



Lake Huron Nearshore Waters Assessment

Data-informed decision making

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March 30th 2023

Integrate ecosystem and water
quality **data** into a place-based
assessment of **cumulative**
stress in nearshore waters

Two key messages

01

Lake Huron nearshore waters are under **stress** from the **cumulative impact** of impaired coastal processes, contaminants in water and sediment, restrictions to human use and nuisance and harmful algae.

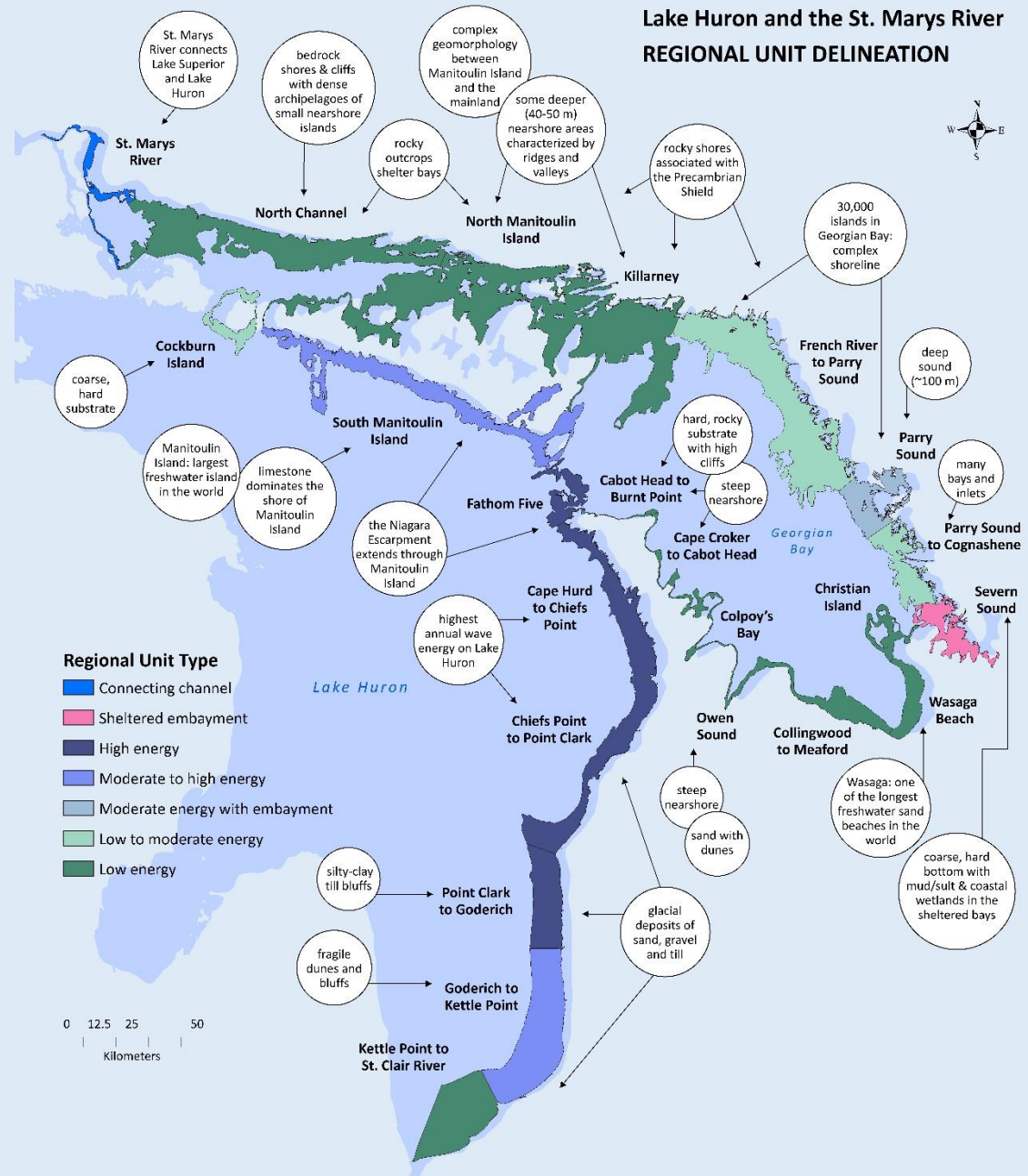
02

Data is a **strategic asset** and should be used to **derive insight** for more informed decision making and prioritization.

Lake Huron and the St. Marys River
 OVERALL ASSESSMENT OF THE STATE OF NEARSHORE WATERS



twenty-three unique Regional Units



how is cumulative stress measured?

eleven measures grouped into four categories based on the General Objectives of the Great Lakes Water Quality Agreement

Coastal Processes

shoreline hardening
tributary connectivity
littoral barriers

Contaminants in Water & Sediment

sediment quality
benthic community
water quality

Nuisance & Harmful Algae

cyanobacteria
cladophora

Human Use

fish consumption
beach postings
treated drinking water

Weight of Evidence Approach

'lines of evidence' (measures); some measures weighted more heavily

Measure	Weight
Shoreline Hardening	+
Littoral Barriers	+
Tributary Connectivity	+
Water Quality	+
Benthic Community	++
Sediment Quality	++
Cyanobacteria	++
<i>Cladophora</i>	+
Dissolved Oxygen/Hypoxia*	+
Beach Postings	+

4 'evidence groups' (categories); all categories weighted equally

Category	Category	Category	Category	Overall Regional Unit Score
L	L	L	L	L VL*
L	L	L	M	L
L	L	L	H	M
L	L	M	M	M
L	L	M	H	M
L	L	H	H	M
L	M	M	M	M
L	M	M	H	M
L	M	H	H	H
L	H	H	H	H
M	M	M	M	M
M	M	M	H	M
M	M	H	H	H
M	H	H	H	H
H	H	H	H	H
?	L	L	L	L
?	L	L	M	L
?	L	L	H	M
?	L	M	M	M
?	L	M	H	M
?	L	H	H	H
?	M	M	M	M
?	M	M	H	M
?	M	H	H	H
?	H	H	H	H
?	?	L	L	L
?	?	L	M	M
?	?	L	H	M
?	?	M	M	M
?	?	M	H	H
?	?	H	H	H
?	?	?	L	?

Weight of Evidence is a process for systematic and transparent integration of multiple datasets using individual 'lines of evidence' (measures)

4 'evidence groups' (categories) grouped into **overall cumulative stress on nearshore waters** in each Regional Unit

Contaminants in Water and Sediment

Water Quality

Contaminants in water can have acute and chronic impacts on aquatic organisms that depend on water for some part of their life cycle. Water quality is assessed by determining the number of sampling events for which contaminant levels exceed Provincial or Federal water quality guidelines at long-term monitoring stations.

Data: **Environment and Climate Change Canada, Great Lakes Water Quality Monitoring and Surveillance Data (2015, 2017, 2018)**

Sediment Quality

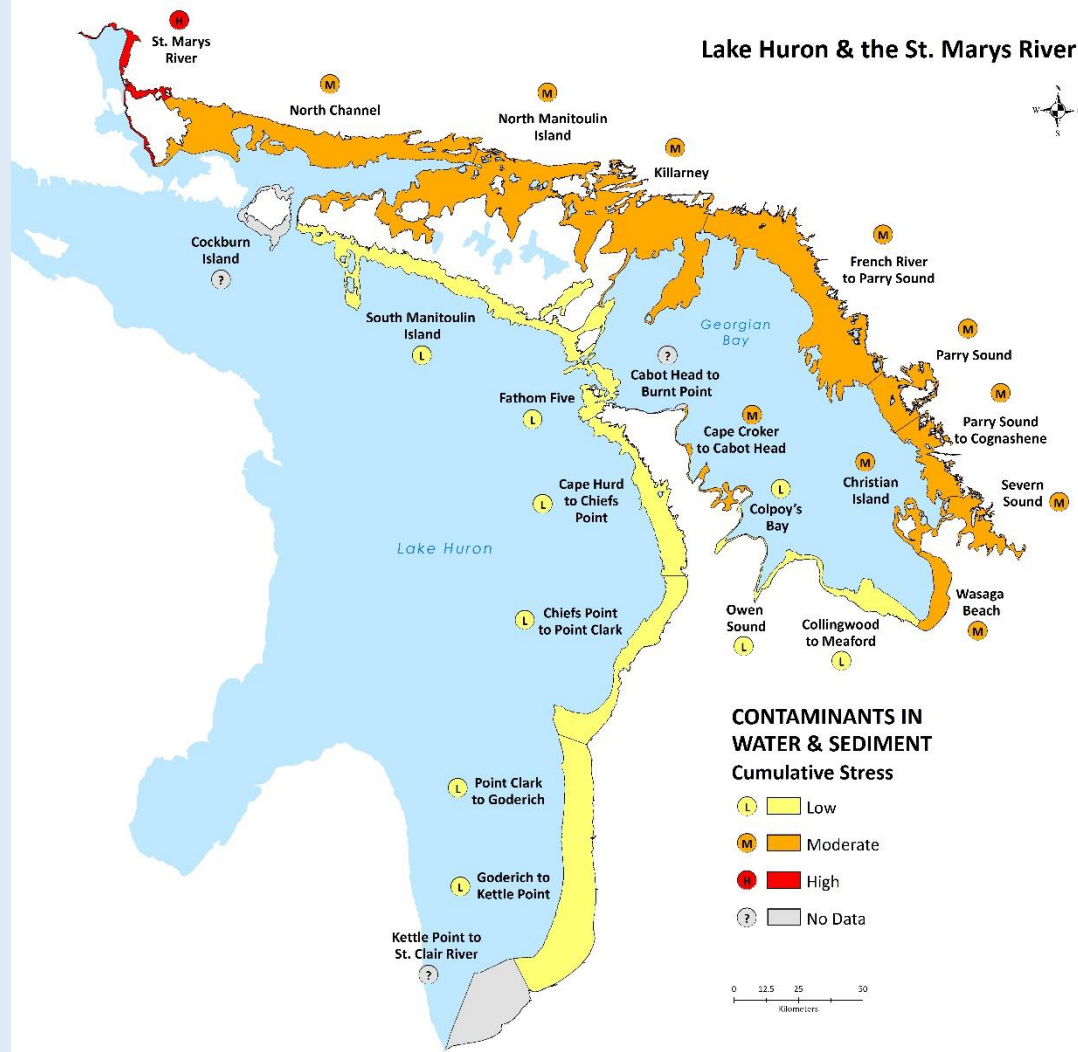
Contaminants in bottom sediment have the potential to be released into the water column and enter the food chain, which can lead to toxic and reproductive effects in species as well as bioaccumulation in aquatic life. Sediment quality is assessed using the severity of median contaminant levels in sediment for four categories (metals, organochlorine pesticides, PAHs and PCBs) at long-term monitoring stations.

Data: **Ontario Environment, Conservation and Parks, Great Lakes Nearshore – Sediment Chemistry (2009, 2011, 2015)**

Benthic Community

The general health of an ecosystem may be reflected in the benthic invertebrate community, as composition can vary from habitat conditions and human stressors. Contaminants in benthic communities can bioaccumulate or biomagnify in the food chain and become a source of contamination to other aquatic life and to humans. The benthic community is assessed by analyzing total benthos, taxon richness and evenness at long-term monitoring stations

Data: **Environment and Climate Change Canada, Great Lakes Action Plan Area of Concern and Reference Site Assessment (2010-2014)**



	St. Marys River	North Channel	North Manitoulin Island	Cockburn Island	South Manitoulin Island	Killarney	French River to Parry Sound	Parry Sound	Parry Sound to Cognashene	Severn Sound	Christian Island	Wasaga Beach	Collingwood to Meaford	Owen Sound	Colpoys Bay	Cape Croker to Cabot Head	Cabot Head to Burnt Point	Fathom Five	Cape Hurd to Chiefs Point	Chiefs Point to Point Clark	Point Clark to Goderich	Goderich to Kettle Point	Kettle Point to St. Clair River	
Sediment Quality	No Data	No > SEL metals > LEL	No > SEL metals > LEL	No Data	0 exc.	No Data	No > SEL metals > LEL	MN > SEL Pb > PEL, 8 metals > LEL	Pb > PEL, 2 PAHs > LEL, 7 metals > LEL	No > SEL Pb > PEL, 8 metals > LEL	No Data	0 exc.	0 exc.	5 metals > LEL	1 metal > LEL	No Data	No Data	1 metal > LEL	2 metals > LEL	0 exc.	0 exc.	1 metal > LEL	No Data	
Water Quality	No Data	1 exc.	0 exc.	0 exc.	0 exc.	0 exc.	0 exc.	0 exc.	No Data	0 exc.	0 exc.	No Data	0 exc.	0 exc.	No Data	0 exc.	0 exc.	0 exc.	0 exc.	0 exc.	0 exc.	0 exc.	0 exc.	No Data
Benthic Community	Poor Quality	Mod. Quality	Mod. Quality	No Data	No Data	Poor Quality	Mod. Quality	Good Quality	Mod. Quality	Mod. Quality	Mod. Quality	Mod. Quality	No Data	Mod. Quality	Good Quality	Poor Quality	No Data	No Data	Mod. Quality	No Data	No Data	Mod. Quality	No Data	No Data

Sediment Quality

Low Stress	<ul style="list-style-type: none"> PCBs < No Effect Level Organochlorine pesticides & PAHs < Lowest Effect Levels Metals < Probable or Severe Effect Levels
Moderate Stress	<ul style="list-style-type: none"> PCBs > No Effect Level OR, Organochlorine pesticides & PAHs > Lowest Effect Levels but < Severe Effect Levels OR, Metals > Probable Effect Levels but < Severe Effect Levels
High Stress	<ul style="list-style-type: none"> Any contaminant > Severe Effect Levels

Thresholds based on Provincial and Federal Guidelines and best professional judgement using data from the Ontario Ministry of the Environment, Conservation and Parks Great Lakes Nearshore Sediment Chemistry (2009, 2011, 2015).

Water Quality

Low Stress	0 exceedances
Moderate Stress	1 or 2 exceedances
High Stress	>2 exceedances

Thresholds based on Provincial and Federal Guidelines and best professional judgement using data from Environment and Climate Change Canada (2015-2018).

Benthic Community

Low Stress	Benthic community condition is functional and of high diversity (top 67 th percentile of scores)
Moderate Stress	Benthic community condition is degraded but functional (33 rd to 67 th percentile of scores)
High Stress	Benthic community condition is severely degraded and not functional (bottom 33 rd percentile of scores)

Thresholds based on statistical analysis using data from Environment and Climate Change Canada (2010-2014).

Coastal Processes

Shoreline Hardening

Hardened shorelines reduce coastal resiliency by altering sediment dynamics, acceleration erosion, increasing water turbidity and eliminating local vegetation. Shoreline hardening is assessed by looking at the percent of the total length of shoreline in a Regional Unit that has been altered with engineered structures or artificial material.

Data: **Delineated by Environment and Climate Change Canada using best available imagery**

Littoral Barriers

Supply, transport and deposition of sediment are natural processes that form and maintain important coastal features like wetlands and beaches. Artificial shores perpendicular (littoral barriers) can disrupt natural movements of sediment and affect the integrity of ecosystems. Littoral barriers are assessed by counting the number of shore perpendicular structures greater than 100 m in length within a Regional Unit.

Data: **Delineated by Environment and Climate Change Canada using best available imagery**

Tributary Connectivity

Connectivity between watersheds and the nearshore support healthy habitats and promotes natural physical processes. Barriers to connectivity can restrict access of fish to spawning/nursery habitats and alter nutrient flows. Tributary connectivity is assessed by calculating the total length of tributaries that are connected to the nearshore.

Data: **Ontario Ministry of Natural Resources and Forestry, Ontario Integrated Hydro Network; Great Lakes Connectivity, Dams and Waterfalls**

Lake Huron & the St. Marys River



COASTAL PROCESSES

Cumulative Stress

- L Low
- M Moderate
- H High
- ? No Data

	St. Marys River	North Channel	North Manitoulin Island	Cockburn Island	South Manitoulin Island	Killarney	French River to Parry Sound	Parry Sound	Parry Sound to Cognashene	Severn Sound	Christian Island	Wasaga Beach	Collingwood to Meaford	Owen Sound	Colpoys Bay	Cape Croker to Cabot Head	Cabot Head to Burnt Point	Fathom Five	Cape Hurd to Chiefs Point	Chiefs Point to Point Clark	Point Clark to Goderich	Goderich to Kettle Point	Kettle Point to St. Clair River
Tributary Connectivity	75%	7%	70%	100%	79%	58%	36%	51%	59%	9%	100%	26%	45%	89%	100%	100%	100%	100%	100%	15%	36%	90%	84%
Shoreline Hardening	16%	6%	1%	<1%	<1%	<1%	<1%	4%	<1%	32%	12%	24%	45%	35%	25%	6%	<1%	4%	4%	17%	15%	28%	56%
Littoral Barriers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3	1	3	1

Tributary Connectivity

Low Stress	>75% of the total length of tributaries (excluding upstream of a waterfall) are connected to the Regional Unit
Moderate Stress	25-75% of the total length of tributaries (excluding upstream of a waterfall) are connected to the Regional Unit
High Stress	<25% of the total length of tributaries (excluding upstream of a waterfall) are connected to the Regional Unit

Thresholds based on the State of the Great Lakes Sub-indicator report for Aquatic Habitat Connectivity using Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry data.

Shoreline Hardening

Low Stress	<25% of the total length of shoreline in a Regional Unit is hardened
Moderate Stress	25-50% of the total length of shoreline in a Regional Unit is hardened
High Stress	>50% of the total length of shoreline in a Regional Unit is hardened

Thresholds based on best professional judgement.

Littoral Barriers

Low Stress	0 littoral barriers
Moderate Stress	1 littoral barrier
High Stress	>1 littoral barriers

Thresholds based on best professional judgement.

Human Use

Fish Consumption

Fish are a diverse and accessible food source for many across the Great Lakes. Depending on the size of a fish and its location, harmful substances such as PCBs and mercury can result in consumption advisories for fish. Fish consumption is assessed by calculating the average number of meals per month recommended for specific size classes of fish likely to be caught in a certain area.

Data: **Ontario Ministry of Environment, Conservation and Parks, Fish Advisory Database (2015, 2017 & 2018; Lake Trout, Rainbow Trout, Yellow Perch, Smallmouth Bass and Walleye)**

Beach Postings

Public beaches are popular recreation spots and their use should not be restricted by environmental quality concerns. Poor water quality at beaches from bacterial contamination can have adverse impacts on human health. Beach postings is assessed by calculating the average percent of time that beaches in a Regional Unit are posted as unsafe for swimming.

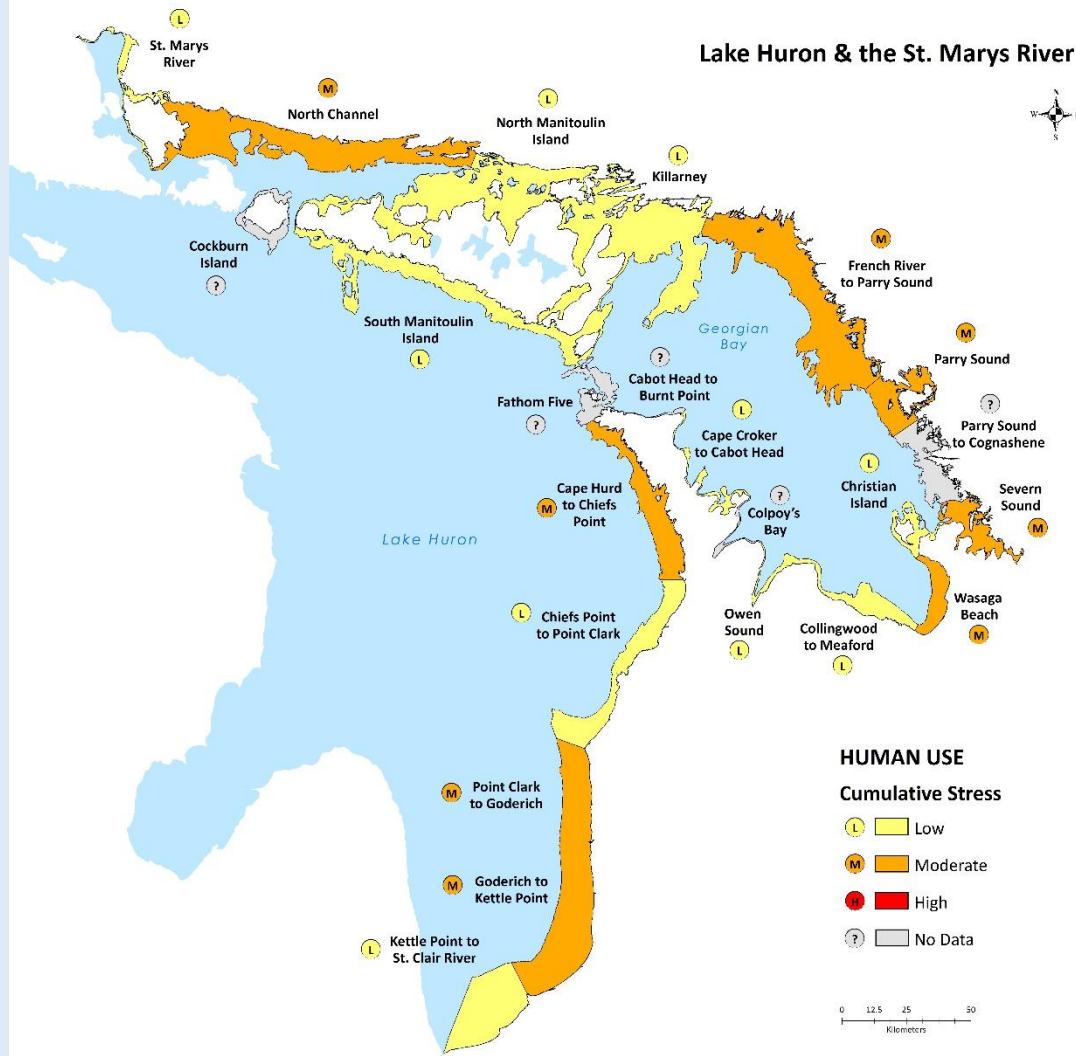
Data: **Swim Drink Fish Canada, SwimGuide (July & August, 2016-2020)**

Treated Drinking Water

The Great Lakes are a source of drinking water for millions of Canadians and should not have an adverse impact on human health. Water intended for human consumption should be free of disease-causing organisms such as *E. coli* or other hazardous concentrations of toxic chemicals or substances. Treated drinking water is assessed by looking at whether adverse water quality incidents were reported at any drinking water treatment plants.

Data: **Ontario Ministry of Environment, Conservation and Parks, Drinking Water Treatment Plant Monitoring Data (2015-2020)**

Lake Huron & the St. Marys River



	St. Marys River	North Channel	North Manitoulin Island	Cockburn Island	South Manitoulin Island	Killarney	French River to Parry Sound	Parry Sound	Parry Sound to Cognashene	Severn Sound	Christian Island	Wasaga Beach	Collingwood to Meaford	Owen Sound	Colpoys Bay	Cape Croker to Cabot Head	Cabot Head to Burnt Point	Fathom Five	Cape Hurd to Chiefs Point	Chiefs Point to Point Clark	Point Clark to Goderich	Goderich to Kettle Point	Kettle Point to St. Clair River
Treated Drinking Water	0 AWQI	0 AWQI	0 AWQI	N/A	0 AWQI	0 AWQI	N/A	N/A	N/A	0 AWQI	N/A	N/A	0 AWQI	0 AWQI	N/A	N/A	N/A	N/A	N/A	0 AWQI	N/A	0 AWQI	0 AWQI
Fish Consumption	8	6	7	9	8	7	7	8	7	9	9	9	9	9	9	5	3	6	6	7	6	6	5
Beach Postings	13%	5%	1%	N/A	2%	0%	6%	<1%	N/A	7%	1%	7%	13%	N/A	N/A	19%	N/A	N/A	0%	4%	14%	11%	3%

Treated Drinking Water

Low Stress	No adverse water quality incidents
Moderate Stress	Does not apply - any incident is considered a high stress
High Stress	1 or more adverse water quality incidents

Thresholds based on Ontario Drinking Water Quality Standards using data from the Ontario Ministry of Environment, Conservation and Parks (2015-2020).

Fish Consumption

Low Stress	Average ≥ 8 meals per month
Moderate Stress	Average 1-7 meals per month
High Stress	Average < 1 meal per month

Thresholds developed in consultation with the Ontario Ministry of the Environment, Conservation and Parks using consumption advisories from the Guide to Eating Ontario Fish; average meals per month based on consumption advisories for Smallmouth Bass, Rainbow Trout, Lake Trout, Walleye and Yellow Perch.

Beach Postings

Low Stress	Beaches posted 5% or less of the time during July and August 2016-2020
Moderate Stress	Beaches posted 5-20% of the time during July and August 2016-2020
High Stress	Beaches posted more than 20% of the time during July and August 2016-2020

Thresholds developed using best professional judgement using data from Swim Drink Fish Canada (2016-2020).

Nuisance and Harmful Algae

Cyanobacteria

Cyanobacteria is a blue-green algae that occurs naturally in freshwater but an overgrowth can result in harmful algae blooms that have the potential to release toxins dangerous to human and ecosystem health. Cyanobacteria is assessed by calculating the extent of blooms within a Regional Unit.

Data: **National Oceanic & Atmospheric Association, Harmful Algal Bloom Monitoring 7-day satellite composite images (June-October 2019)**

Cladophora

Cladophora is a native filamentous green algae that typically grows on hard substrate in shallow waters. It can become a nuisance when it detaches from the bottom and washes onto shore where it can foul beaches and clog water intakes.

Data: **Michigan Tech Research Institute, Satellite-derived Submerged Aquatic Vegetation Mapping (Vegetative growing season, 2016-2018)**

Lake Huron & the St. Marys River



NUISANCE & HARMFUL ALGAE

Cumulative Stress

- Low
- Moderate
- High
- No Data
- Concern to human and ecosystem health due to Cyanobacteria

	St. Marys River	North Channel	North Manitoulin Island	Cockburn Island	South Manitoulin Island	Killarney	French River to Parry Sound	Parry Sound	Parry Sound to Cognashene	Severn Sound	Christian Island	Wasaga Beach	Collingwood to Meaford	Owen Sound	Colpoys Bay	Cape Croker to Cabot Head	Cabot Head to Burnt Point	Fathom Five	Cape Hurd to Chiefs Point	Chiefs Point to Point Clark	Point Clark to Goderich	Goderich to Kettle Point	Kettle Point to St. Clair River
Cyanobacteria	<2%	<2%	<2%	<2%	<2%	<2%	<2%	<2%	<2%	<2%	<2%	<2%	<2%	<2%	<2%	3%	<2%	<2%	4%	4%	<2%	5%	
Cladophora	N/A	unable to verify	unable to verify	unable to verify	unable to verify	unable to verify	unable to verify	unable to verify	N/A	unable to verify	unable to verify	unable to verify	unable to verify	unable to verify	unable to verify	unable to verify	unable to verify	unable to verify	28%	24%	26%	34%	38%

Cyanobacteria

Low Stress	No cyanobacteria bloom that exceeds 2% of the Regional Unit detected in any 7-day composite
Moderate Stress	Not applicable
High Stress	Cyanobacteria bloom exceeds 2% of the Regional Unit in any 7-day composite

Thresholds based on the World Health Organization cyanobacteria guidelines using satellite composites from NOAA's Harmful Algal Bloom Forecasting Branch (2019).

Cladophora

Low Stress	<20% coverage
Moderate Stress	20-35% coverage
High Stress	>35% coverage

Thresholds developed using best professional judgement using 2016-2019 satellite-derived Submerged Aquatic Vegetation (SAV) Mapping from Michigan Tech Research Institute (MTRI).

Identify areas of **high**
ecological value



Identify areas of **high ecological value**

Uniqueness/Rarity

Special importance for life-history stages of species

Maintenance/persistence of nearshore features/processes

Important for species at risk

Vulnerable, fragile, sensitive area

Naturalness

Scientific importance

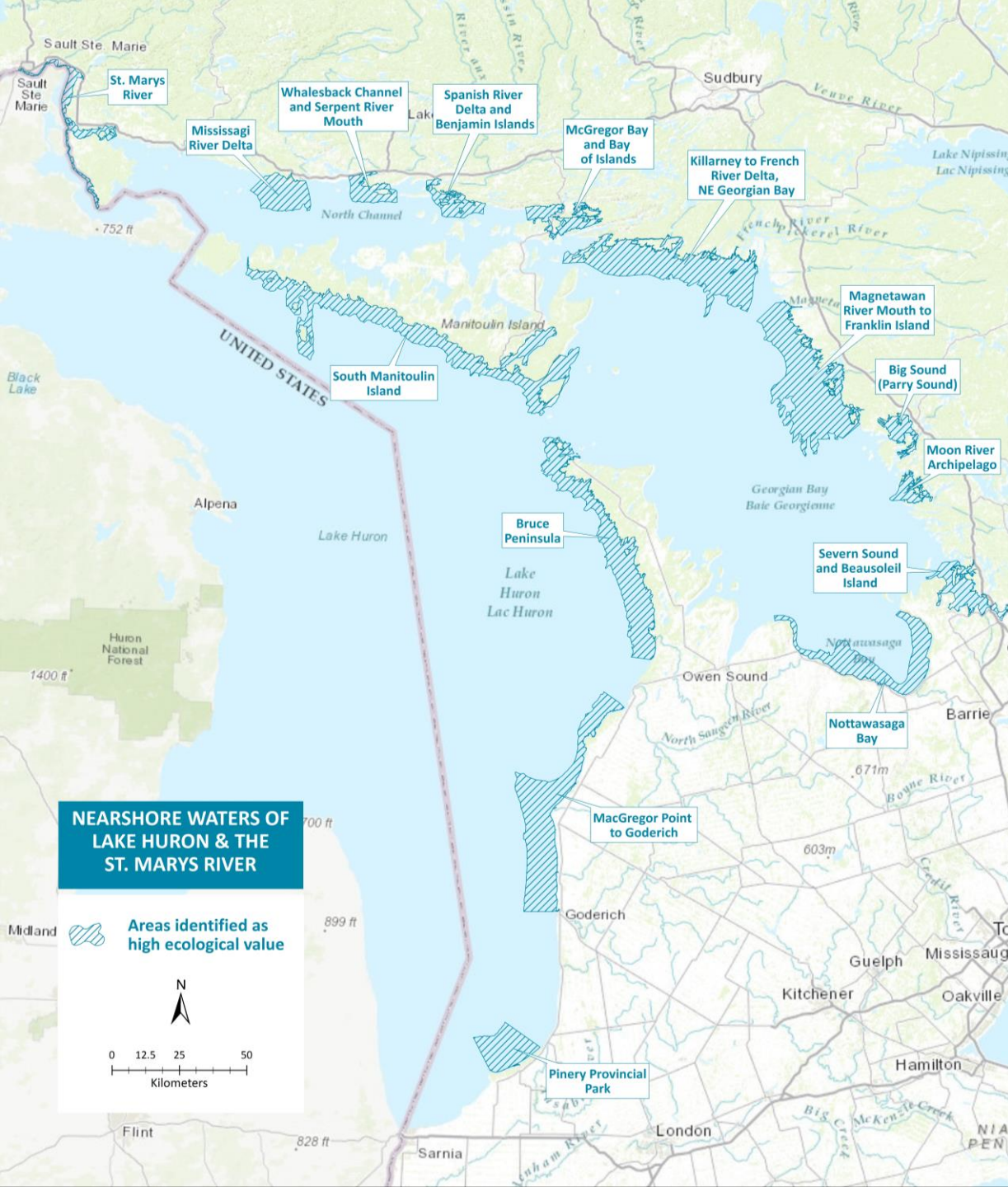
Socio-economic importance

Cultural/historic importance

Threats

BIOPHYSICAL ATTRIBUTES

ADDITIONAL CONSIDERATIONS



Lake Huron

- 15 areas of high ecological value identified
- Extensive natural shoreline in the northern portion; development pressure and habitat disturbance increases southward
- Key threats:
 - Invasive species
 - Recreational use
 - Climate change and associated water level changes
 - Shoreline development; dredging
 - Dams, barriers to fish passage
 - Agricultural drainage (sediments, nutrients)
 - Localized fecal bacteria pollution

data-informed decision making

assessment data is accessible on the **Government of Canada Open Data Portal** to facilitate visualization, integration and analysis



coordinated geospatial framework to inform priorities for nearshore prevention, restoration and protection measures



integrated, data-informed decision making to protect and conserve Great Lakes nearshore waters

Regional Units that are:

- near a **higher** stress threshold
- near a **lower** stress threshold



At risk of further degradation



Potential for restoration

Better understand which measure (line of evidence) should be addressed to reduce cumulative stress in the nearshore

&

Use assessment data to measure change or incremental progress by having a more comprehensive understanding of desired outcomes



Lake	Regional Unit (color coded to current level of cumulative stress)	Category Change Required (color coded to level of reduced cumulative stress)	Measure Changes	Metric (calculated based on measure thresholds)	“Lever” to reduce stress
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Huron (LH06)	Killarney	Coastal Processes from Moderate to Low brings Cumulative Stress to LOW	Tributary Connectivity from Moderate to Low	Reconnect 287 km of tributary length	Remove dam
		Contaminants in Water & Sediment from moderate to low brings Cumulative Stress to LOW	Benthic Community from High to Low		

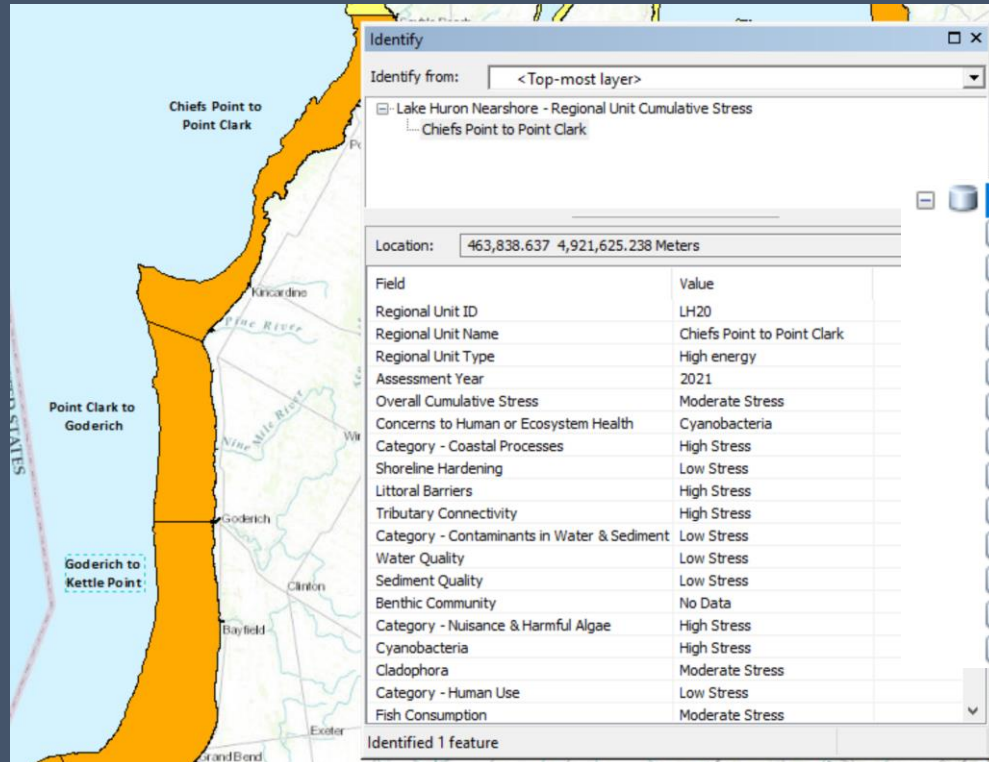
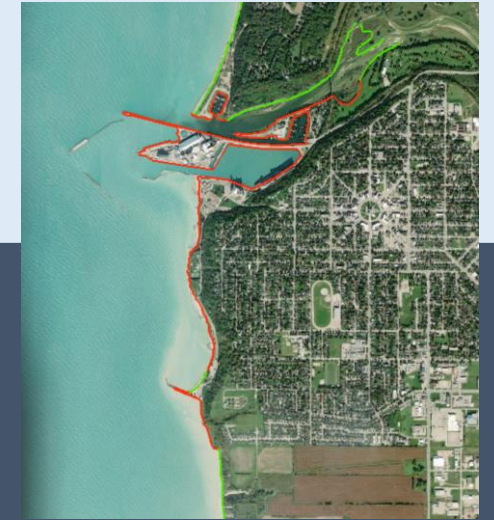
Huron (LH21)	Point Clark to Goderich	No
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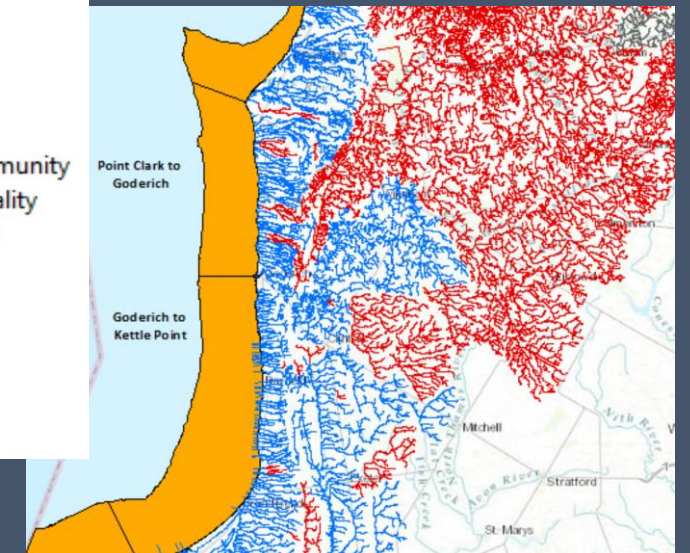
MacGregor Point to Goderich	<p>Death by 1000 cuts of shoreline hardening leading to impaired coastal processes; many development applications to do more work (zoning of hazard areas for development)</p> <p>If NOT addressed, poses risk when experience high waters which will erode the toe of the slope; impacts of climate change need to be considered</p>
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Where can we reduce cumulative stress in nearshore waters and/or, prevent further degradation

Greater insights through the integration, visualization & sharing of data



- LakeHuronNearshoreWatersAssessment_z17N.gdb
- LakeHuronNearshoreCumulativeStress
 - LH_CoastalProcesses_Littoral_Barriers
 - LH_CoastalProcesses_Shoreline_Hardening
 - LH_CoastalProcesses_Tributary_Connectivity
 - LH_ContaminantsWaterSediment_Benthic_Community
 - LH_ContaminantsWaterSediment_Sediment_Quality
 - LH_ContaminantsWaterSediment_Water_Quality
 - LH_HumanUse_Beach_Postings
 - LH_HumanUse_Fish_Consumption
 - LH_HumanUse_Treated_Drinking_Water
 - LH_NuisanceHarmfulAlgae_Cladophora
 - LH_NuisanceHarmfulAlgae_CladophoraPts
 - LH_NuisanceHarmfulAlgae_Cyanobacteria



Resources

Lake Huron Canadian Nearshore Assessment

[2021 Results Report](#)

[2021 Highlights Report](#)

Lake Huron Nearshore Waters Assessment

[Open Data](#)

Canadian Great Lakes Nearshore Assessment

[Detailed Methodology](#)