How is the story being told? The importance of appropriately synthesizing data and information

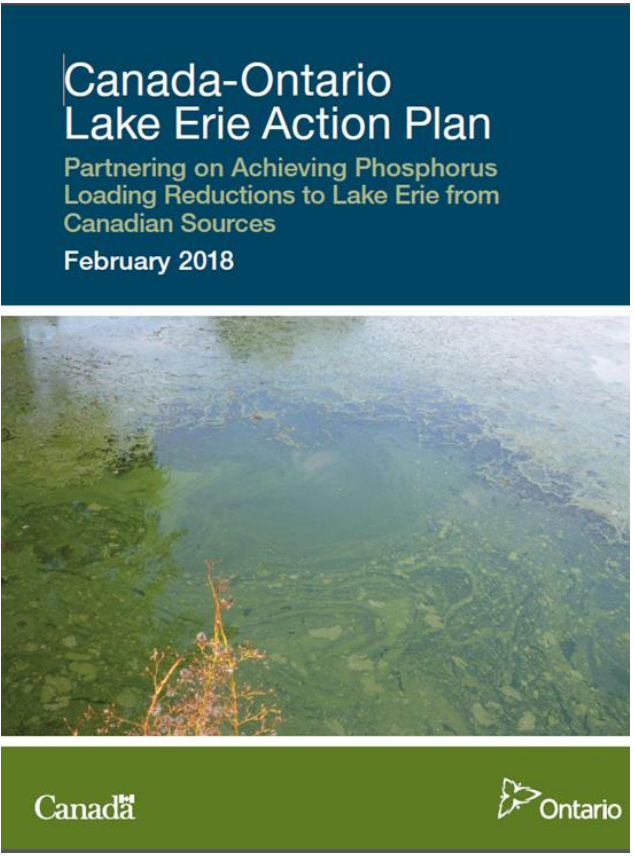
2018 Toronto RAP Science Seminar

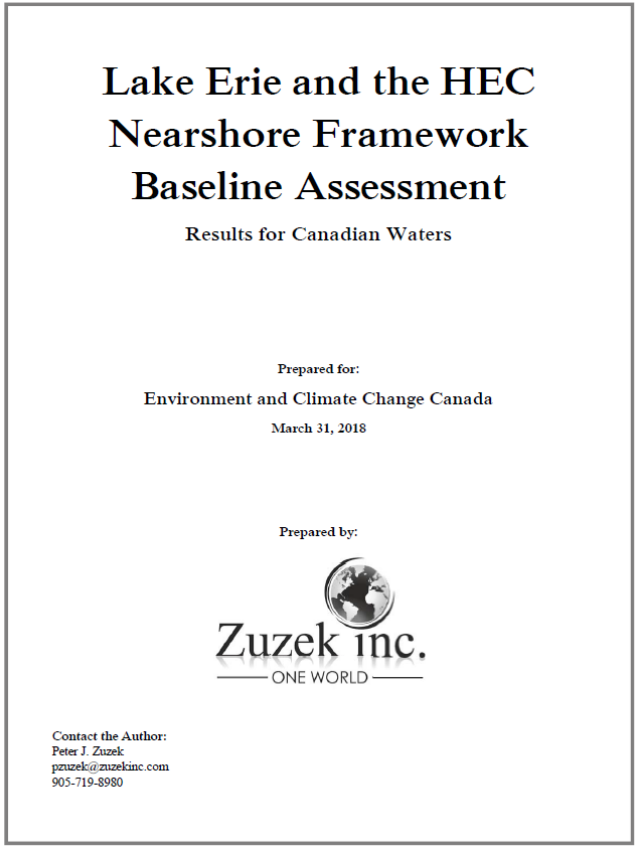
Mary Thorburn
Ministry of the Environment, Conservation and Parks
November 21, 2018

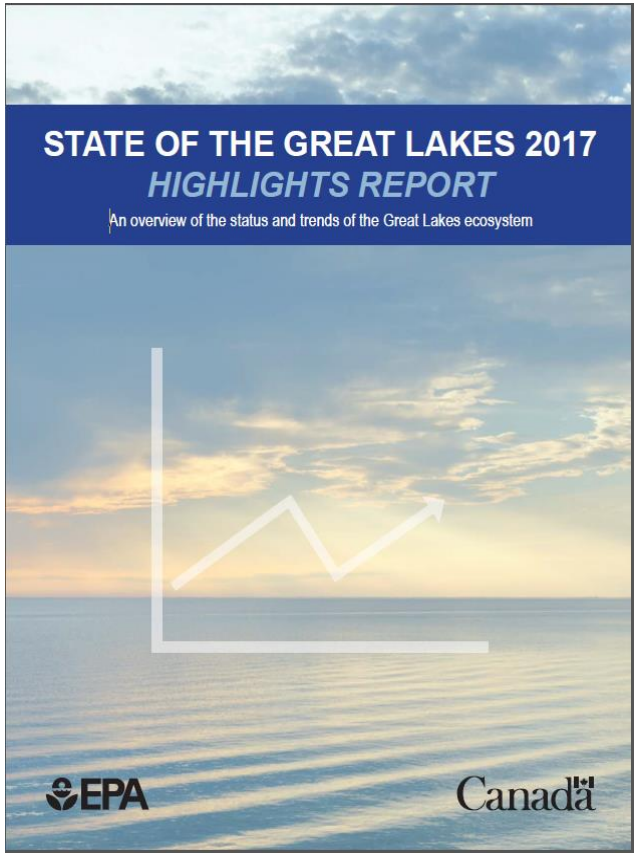
Advantages of Synthesizing Data and Information

- Integrating information from different locations, spatial and temporal scales and fields of study enables a better understanding of what is going on in the system (Great Lakes basin scale, lake scale, nearshore, and watershed scale).
- Combining different data and information sets improves the over all analysis and interpretation (often provides a more complete picture).
- Leveraging data and information from a wider group of potential partners enhances knowledge transfer, decision-making and policy development.
- Enables better coordination of monitoring and surveillance efforts to maximize value of the data.

Recent Examples of Synthesized Data & Information



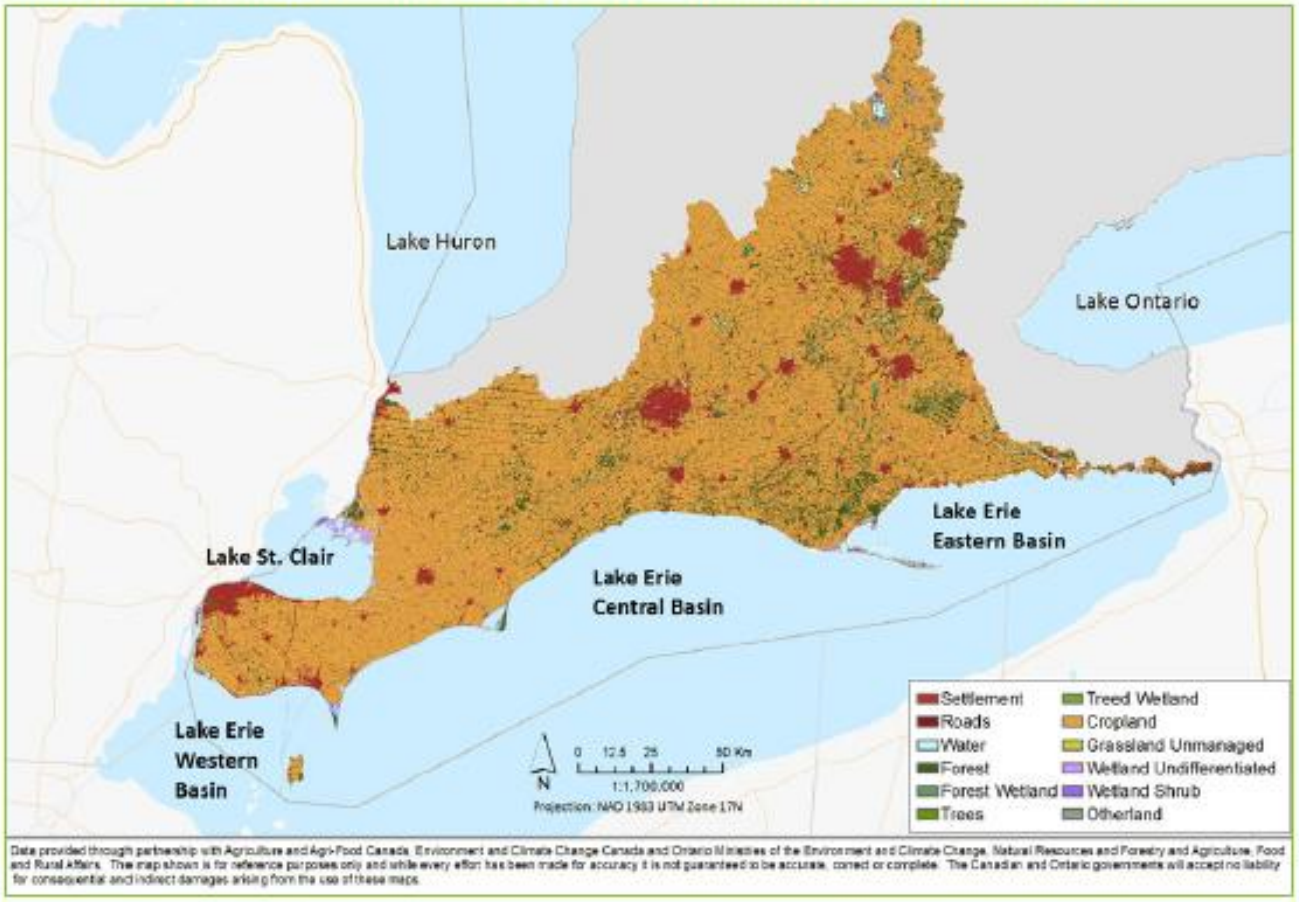




Canada-Ontario Lake Erie Action Plan

Staff from 5 federal and provincial agencies were asked to compile and assess existing data and information to characterize geographic areas within the Canadian side of the Lake Erie basin

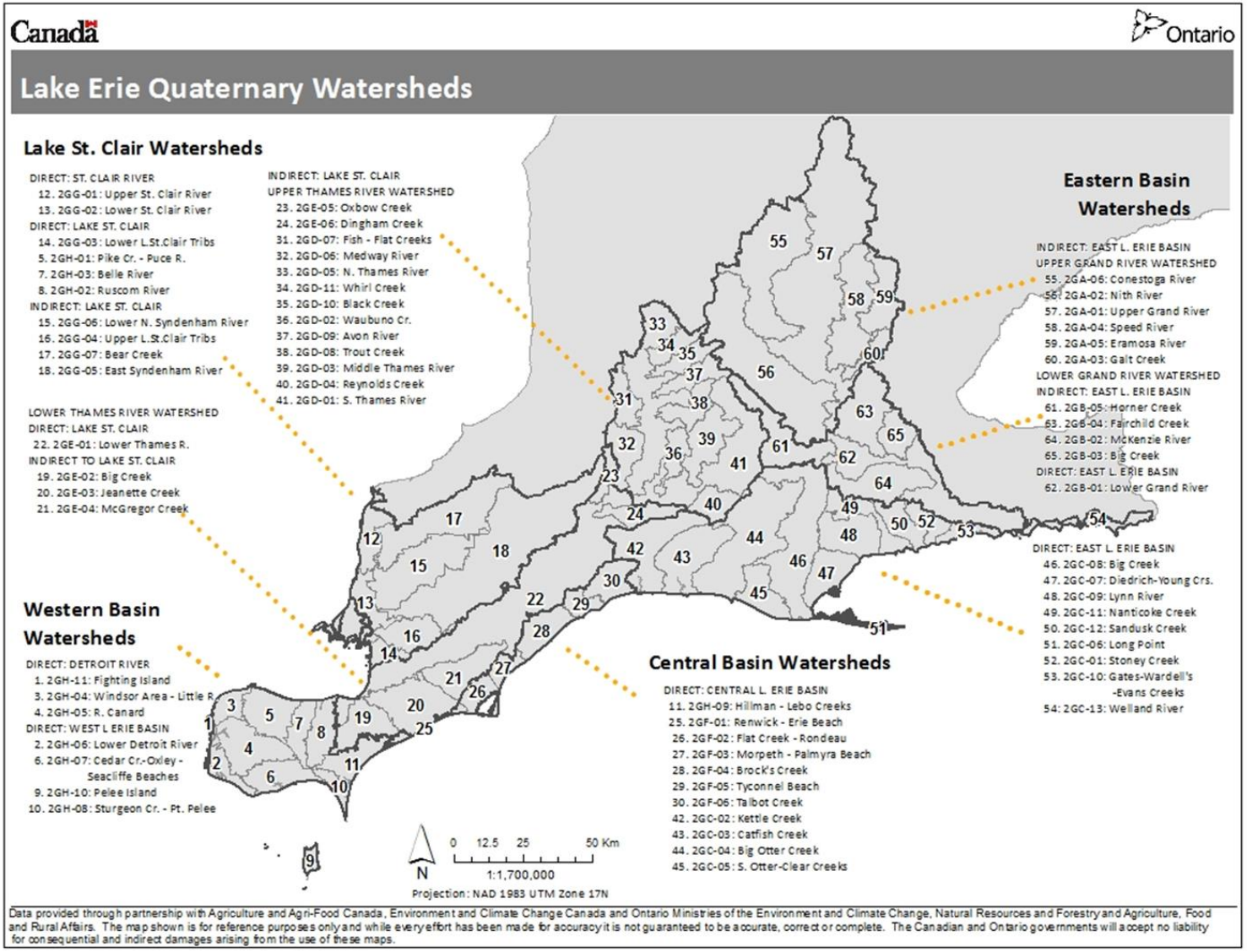
FIGURE 4: Overview of land use and land cover in the Lake Erie basin, 2010.



Data provided through partnership with Agriculture and Agri-Food Canada, Environment and Climate Change Canada and Ontario Ministries of the Environment and Climate Change, Natural Resources and Forestry and Agriculture, Food and Rural Affairs. The map shown is for reference purposes only and while every effort has been made for accuracy it is not guaranteed to be accurate, correct or complete. The Canadian and Ontario governments will accept no liability for consequential and indirect damages arising from the use of these maps.

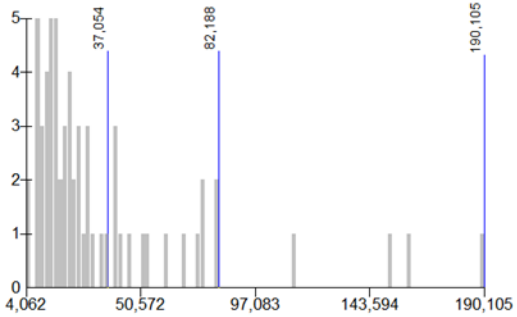
Source: Agriculture and Agri-Food Canada

Data and Information Selection Criteria



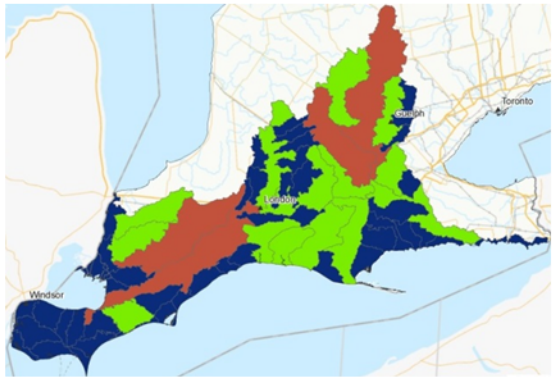
For each of the 35 parameters:

- Assessed the distribution among all watersheds in the Lake Erie basin
- Created 3 classes (high, medium, low) for each parameter based on the distribution ("clustering") of the data among all of the 65 Lake Erie watersheds using statistical methods



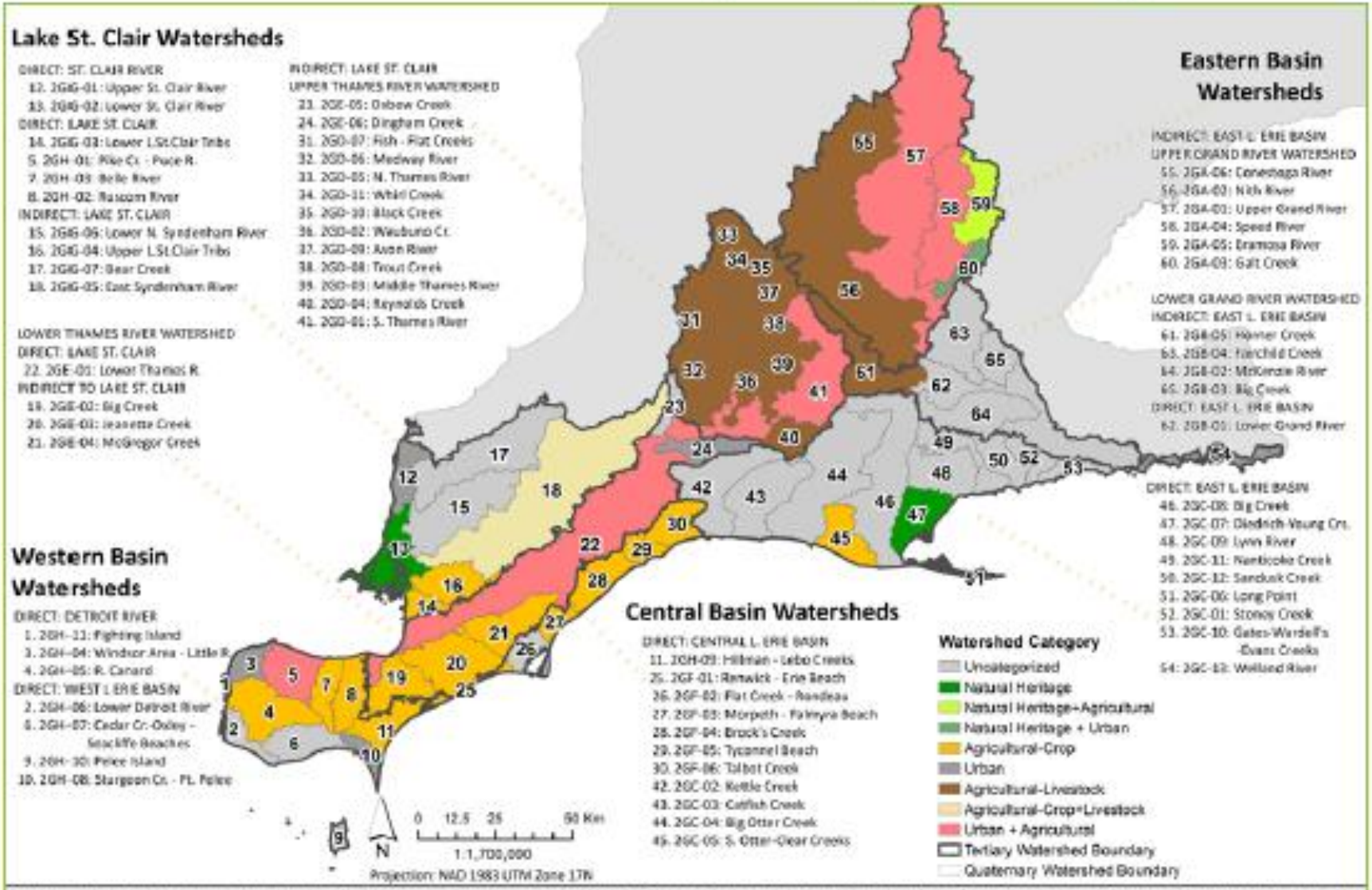
Watershed size

- High
- Medium
- Low



- This means there is ***no inherent value judgement for any class*** (H, M, L) *except* where pre-determined thresholds were available
- Pre-determined thresholds were used for 3 parameters:
  - water quality, % natural heritage cover and risk of soil erosion

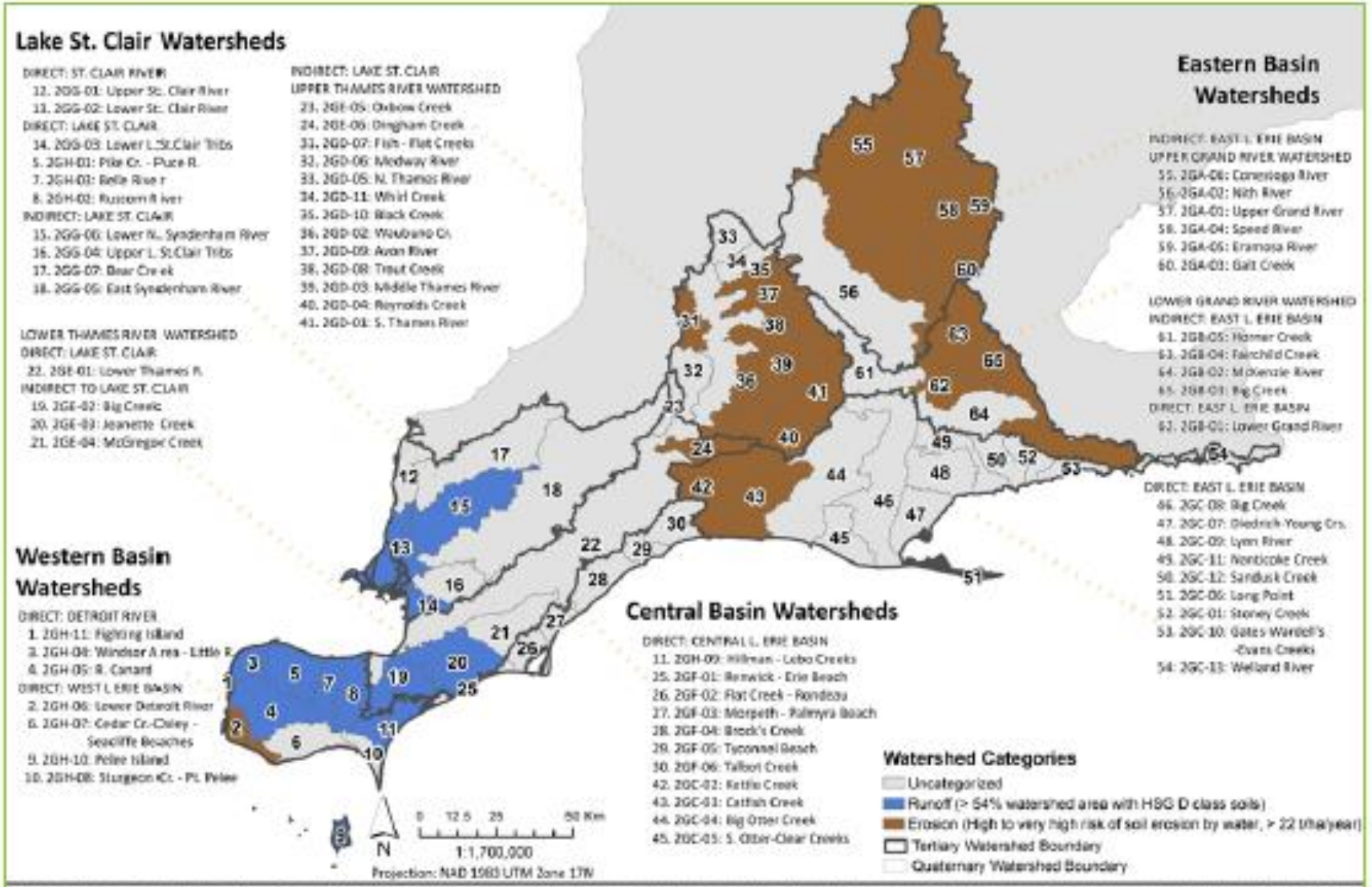
FIGURE 5: Lake Erie basin watersheds categorized by land use/activity.



Data provided through partnership with Agriculture and Agri-Food Canada, Environment and Climate Change Canada and Ontario Ministries of the Environment and Climate Change, Natural Resources and Forestry and Agriculture, Food and Rural Affairs. The map shown is for reference purposes only and while every effort has been made for accuracy it is not guaranteed to be accurate, correct or complete. The Canadian and Ontario governments will accept no liability for consequential and indirect damages arising from the use of these maps.

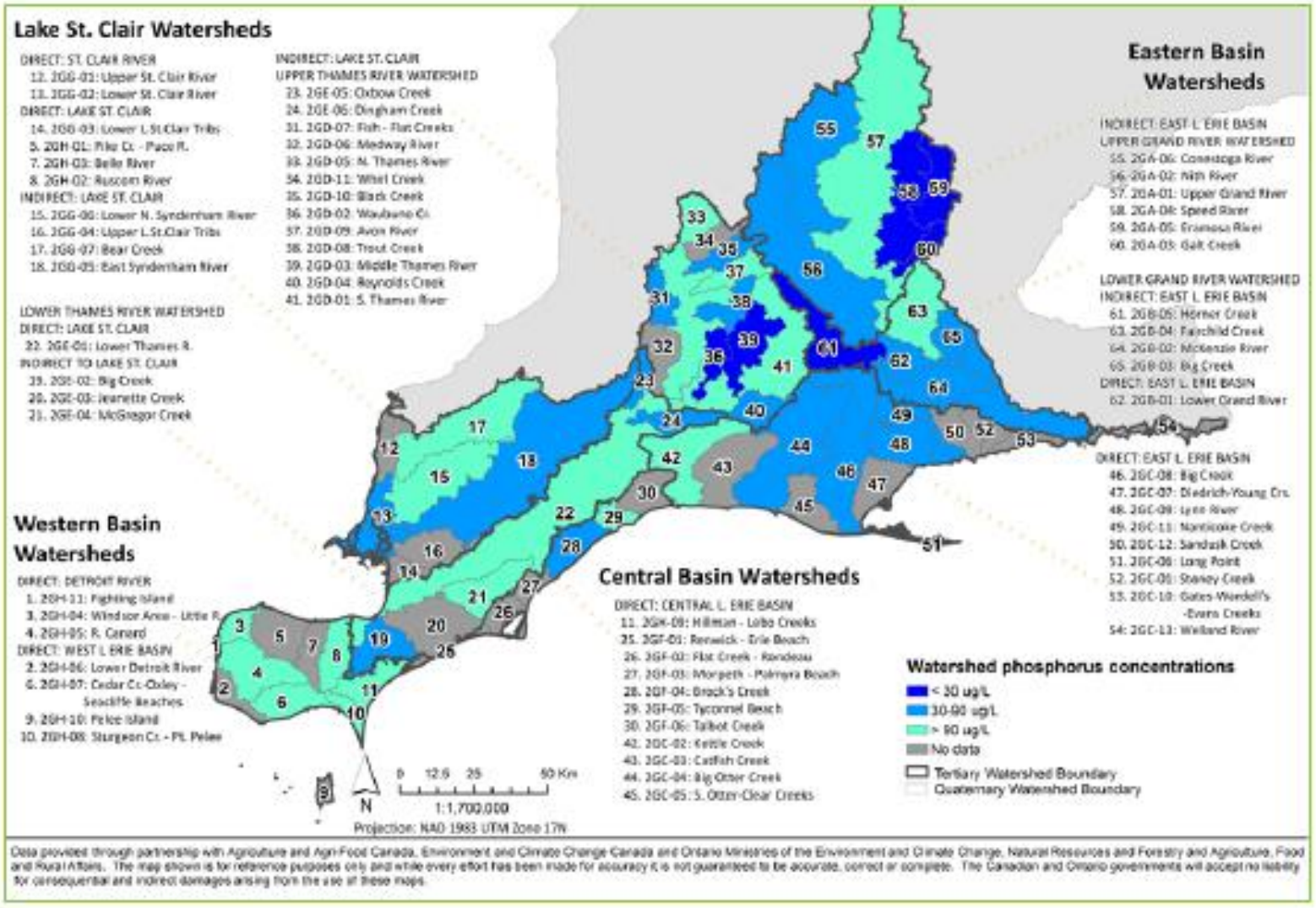
Source: Agriculture and Agri-Food Canada

FIGURE A.1: Quaternary watersheds of the Lake Erie basin categorized by soil and landscape features related to phosphorus transport pathways of runoff and erosion.



Data provided through partnership with Agriculture and Agri-Food Canada, Environment and Climate Change Canada and Ontario Ministries of the Environment and Climate Change, Natural Resources and Forestry and Agriculture, Food and Rural Affairs. The map shown is for reference purposes only and while every effort has been made for accuracy it is not guaranteed to be accurate, correct or complete. The Canadian and Ontario governments will accept no liability for consequential and indirect damages arising from the use of these maps.

FIGURE A.2: Quaternary watersheds of the Lake Erie basin categorized by the average quaternary watershed concentration (average of the maximum median over the period of 2009–12) of total phosphorus derived from the Ministry of the Environment and Climate Change Provincial Water Quality Monitoring Network.



Data provided through partnership with Agriculture and Agri-Food Canada, Environment and Climate Change Canada and Ontario Ministries of the Environment and Climate Change, Natural Resources and Forestry and Agriculture, Food and Rural Affairs. The map shown is for reference purposes only and while every effort has been made for accuracy it is not guaranteed to be accurate, correct or complete. The Canadian and Ontario governments will accept no liability for consequential and indirect damages arising from the use of these maps.

Characterization process highlighted data gaps

Water Quality Data

- measured P loading data
- good for base flow conditions but not for spring/storm runoff events,
- 35 % of watersheds have no data

Soil Phosphorus

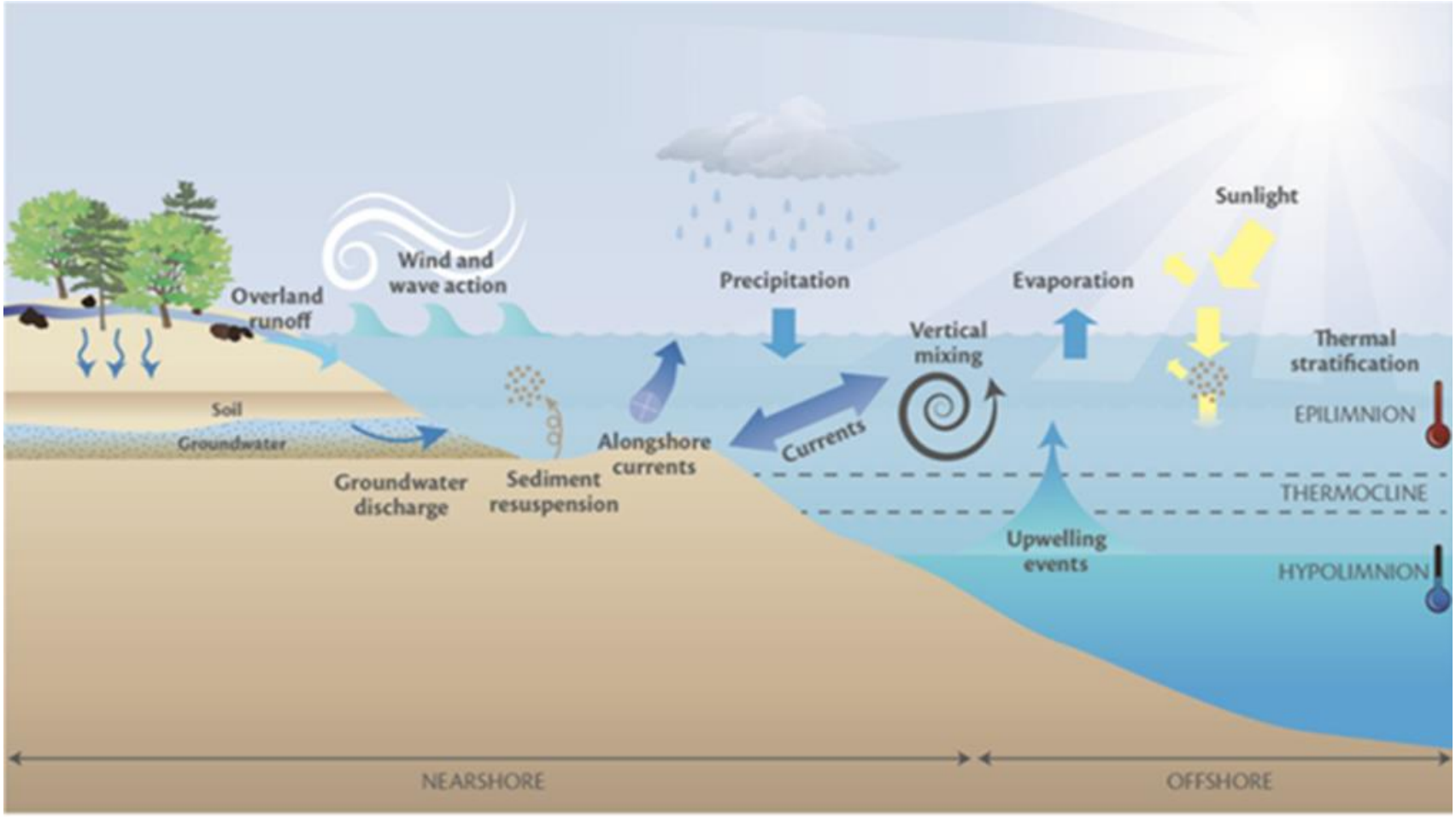
- Accessible soil phosphorus data at the basin wide scale (currently most of the data is privately held and often not geo-referenced)

Land Management Data

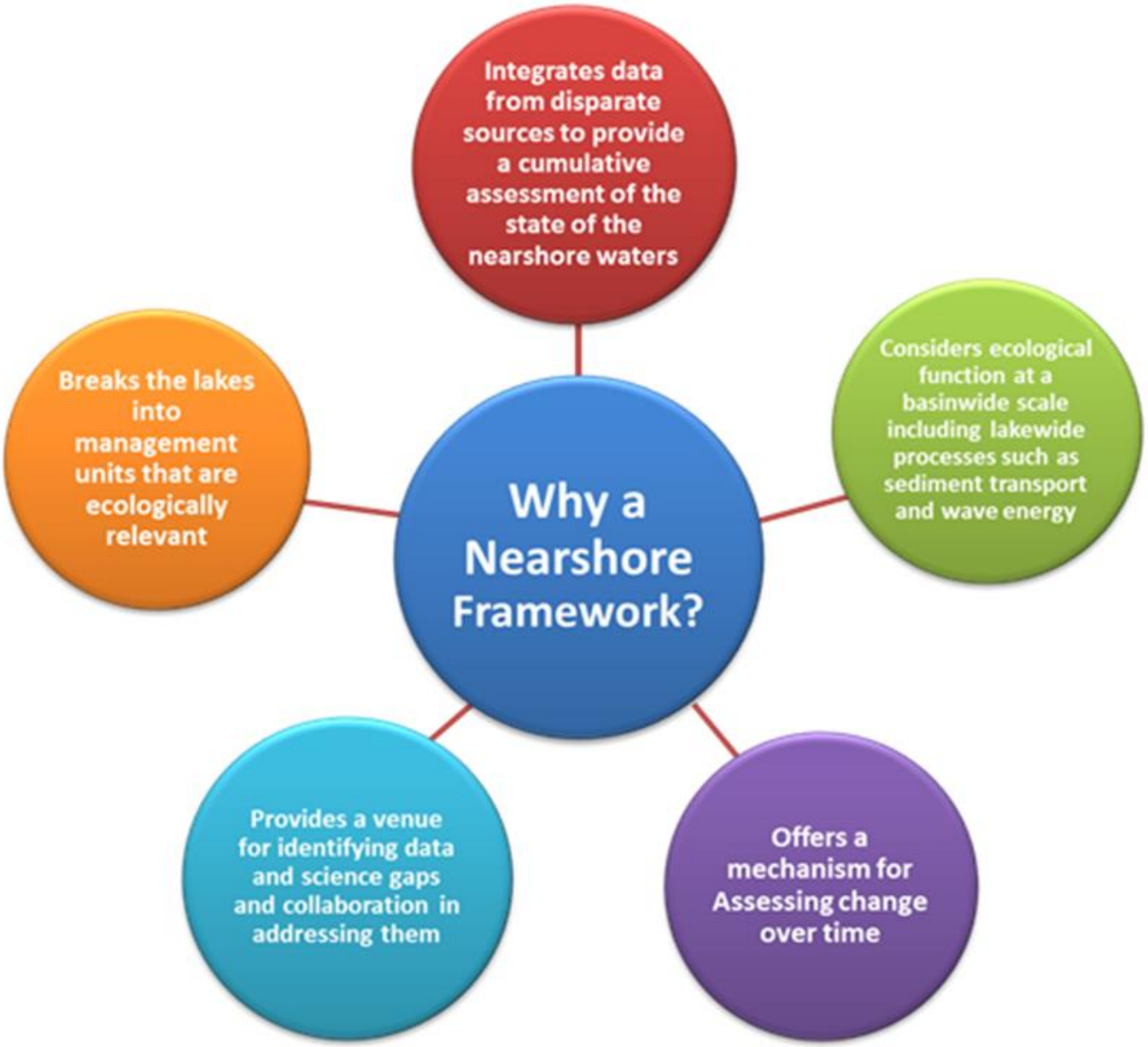
- consistent quaternary (sub)watershed-level data on urban and agricultural land management activities

Great Lakes Nearshore Framework

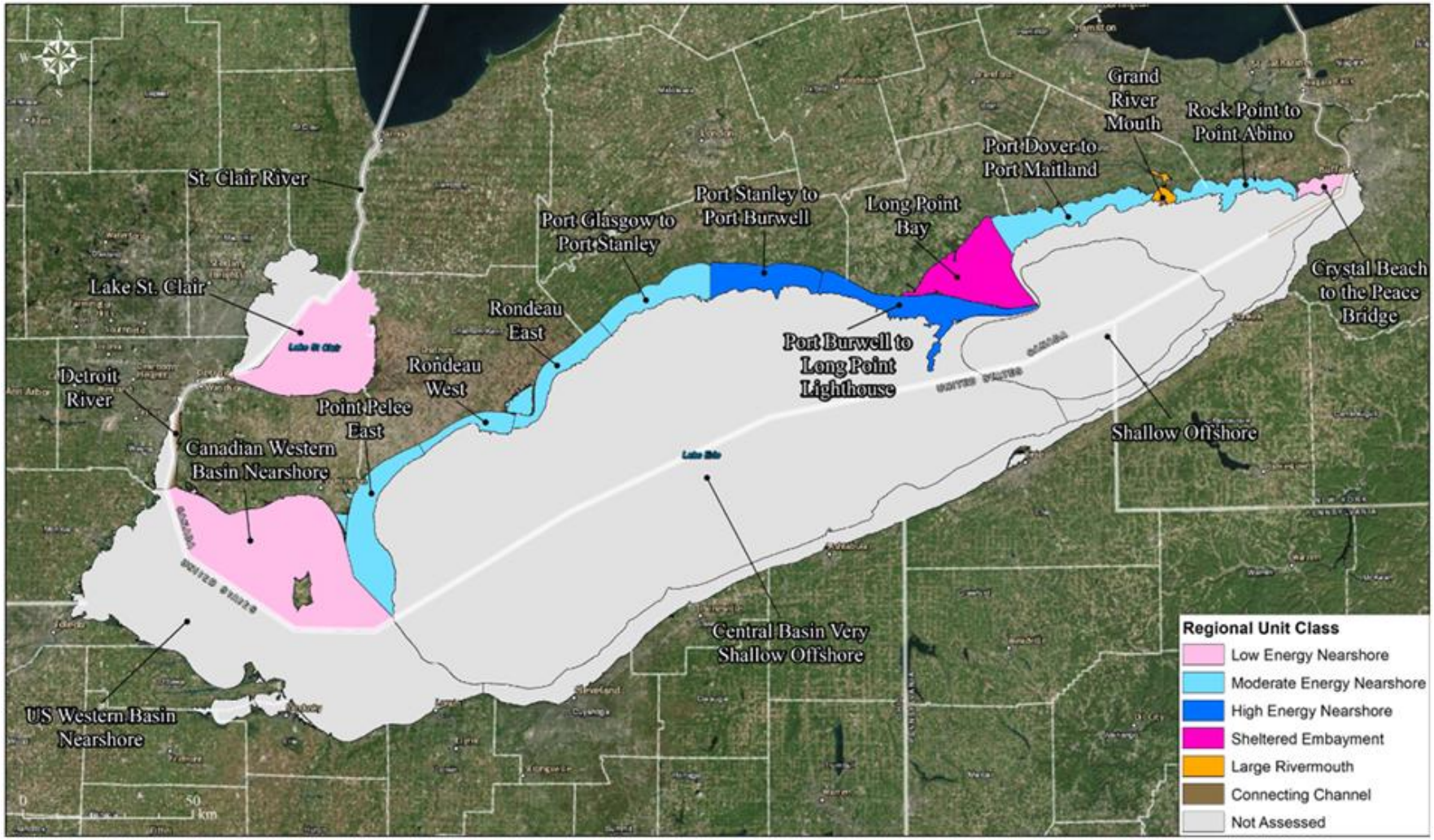
Improved ecological health of nearshore areas through assessment, identification of priority areas and integrated management, including prevention, restoration and protection



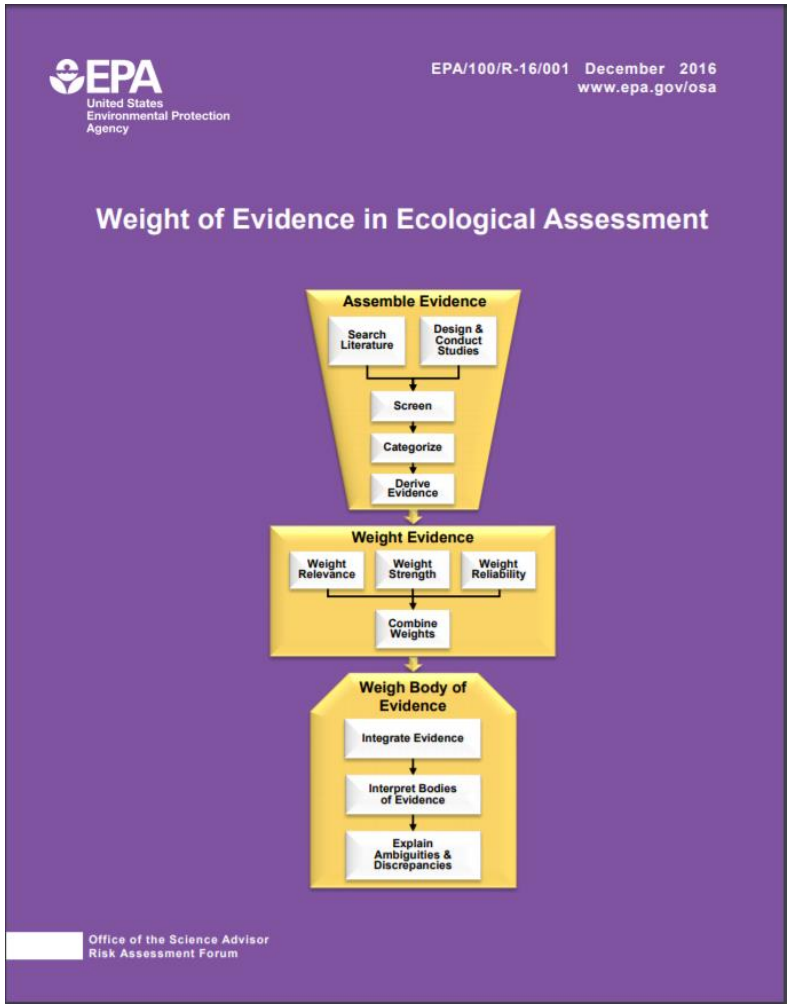
Key natural processes occurring within coastal zone of Great Lakes (Great Lakes Coastal Framework 2014).


Why a Nearshore Framework?
Integrates data from disparate sources to provide a cumulative assessment of the state of the nearshore waters
Considers ecological function at a basinwide scale including lakewide processes such as sediment transport and wave energy
Offers a mechanism for Assessing change over time
Provides a venue for identifying data and science gaps and collaboration in addressing them
Breaks the lakes into management units that are ecologically relevant

Draft Nearshore Assessment
Phase 1: Delineation of the Nearshore



Draft Nearshore Assessment
Phase 2: Condition Assessment



Followed the US EPA weight evidence approach.

Guided by the following principals:

- Transparent (for data, decision making and reporting)
- Sensitive (variables and scoring approach can discriminate)
- Operational (data available for baseline and repeat surveys)
- Adaptive (variable, data and methods will improve overtime)

Aligns with the Great Lakes Water Quality Agreement Objectives

Physical Processes, Connectivity and Habitat

Shoreline Hardening & Littoral Barriers

Source Data: Google Earth Imagery interpretation.
Date Range: 2013-2017

Criteria:

Red - 2 or more barriers, regardless of armouring. Or >50% armoured and 1 or more littoral barriers.

Yellow - Less than 25% armoured but one littoral barrier. Or 25 to 50% armoured and 0 to 1 littoral barrier.

Green - Less than 25% armoured and no littoral barriers.

Tributary Connectivity

Source Data: Ontario Hydro Network, Ministry of Natural Resources and Forestry
Date Range: last updated Feb. 2017

Criteria:

Red - Less than 25% of tributaries hydraulically connected to the lake.

Yellow - 25 to 75% of tributaries hydraulically connected to the lake.

Green - Greater than 75% of tributaries hydraulically connected to the lake.

Wetland Condition

Source Data: MNRF 2018 Ecological Land Classification and historical wetland mapping from the Coastal Wetland Monitoring Program.
Date Range: Historical and 2018 (from 2015 imagery).

Criteria:

Red - No score of Red assigned since a regional unit should not be penalized if the geo-physical conditions don't support the creation of wetlands.

Yellow - Four regional units feature between 2% and 5% of the coastal wetlands in the study area and thus receive a yellow.

Green - Two regional units each feature ~40% of all the coastal wetland in the study area and thus receive a green.

CATEGORY SCORE

Water and Sediment

Sediment Quality

Source Data: Ministry of the Environment and Climate Change
Date Range: 2004 to 2014

Criteria:

Red - Greater than 40 Lowest Effect Level (LEL) exceedances for MOECC Sites from 2004 to 2014.

Yellow - 20 to 40 Lowest Effect Level (LEL) exceedances from MOECC Sites from 2004 to 2014.

Green - Less than 20 Lowest Effect Level (LEL) exceedances for MOECC Sites from 2004 to 2014.

Benthos

Source Data: Ministry of the Environment and Climate Change
Date Range: 2004

Criteria:

Red - Median quality of benthic communities in regional unit sites less than 33rd percentile of range of quality across all sites.

Yellow - Median quality of benthic communities in regional unit sites between 33rd and 67th percentiles of range of quality across all sites.

Green - Median quality of benthic communities in regional unit sites greater than 67th percentile of range of quality across all sites.

CATEGORY SCORE

Water Quality

Source Data: MOECC Nearshore Monitoring Stations (15)
Date Range: 2001 to 2016

Criteria:

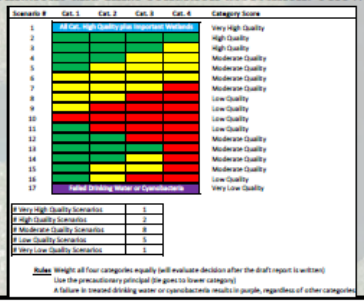
Red - More than 2 mercury exceedances (0.026 ug/L) in water samples.

Yellow - 1 to 2 mercury exceedances (0.026 ug/L).

Green - No mercury exceedances in water samples.

2018 CONDITION ASSESSMENT: TBD

Overall Condition Assessment based on equal weighting of four category scores. See the range of colour combinations and final condition assessment below.



Satellite Cyanobacteria Index

Source Data: NOAA
Date Range: 2012 to 2017 (10 day composites)

Criteria:

Red - CI greater than 100 with area 2% or greater. For the Western Basin and Detroit River, area is 20% or greater.

Yellow - n/a

Green - World Health Organization exceedances (1 ug/L / 100 CI) within Regional Unit less than 2%. For the Western Basin and Detroit River, the threshold is less than 20%.

Satellite Derived Chl

Source Data: Environment and Climate Change Canada
Date Range: 2017 (bi-monthly composites)

Criteria:

Red - average concentration greater than 6 ug/L for two or more consecutive bi-monthly composites for Lake St. Clair, Detroit River, and Western Basin. Greater than 2.6 ug/L for St. Clair River. Greater than 3.6 ug/L for the Central and Eastern Basin.

Yellow - n/a

Green - average concentration less than 6 ug/L for Lake St. Clair, Detroit River, and Western Basin. Less than 2.6 ug/L for the St. Clair River. Less than 3.6 ug/L for the Central and Eastern Basin.

Dissolved Oxygen and Hypoxia

Source Data: Environment and Climate Change Canada
Date Range: 2004, 2012 to 2014

Criteria:

Red - One or more point samples less than 2 mg/L.

Yellow - One or more point samples between 2 and 6 mg/L.

Green - All point samples greater than 6 mg/L.

CATEGORY SCORE

Nutrients

Treated Drinking Water

Source Data: MOECC monitoring of treated drinking water according to Ontario Regulation 169/03.
Date Range: 2013 to 2017

Criteria:

Red - Adverse Water Quality Incidents for treated drinking water lasting two days or longer.

Yellow - n/a

Green - No Adverse Water Quality Incidents or no Adverse Water Quality Incidents lasting longer than one day.

Beach Postings

Source Data: Beach Postings by the Public Health Unit.
Date Range: 2015-2016 (only July and Aug., peak usage)

Criteria:

Red - posting greater than 30% of the time. Overall score based on average of raw data.

Yellow - posting between 5% to 30% of the time. Overall score based on average of raw data.

Green - posting less than 5% of the time (Blue Flag Criteria). Overall score based on average of raw data.

Fish Consumption Guidelines

Source Data: Ministry of the Environment and Climate Change
Date Range: Published in 201x (fish collection period unknown)

Criteria:

Red - less than 11 meals of perch per month (avg. of 4 class sizes, 15-20 cm to 30-35 cm) for general population.

Yellow - 11 to 20 meals of perch per month (avg. of 4 class sizes, 15-20 cm to 30-35 cm) for general population.

Green - greater than 20 meals of perch per month (avg. of 4 class sizes, 15-20 cm to 30-35 cm) for general population.

CATEGORY SCORE

Human Use

WEIGHT OF EVIDENCE SCORING FOR THE CONDITION ASSESSMENT

Individual Condition Variable Score

The scoring rules for the 12 condition variables are summarized on the adjacent map panels, along with data sources, and date range. For the initial baseline assessment, historical data sources were considered when sufficient recent data was not available. In the future, each lake will be re-assessed on a five-year cycle with current data.

Category Scores

The individual condition variables were weighted based on their relevance, strength, and reliability to evaluate the four Categories. Each variable received one, two, or three pluses. See the table below. Based on the total number of pluses received for the three Condition Variables in a given Category, a decision was made on whether to weight them equally or differently. For example, all the Condition Variables in Human Use were weighted equally when establishing the score for the category. Conversely, with Nutrients, the the satellite cyanobacteria index was assigned more weight than satellite estimates of chlorophyll and dissolved oxygen. This approach is consistent with the Weight of Evidence guidance for ecological assessments (EPA, 2016).

Category	Condition Variable	Relevance	Strength	Reliability	Weight
Physical Alterations to Shorelines and Wetlands	Tributary Connectivity	+ +	+ +	+ +	+
	Shoreline Hardening & Barriers	+ +	+	+	+
	Wetland Condition	+ ++	+ +	+	+
Water and Sediment	Pollution in Sediment	+++	++	++	++
	Benthic Community	+++	++	++	++
	Water Quality	++	+	+	+
Nutrients	Satellite Cyanobacteria Index	+++	++	++	++
	Satellite Chl	+	++	++	+
	Dissolved Oxygen and Hypoxia	+++	+	+	+
Human Use	Treated Drinking Water	++	+ +	+	+
	Fish Consumption	+ +	+	+ +	+
	Beach Postings	+ +	+ +	+	+

Overall Condition Score

The four Category Scores were then used to establish the overall Condition Score for each Regional Unit. Each of the four Categories were weighted equally when considering their condition score. The summary graphic in the centre of the map presents the logic for combining the Category results. For example, three Greens and one Yellow result in an overall score of high quality.

When developing the decision making framework for this WOE assessment, a series of rules were established as follows:

1)Decisions on the thresholds, weighting of the condition variables, and the overall scoring approach for the Condition Assessment will be re-evaluated once the draft assessment is complete. Changes in the approach will be implemented if necessary.

2)In the case of a tie (e.g., two yellows and two reds), the Regional Unit is assigned the lower score (e.g., red).

3)If all Categories received a Green and the Regional Unit also featured significant coastal wetlands, it would receive a score of very high quality to raise awareness for the area.

4)Any failure in the Satellite Cyanobacteria or Treated Drinking Water Condition Variables would result in an automatic very low quality score for the Regional Unit.

References

EPA, 2016. Weight of Evidence in Ecological Risk Assessment. Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, DC 20460.

Lake Erie 2018 Nearshore Framework Condition Assessment

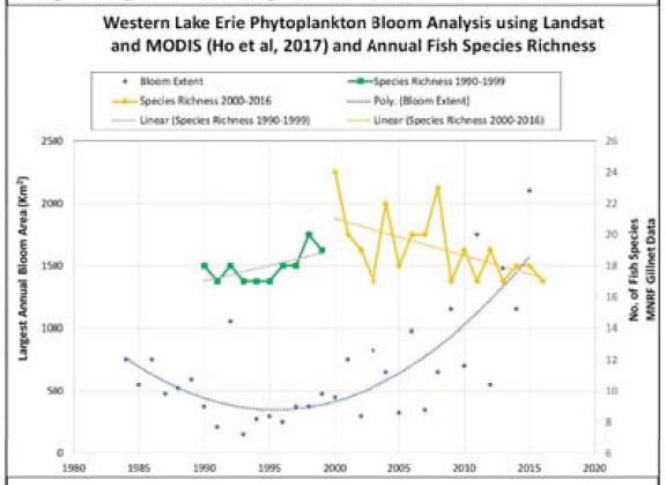
Condition Variable Source Data and WOE Scoring Approach

Zuzek inc.
ONE WORLD
www.zuzekinc.com

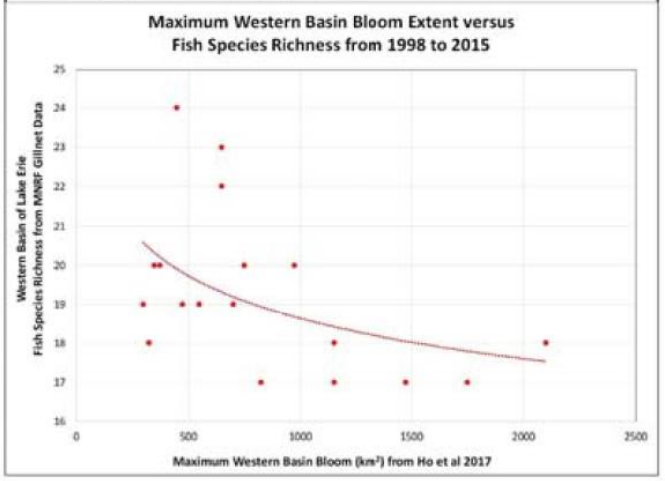
Draft Nearshore Assessment Phase 3: Biological Confirmation

Western Basin Bloom Extent versus MNRF Gillnet Abundance for the Western Basin

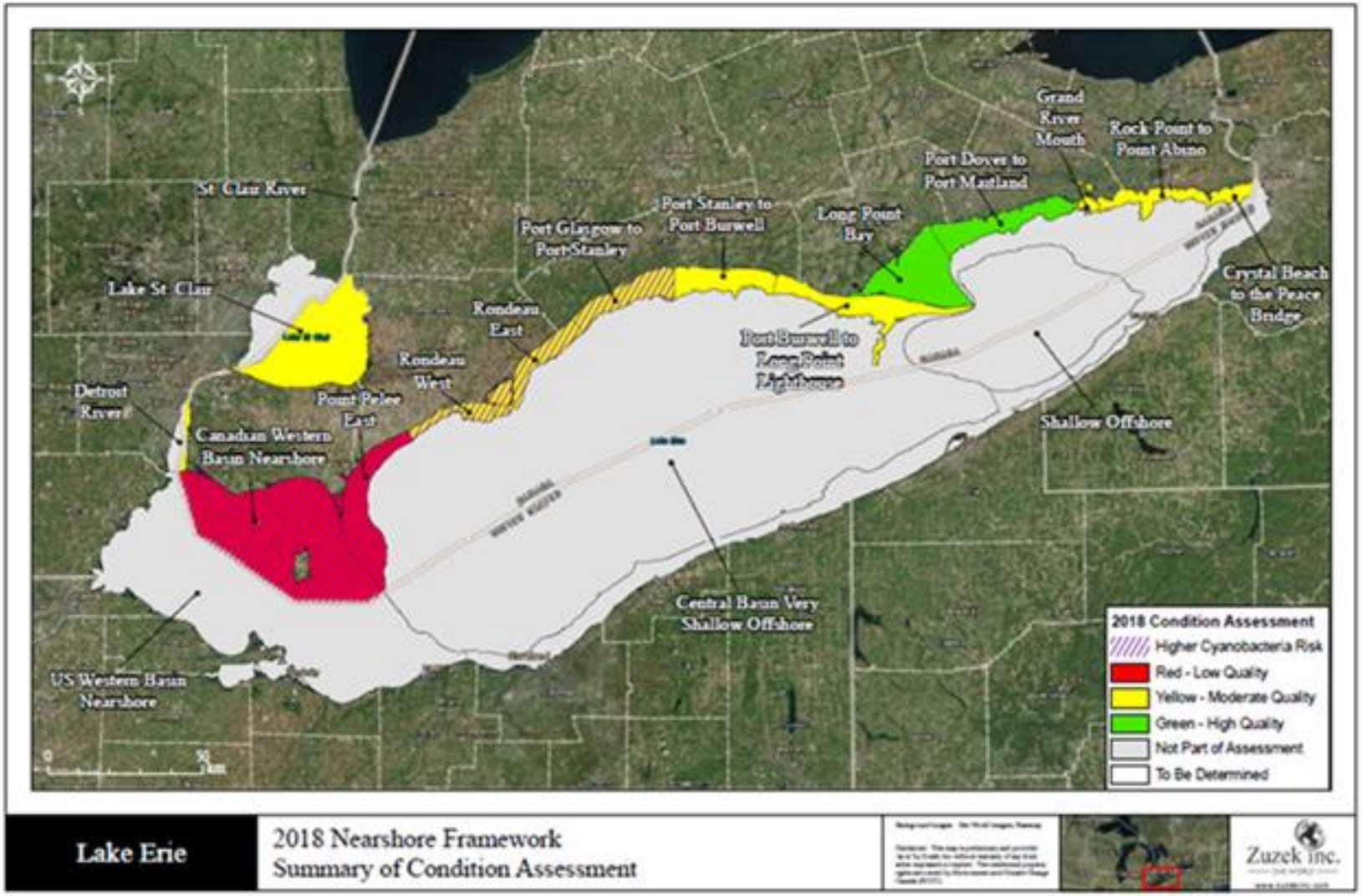
The maximum annual extent of the western basin algal bloom is compared against the fish species richness.



The annual maximum bloom extent is regressed against fish species richness in the western basin of Lake Erie. As bloom extent increases, species richness decreases.

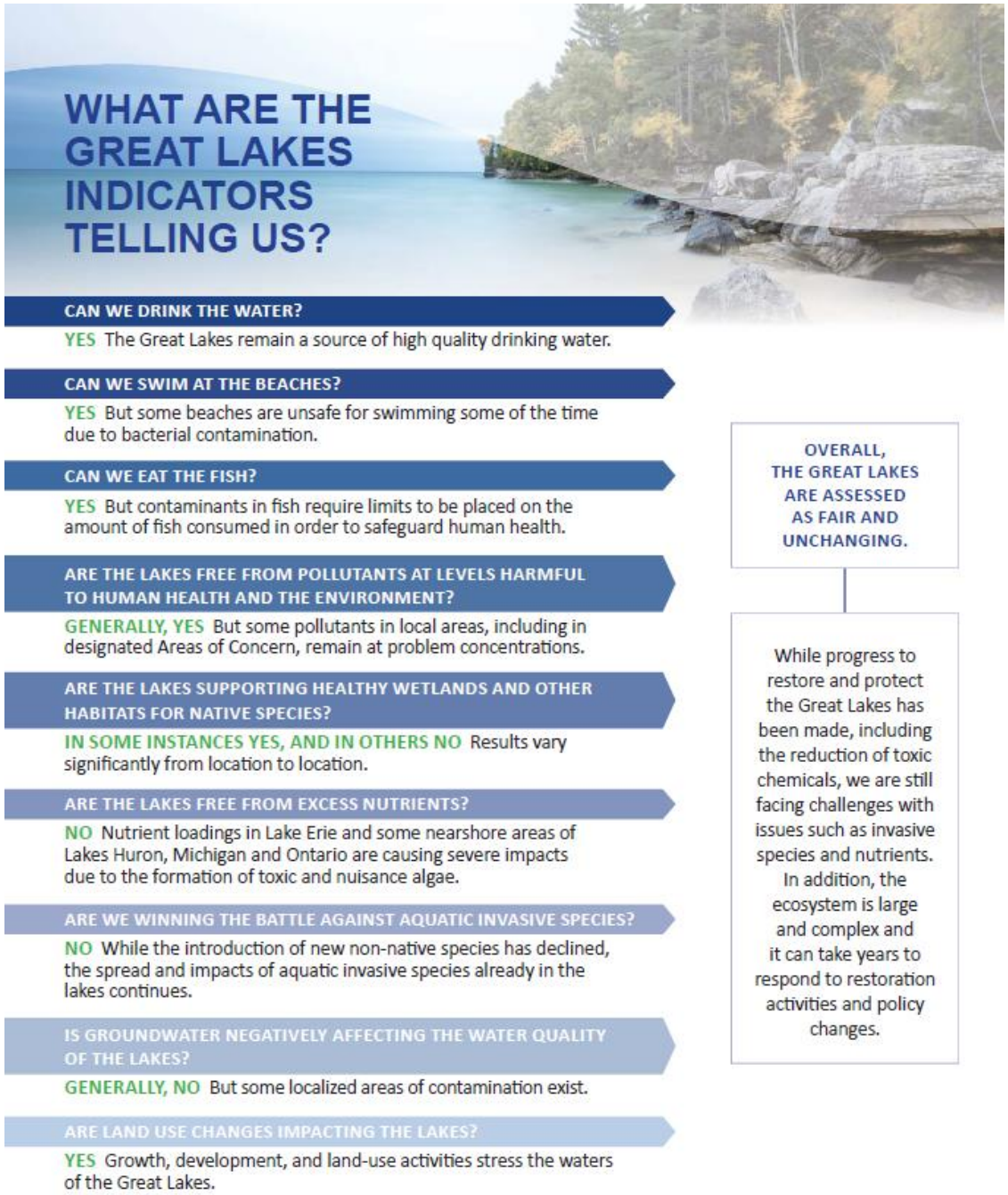


The 2018 Draft Condition Assessment for Lake Erie and the Huron Erie Corridor

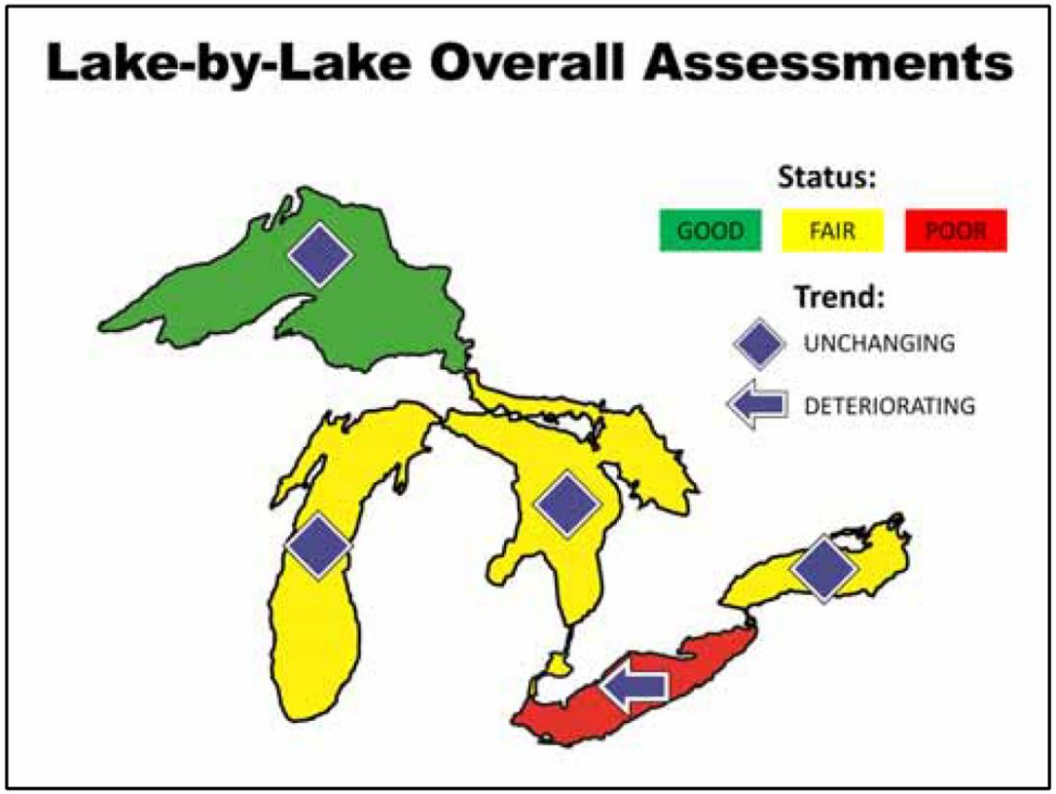


2017 State of the Great Lakes

- Report on the 9 general objectives of the 2012 Great Lakes Water Quality Agreement
- Nearly 200 authors and contributors prepared 44 sub-indicator reports used in the assessment
- State of the Great Lakes are reported on every three years



2017 State of the Great Lakes



Overall Assessments of the Nine Great Lakes Indicators of Ecosystem Health

Great Lakes Indicator	Status and Trend
Drinking Water	Status: Good Trend: Unchanging
Beaches	Status: Fair to Good Trend: Unchanging
Fish Consumption	Status: Fair Trend: Unchanging
Toxic Chemicals	Status: Fair Trend: Unchanging to Improving
Habitats and Species	Status: Fair Trend: Unchanging
Nutrients and Algae	Status: Fair Trend: Unchanging to Deteriorating
Invasive Species	Status: Poor Trend: Deteriorating
Groundwater Quality	Status: Fair Trend: Undetermined
Watershed Impacts and Climate Trends	Watershed Impacts: Status: Fair Trend: Unchanging
	Climate Trends: No Overall Assessment

Discussion

- A good story needs to be supported by comprehensive and reliable data and information.

- Synthesizing data and information from different sources often improves the collective understanding of a system it can also shine a light on data and information gaps.

- Assumptions made and threshold used, to compare, contrast, and characterize the different areas will strongly influence the final assessment.

- Synthesizing data and information is time consuming as it requires multiple parties to come together with their data but it will also help develop and reinforce strong, constructive inter-agency working relationships.

Acknowledgements

- COA Nutrients Annex Science Task Team
- GLWQA Lakewide Management Annex Nearshore Assessment Core Team
- GLWQA Science Annex Indicators Task Team