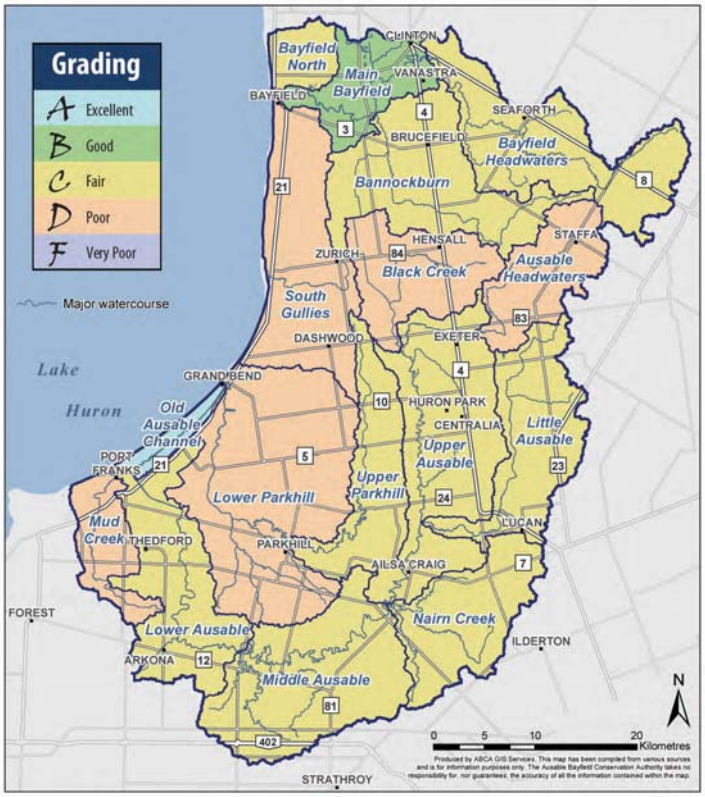
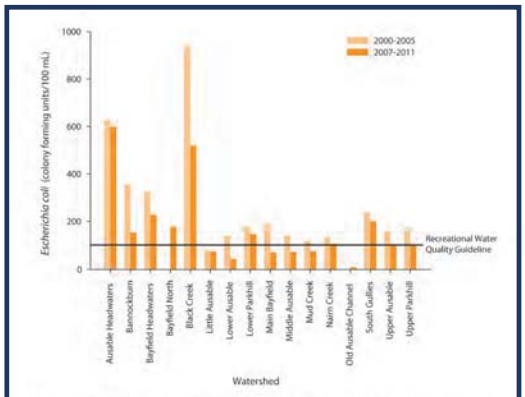
Water Quality along Lake Huron

What are the issues?



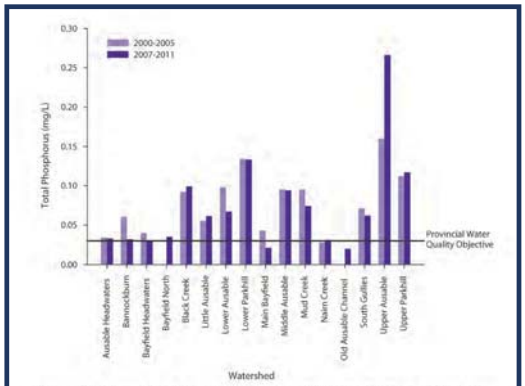
Grade distribution of overall surface water quality conditions throughout the Ausable Bayfield watersheds

From Watershed Report Card (2013)



Concentrations of *Escherichia coli* (E. coli) across all Ausable Bayfield watersheds. Black line represents the Recreational Water Quality Guideline (100 cfu/100 mL).

From Watershed Report Card (2013)

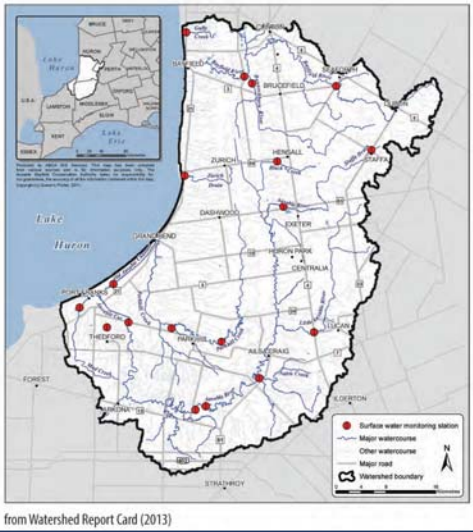


Concentrations of total phosphorus across all Ausable Bayfield watersheds. Black line represents the Provincial Water Quality Objective (0.03 mg/L).

Lake Huron Water Quality

- **Algal fouling** – Irregular, less frequent, less widespread, but some significant local events
- **Influences** – Tributaries contribute; many complex factors at work
- **Beach postings** – Irregular; recurrent; variable
- **Stewardship** – Watershed plans developed and increased uptake in best management practices (BMPs) realized
- **Where improvements can be seen** – Best management practices and projects effective at the site and watershed scale

Surface water quality monitoring stations in Ausable Bayfield watersheds



from Watershed Report Card (2013)

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Water Quality along Lake Huron

What is this community doing to protect the Lake?

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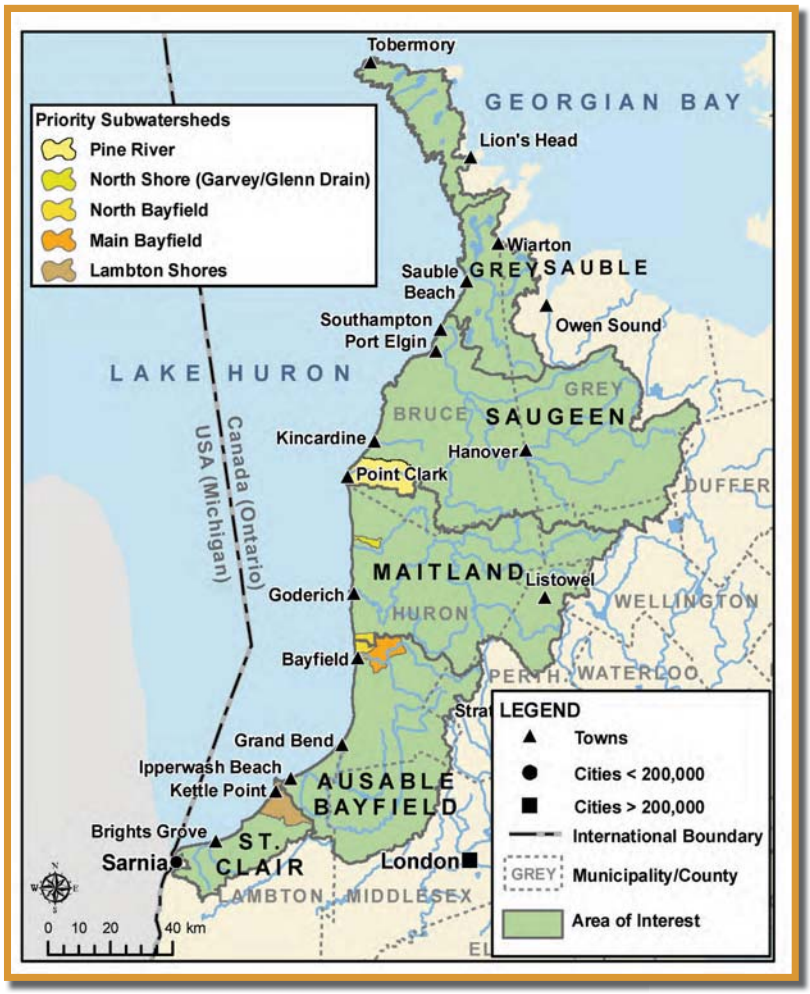
Water Quality along Lake Huron

Is what we are doing working?



Water Quality Trends

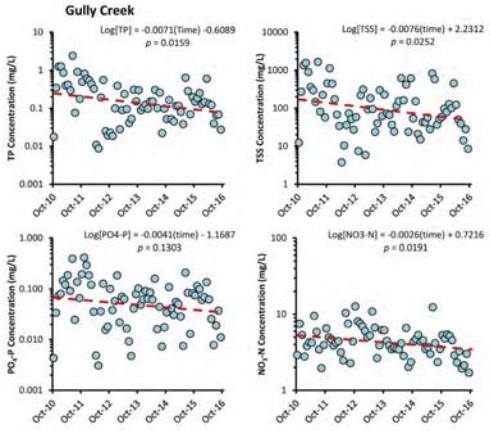


Figure 6: An example of water quality trends in monthly flow-weighted mean concentrations for Gully Creek (October 2010 to September 2016).

Water Quality Trends

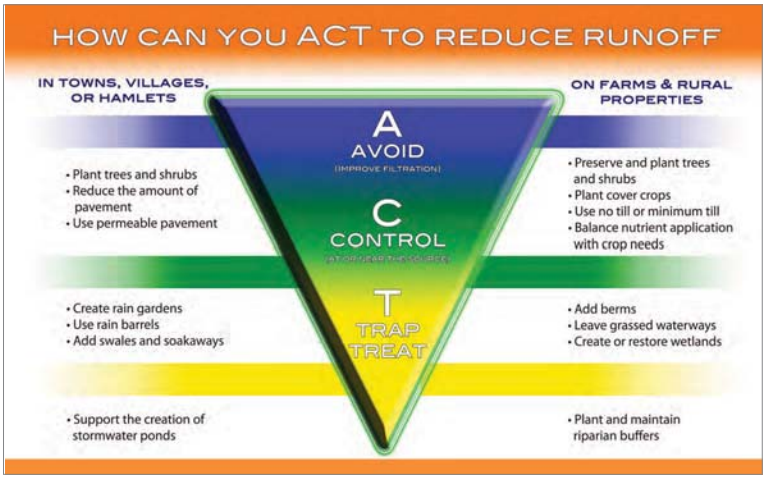
Water quantity and quality trends in monthly concentrations for the priority watersheds. Arrows represent direction of trend.

Station	Water Years	Flow	TP	PO_4-P	NO_3-N	TSS
South Pine	2012-2016	–	–	–	–	▼
Garvey-Glenn	2012-2016	–	–	–	–	▼
Gully	2010-2016	–	▼	–	▼	▼
Trick's	2012-2016	–	▲	–	▼	▲
Shashawandah	2012-2016	–	–	–	–	–

– Non-significant trend ($p > 0.05$)
▲ Significant positive (degrading) trend ($p < 0.05$)
▼ Significant negative (improving) trend ($p < 0.05$)

What We Know

- Runoff contributes to water quality issues
- There is a hierarchy of environmental actions
- There is a hierarchy of environmental responses



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The Effects of a Changing Lake

How do we measure and map change along the shoreline?

Dynamic Beach

Hazards along the shoreline are mapped as **Lakeshore Area 1** and **Lakeshore Area 2**.

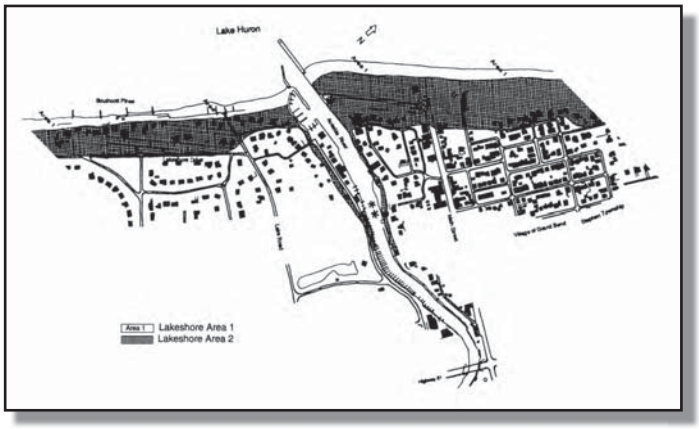
Lakeshore Area 1 is adjacent to the lake where the hazard is considered to be greater than in **Lakeshore Area 2**.

In the existing Shoreline Management Plan (2000), 1:2,000 mapping from the federal government, created from 1988 air photos, was used to identify and map Lakeshore Areas 1 and 2.

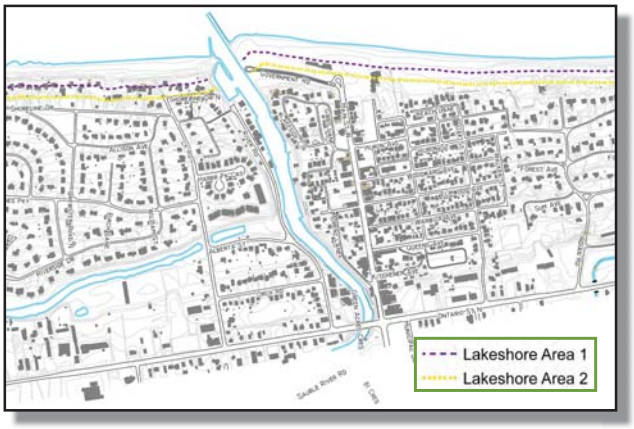
The shoreline from, approximately, the Maple Grove Subdivision, in the Municipality of South Huron, south to the ABCA jurisdictional boundary at Seth Lane south of Port Franks is known as the ***DUNES*** or ***DYNAMIC BEACH AREA***.

The dynamic beach area of the ABCA watersheds.

Current Shoreline Management Plan (2000)



Updated Mapping Based on Current Provincial Policy Direction



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Refer to the current Shoreline Management Plan (2000) for a full definition of lakeshore areas.

The Effects of a Changing Lake

How do we measure and map change along the shoreline?

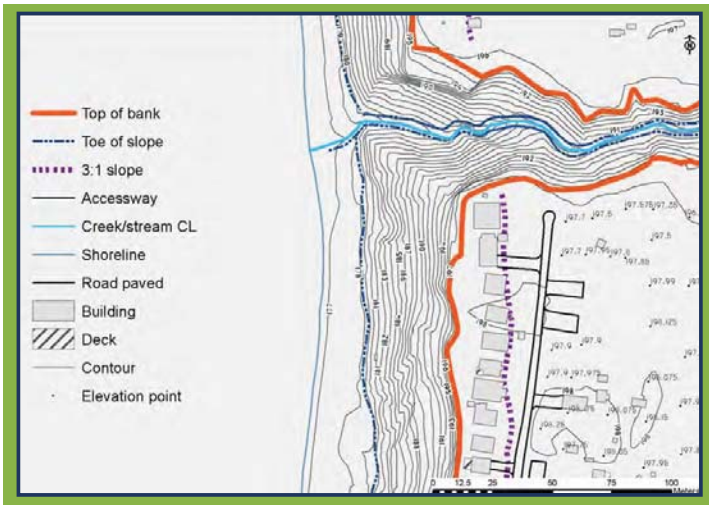
Cohesive Bluffs

Hazards along the shoreline are mapped as **Lakeshore Area 1** and **Lakeshore Area 2**.

Lakeshore Area 1 is adjacent to the lake where the hazard is considered to be greater than in Lakeshore Area 2.

The shoreline from, approximately, the Maple Grove Subdivision in Municipality of South Huron, where the height of the bluffs are approximately 5 metres, north to the Ausable Bayfield Conservation Authority (ABCA) jurisdictional boundary at Towerline Road in the Municipality of Central Huron, where the height of the bluffs are approximately 20 metres, is known as the ***COHESIVE BLUFFS***.

In the ***COHESIVE BLUFFS*** the composition of the till creates an erosion hazard at the toe and the top of the bluffs. We are interested in the location and movement of the toe and top of the bluff, as well as the location of the stable top of bank. A slope that is ***3:1*** vertical distance to horizontal distance is considered ***stable***.

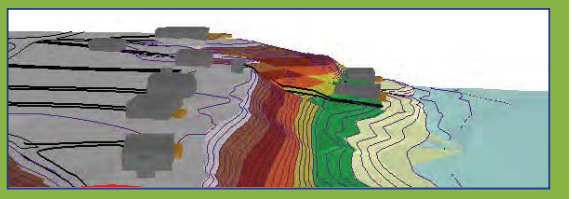


An example of a modern map for the shoreline.

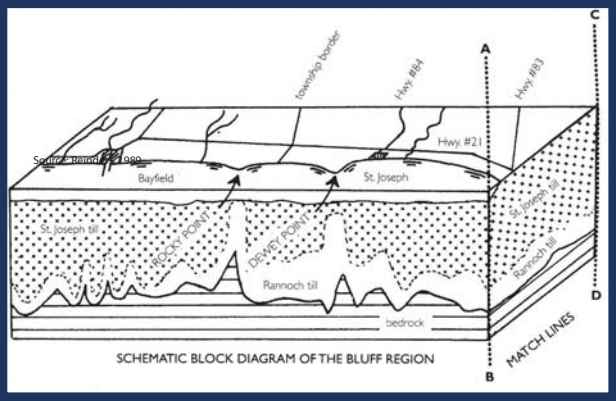
Modern mapping and data collection techniques allow for monitoring and measuring of the changing lake.

The Ausable Bayfield Conservation Authority (ABCA) has a wealth of data and information on Lake Huron.

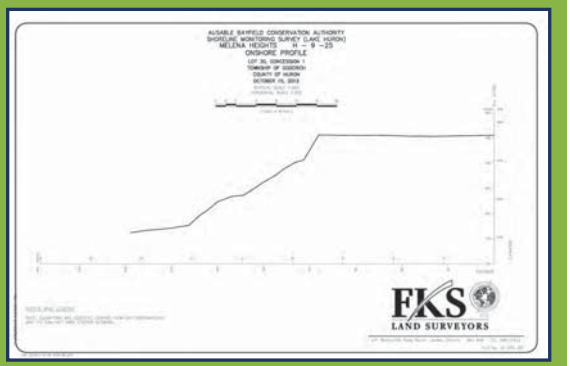
Examples of current mapping tools and products are at left and below.



A three-dimenisional (3-D) view of a cohesive bluff in the Ausable Bayfield Conservation Authority watershed area showing the buildings in grey.



Ausable Bayfield Conservation Authority watershed area cohesive bluffs.



2012 ground survey utilizing Global Positioning System (GPS) to tie into location into a Geographic Information Systems (GIS) system.

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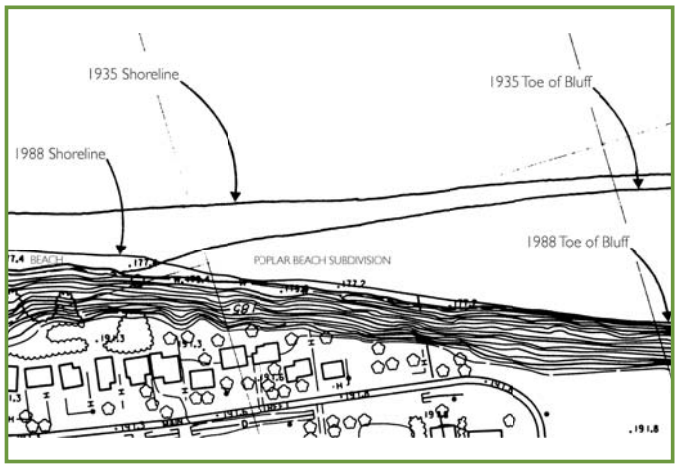
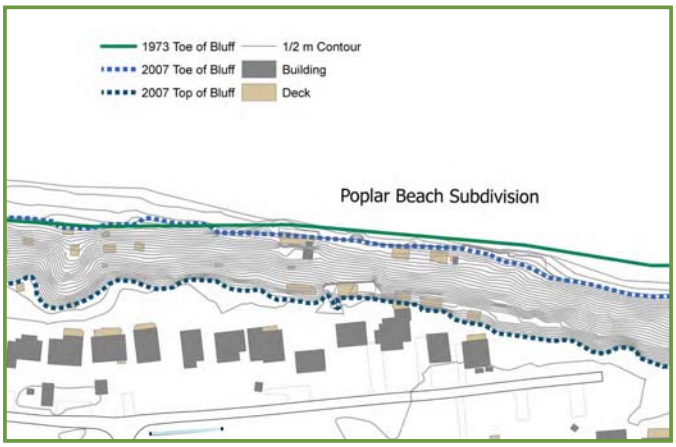
The Effects of a Changing Lake

How do we measure and map change along the shoreline?

Average Annual Recession Rate

Average Annual Recession Rates (AARR) In the ***COHESIVE BLUFFS,*** the average annual recession rate is calculated by comparing the historic location of the toe of the slope and/or top of the bluff with more recent locations. The toe of slope and top of the bank were mapped and compared in a geographic information system (GIS). Ground surveys, contour maps, and air photos can be used.





Shoreline Management Plan (2000)

The toe of the slope location or shoreline from 1935 was compared with the toe of the slope from 1988.

The 1988 mapping from the federal government was also used for comparison with the 1935 geo-referenced survey.

Recalculated Rates

Rates were re-examined using 1973 scanned images from the National Air Photo Library that were geo-referenced to align with 2007 aerial photography and features.

The toe of the slope and top of the bank locations were compared from 1973 to 2007. Recalculated rates were checked with historic information

100 Year Erosion Limit

To determine the 100 year erosion limit, you take the ***AVERAGE ANNUAL RECESSION RATE*** and multiply it by 100 years.

The 100 year erosion limit helps to determine hazard planning setbacks.

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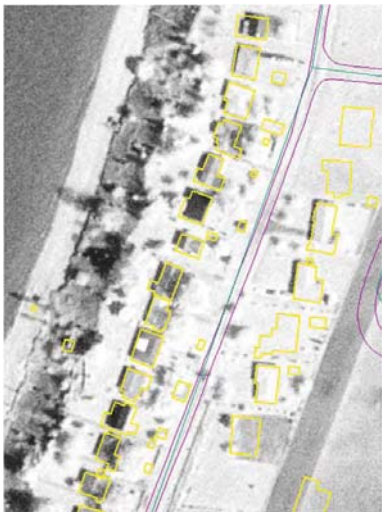
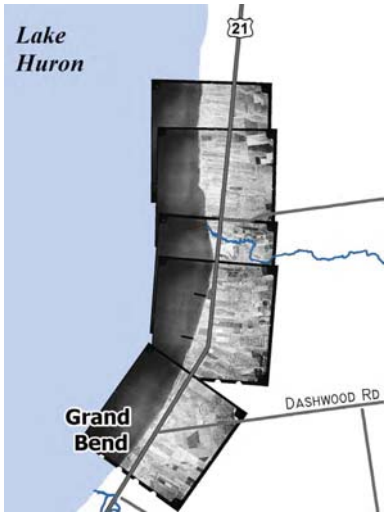


1973 Air Photo with 2007 Building and Roads



1973 Geo-Referenced Images

THE EFFECTS OF A CHANGING LAKE

Shoreline Oblique Photography

Cohesive Bluff Area

Dynamic Beach Area

2009 Average April Lake Level – 176.20 metres

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2017 Average April Lake Level – 176.66 metres

Hazard Identification

How are the Lakeshore Hazards determined in the current Shoreline Management Plan (2000)?

Lakeshore Area 1

Flood Hazard

- That area of the shoreline which is landward from the water's edge, including the 100-year flood level plus a horizontal 15-metre wave uprush setback.

Erosion Hazard

- That area of the shoreline which is lakeward of the stable slope line, and includes the slope and toe of the lakebank.

Dynamic Beach Hazard

- That area of the shoreline which is measured landward from the water's edge including the **Flood Hazard** plus a distance of 15 metres measured horizontally.

Lakeshore Area 2

Flood Hazard

- Not Applicable.

Erosion Hazard

- That area of the shoreline located landward the greater of the following:

– from the Lakeshore Area 1 Erosion Hazard and extending to the 100-year erosion setback line

or

– a setback of 30 metres extending landward from the top of the unaltered lake bluff

Dynamic Beach Hazard

- That area landward from the Lakeshore Area 1 Dynamic Beach Hazard to where water erosion ceases to influence dune morphology and wind erosion creates embryo and foredunes with sparse vegetative cover established.
- This distance is a minimum of 15 metres landward from Lakeshore Area 1, however generally extends over the entire dune area stretching to the shore parallel road.

For complete definitions please consult the Shoreline Management Plan (2000) and Provincial Policy.

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Hazard Identification

How does existing provincial policy direct us?

The 2014 **Provincial Policy Statement** states the **Erosion Hazard:**

- Means the loss of land, due to human or natural processes, that poses a threat to life and property.
- The erosion hazard limit is determined using considerations that include the 100-year erosion rate (the average annual rate of recession extended over a one hundred year time span), an allowance for slope stability, and an erosion/erosion access allowance.

Provincial Technical Guides indicate that:

- The **erosion hazard** consists of the combined influence of the **stable slope allowance, 100 times the average annual recession rate** and/or an **erosion allowance**.

  1) the **stable slope allowance** is a horizontal distance measured landward from the toe of the cliff/bluff/bank (i.e., standard 3 times the height of the cliff/bluff/bank or based on a study using accepted geotechnical principles);

  2) the 100 times the average annual recession rate, applied where 35 years of recession rate information is available, is a horizontal distance measured landward from the landward extent of the stable slope allowance; (*emphasis added*)

  and

  3) the **erosion allowance** of either:

  a) a horizontal distance of 30 metres, in the absence of a known recession rate and in the absence of studies using accepted scientific and engineering principles, measured landward from the landward extent of the stable slope allowance or from the top of the cliff/bluff/bank, where slopes are considered to be "stable".

  or

  b) a horizontal distance determined through studies using accepted scientific and engineering principles (e.g., connecting channels, bedrock shorelines, naturally well sheltered areas, or along the Lake St. Clair shorelines) measured landward from the landward extent of the stable slope allowance or from the top of the cliff/bluff/bank, where slopes are considered to be "stable."

Based on the above three contributing factors, the erosion hazard is the *greater* of:

A + C OR B + C

A) the sum of the **stable slope allowance** plus **100 times the average annual recession rate** measured landward from the toe of the cliff/bluff/bank

B) the sum of the **stable slope allowance** plus a **30-metre erosion allowance** measured landward from the toe of the cliff/bluff/bank

C) a 30-metre horizontal allowance as measured from the top of the cliff/bluff/bank

Refer to the Provincial Policy Statement (2014) and supporting technical guidelines for full descriptions.

AUSABLE BAYFIELD CONSERVATION

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Hazard Identification

How does current provincial direction affect how the Lakeshore Hazards are defined?

Lakeshore Area 1

Flood Hazard – *Unchanged*

That area of the shoreline which is landward from the water's edge, including the 100-year flood level plus a horizontal 15-metre wave uprush setback.

Erosion Hazard – *Unchanged*

That area of the shoreline which is lakeward of where the stable slope line meets original ground, and includes the slope and toe of the lakebank.

Dynamic Beach Hazard – *Unchanged*

That area of the shoreline which is landward from the water's edge including the **Flood Hazard** plus a distance of 15 metres measured horizontally.

Lakeshore Area 2

Flood Hazard – *Unchanged*

Not Applicable.

Erosion Hazard

That area of the shoreline located landward the greater of the following:

– from the Lakeshore Area 1 Erosion Hazard and extending to the 100 year erosion setback line – *Unchanged*

or

– a setback of 30 metres extending landward from where the stable slope line meets original ground.

Dynamic Beach Hazard

That area of the shoreline which is landward from the Lakeshore Area 1 Dynamic Beach Hazard plus a horizontal distance of 30 metres.

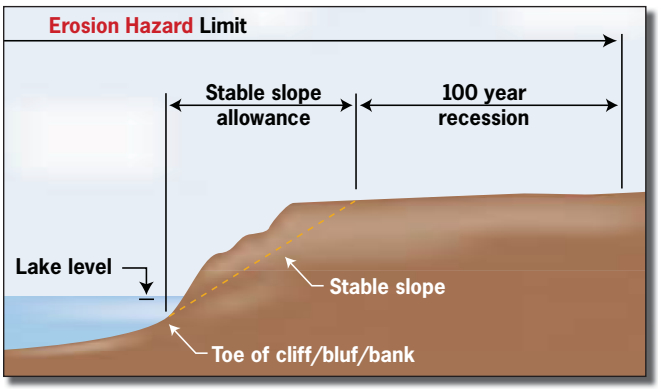
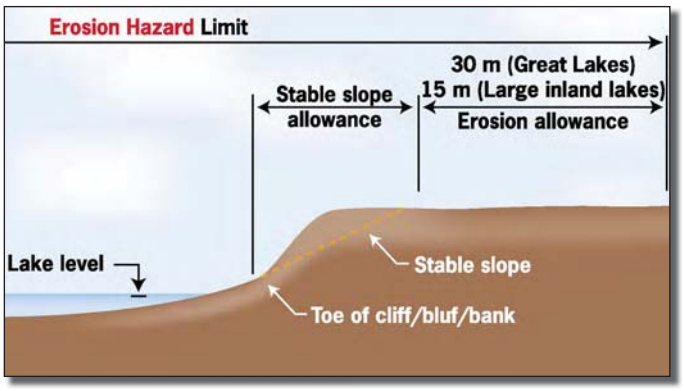


IMAGE SOURCE: Ontario Ministry of Natural Resources and Forestry



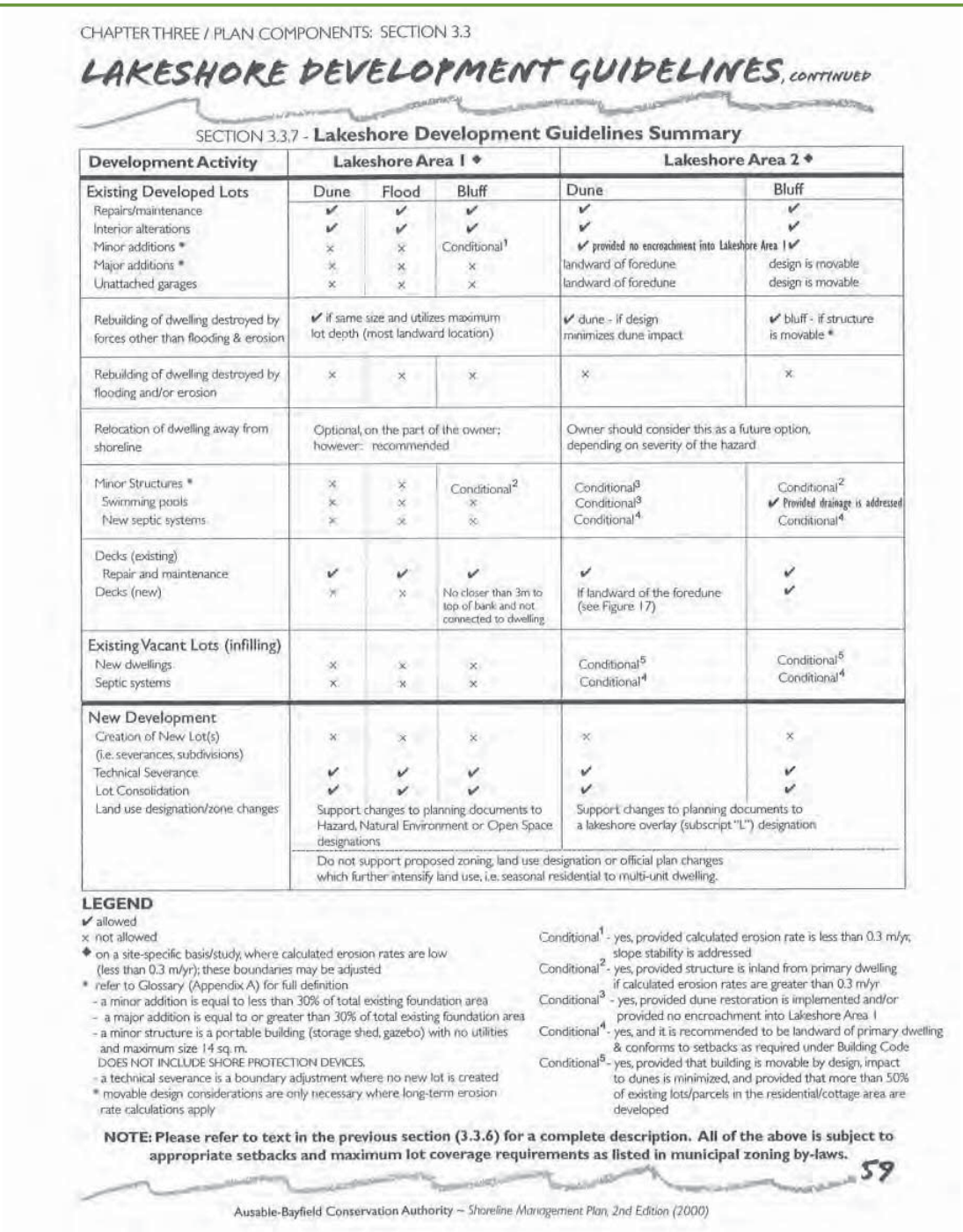
AUSABLE BAYFIELD CONSERVATION

CREATING AWARENESS | TAKING ACTION

SHORELINE MANAGEMENT

How does Ausable Bayfield Conservation Authority currently review shoreline development in regulated areas?

The policies of the Ausable Bayfield Conservation Authority (ABCA) have *not* been changed.
Currently the ABCA uses the Development Guidelines (below) contained in the Shoreline Management Plan (2000).



CHAPTER THREE / PLAN COMPONENTS: SECTION 3.3

LAKESHORE DEVELOPMENT GUIDELINES, CONTINUED

SECTION 3.3.7 - **Lakeshore Development Guidelines Summary**

Development Activity	Lakeshore Area 1 ◆			Lakeshore Area 2 ◆	
Existing Developed Lots	Dune	Flood	Bluff	Dune	Bluff
Repairs/maintenance	✔	✔	✔	✔	✔
Interior alterations	✔	✔	✔	✔	✔
Minor additions *	×	×	Conditional[1]	✔ provided no encroachment into Lakeshore Area 1	✔
Major additions *	×	×	×	landward of foredune	design is movable
Unattached garages	×	×	×	landward of foredune	design is movable
Rebuilding of dwelling destroyed by forces other than flooding & erosion	✔ if same size and utilizes maximum lot depth (most landward location)			✔ dune - if design minimizes dune impact	✔ bluff - if structure is movable *
Rebuilding of dwelling destroyed by flooding and/or erosion	×	×	×	×	×
Relocation of dwelling away from shoreline	Optional, on the part of the owner; however: recommended			Owner should consider this as a future option, depending on severity of the hazard	
Minor Structures *	×	×	Conditional[2]	Conditional[3]	Conditional[2]
Swimming pools	×	×	×	Conditional[3]	✔ Provided drainage is addressed
New septic systems	×	×	×	Conditional[4]	Conditional[4]
Decks (existing)					
Repair and maintenance	✔	✔	✔	✔	✔
Decks (new)	×	×	No closer than 3m to top of bank and not connected to dwelling	If landward of the foredune (see Figure 17)	✔
Existing Vacant Lots (infilling)					
New dwellings	×	×	×	Conditional[5]	Conditional[5]
Septic systems	×	×	×	Conditional[4]	Conditional[4]
New Development					
Creation of New Lot(s) (i.e. severances, subdivisions)	×	×	×	×	×
Technical Severance	✔	✔	✔	✔	✔
Lot Consolidation	✔	✔	✔	✔	✔
Land use designation/zone changes	Support changes to planning documents to Hazard, Natural Environment or Open Space designations			Support changes to planning documents to a lakeshore overlay (subscript "L") designation	
	Do not support proposed zoning, land use designation or official plan changes which further intensify land use, i.e. seasonal residential to multi-unit dwelling.				

LEGEND

✔ allowed
× not allowed
◆ on a site-specific basis/study, where calculated erosion rates are low (less than 0.3 m/yr); these boundaries may be adjusted
* refer to Glossary (Appendix A) for full definition
- a minor addition is equal to less than 30% of total existing foundation area
- a major addition is equal to or greater than 30% of total existing foundation area
- a minor structure is a portable building (storage shed, gazebo) with no utilities and maximum size 14 sq. m. DOES NOT INCLUDE SHORE PROTECTION DEVICES.
- a technical severance is a boundary adjustment where no new lot is created
* movable design considerations are only necessary where long-term erosion rate calculations apply

Conditional[1] - yes, provided calculated erosion rate is less than 0.3 m/yr, slope stability is addressed
Conditional[2] - yes, provided structure is inland from primary dwelling if calculated erosion rates are greater than 0.3 m/yr
Conditional[3] - yes, provided dune restoration is implemented and/or provided no encroachment into Lakeshore Area 1
Conditional[4] - yes, and it is recommended to be landward of primary dwelling & conforms to setbacks as required under Building Code
Conditional[5] - yes, provided that building is movable by design, impact to dunes is minimized, and provided that more than 50% of existing lots/parcels in the residential/cottage area are developed

NOTE: Please refer to text in the previous section (3.3.6) for a complete description. All of the above is subject to appropriate setbacks and maximum lot coverage requirements as listed in municipal zoning by-laws.

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Ausable-Bayfield Conservation Authority – *Shoreline Management Plan, 2nd Edition (2000)*

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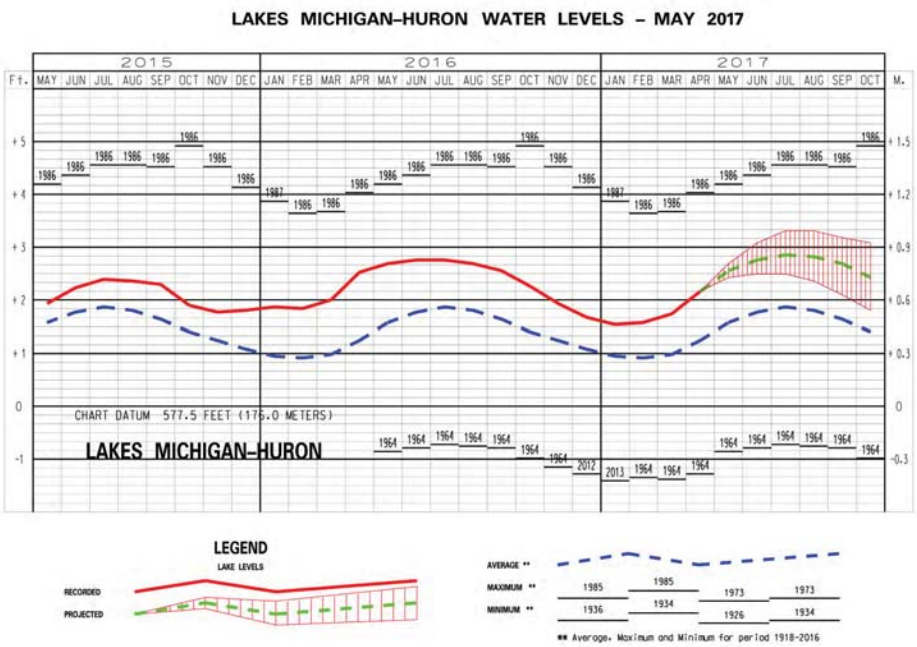
What are current Lake Huron water levels?

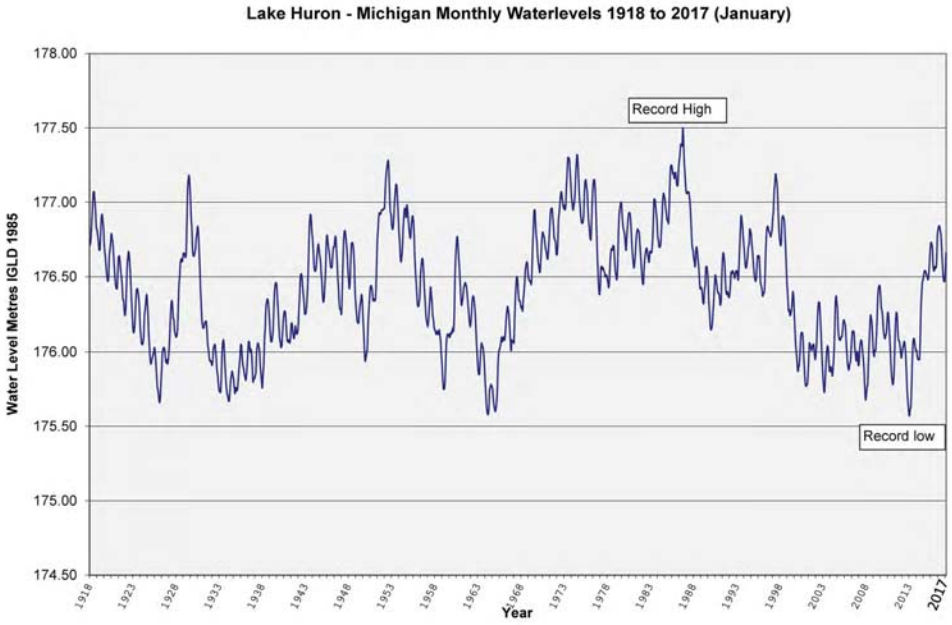
The water levels of Lake Huron are not at the record highs of 1986 (177.50 metres) but they have rebounded from the lower-than-average lake levels of the 1999-2014 period, including the record low of 175.57 metres in January of 2013.

Recent Lake Levels



Courtesy US Army Corps of Engineers

Historic Lake Levels



Monthly Mean Water Levels for Lakes Huron-Michigan. Data obtained from The Canadian Hydrographic Service, Department of Fisheries and Oceans. All levels are referenced to the International Great Lakes Datum of 1985 (IGLD 85)