher margin of profit for farmers.

Watershed Dynamics and Theories – Dr. Merrin Macrae

What is the difference between particulate phosphorus and dissolved phosphorus?

Particulate phosphorus attaches to the particles of soil whereas the dissolved phosphorus is found in the water runoff from the field.

What is the relationship between the slope of the land and the type of the phosphorus seen in nearby waters? Why?

The steeper the slope the more particulate phosphorus seen in nearby waters. Runoff water moves faster down steep slopes and can carry heavier particles.

How does climate change affect the amounts of phosphorus ending up in watersheds?

Amount of precipitation, timing of precipitation and melts.

Edge of Field of Research

What is the objective of **Edge of Field Research**?

Quantify impacts, how the type of field management practices can affect phosphorus levels in nearby watersheds.

What factor do Canadian researchers in particular, focus their investigations? What have they observed?

They have investigated the effect of snow melt/runoff on amounts of phosphorus leaving fields. They have found that these are the peak times of nutrient run off.

Managing the Risk of Phosphorus Runoff- Kevin McKague

What actions were taken after the 70's to lesson the phosphorus overload?

Removal of phosphorus from detergents, improvements to wastewater treatment, reduction soil erosion, and subsequent loss of phosphorus from the field.

What is PLATO? Describe how farmers can use Plato to help nearby watersheds.

PLATO is a Phosphorus Loss Assessment Tool for Ontario. Farmers can input information about their field, their crop, their nutrient application (source/rate/timing/place) in order to find out the risk index of phosphorus loss. This allows farmers to make changes to reduce phosphorus loss to nearby watersheds.