

HURON COUNTY EXTREME LAKE LEVELS INTEGRATED ASSESSMENT

October 2016

Phase 2 Report to:

- the Extreme Lake Levels Subcommittee of the Huron County Water Protection Committee, and
- the Graham Sustainability Institute of the University of Michigan, and
- the University of Toronto Ecological Modelling Lab, Scarborough campus.

Integrated Assessment Question: what environmentally, socially, politically and economically feasible policy options and management actions can people, businesses, and governments implement in order to adapt to current and future variability in Great Lakes water levels?

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TABLE OF CONTENTS

Executive Summary.....	3
Recommendations for policy and adaptive management action.....	3
Introduction.....	5
Background.....	5
Locality.....	5
Phase 1 Integrated Assessment findings.....	6
Phase 2 objectives.....	7
Phase 2 efforts.....	7
Status/next steps.....	8
Policies and Adaptive Actions.....	9
New legislation.....	9
Climate change funding opportunities.....	9
Ontario’s policy framework for extreme lake levels.....	11
Emergency planning.....	12
Shoreline property owners.....	14
Shoreline protection structures.....	16
Cottage relocation.....	17
Local economic development.....	18
Conservation, stewardship, environment.....	19
Recommendations Analysis Matrix.....	22
Additional Considerations.....	27
Erosion prediction difficult.....	27
Great Lakes water diversion.....	27
Implementation/ next steps.....	27
References and Key Resources.....	28
Appendices.....	30
1. Conservation and stewardship funding programs.....	30
2. Project chronology.....	31
3. IA team, students and Huron County contributors.....	32
4. Water Protection Steering Committee.....	33
5. Extreme Lake Levels Subcommittee members.....	34
6. List of presentations.....	35

EXECUTIVE SUMMARY

The past decades have seen unprecedented fluctuation in Great Lakes water levels. The shoreline communities of Huron County, Ontario, have experienced significant economic, environmental, and social impacts from a decade of extreme low water levels which ended in 2014, and high water levels since then.

This variability in lake levels is not new, and is expected to continue over coming decades. What is new is the growing evidence that climate change exacerbates water level impacts, creating a “multiplier effect” through lake warming and more frequent, extreme storms.

In Huron County, periods of low lake levels benefit the tourism economy with the attraction of broad beaches and recreational opportunities. However, low lake levels increase the need for costly dredging and infrastructure adjustments by marina and harbour operators, and Great Lakes shipping is less profitable because of the need to reduce cargo weight per ship. High lake levels, by contrast, benefit marina operations, fishing and Great Lakes shipping, but increase bluff erosion and concerns about public safety, liability and disaster readiness. Lining Huron County’s 50 km (31 miles) of steep bluffs are more than 1,000 residences in a natural hazard area subject to sudden slumps.

Integrated Assessment (IA) is an interdisciplinary and collaborative research methodology, which actively involves subject matter experts, decision-makers, and key stakeholders working to find sustainable solutions to address real-world sustainability problems.

This Huron County IA is one of four projects funded in November 2015 by the Graham Sustainability Institute of the University of Michigan. With the endorsement of the County of Huron, an inter-disciplinary research team, including local experts, has worked with the County’s Water Protection Steering Committee (WPSC), an advisory group representing local government, businesses, residents and conservation organizations, to review issues and options for adaptation to extreme lake levels.

Recommendations for policy and adaptive management action

This Huron County Extreme Lake Levels Integrated Assessment recommends 23 policy and adaptive management actions by governments, non-profit conservation organizations, residents’ associations, businesses and property owners to:

- Address the “multiplier effect” of climate change impacts on extreme lake levels by:
 - pursuing federal climate change “disaster-readiness” infrastructure funding for storm water management and drainage improvements;
 - pursuing provincial Climate Change Action Plan funding opportunities;
 - exploring opportunities for coordinated provincial funding and program support as a “geographically focussed initiative” under the *Great Lakes Protection Plan, 2015*.
- Build on Ontario’s strong policy framework by:

- harmonizing the conservation authorities' natural hazard mapping and regulations for the Lake Huron shoreline;
 - establishing municipal shoreline tree protection by-laws;
 - providing a contact list and fact sheet with land-use planning advice on availability of lots for residential development, and municipal financial incentives, to residents wishing to relocate their cottage to a safer location back from the bluff.
- Enhance emergency preparedness by municipalities, first response organizations (police, fire, ambulance, hospitals, utilities, etc.) and shoreline property owners through review of infrastructure vulnerability, bluff collapse disaster exercises, and updates of municipal emergency plans and programs mandated by the *Emergency Management and Civil Protection Act*.
 - Municipal Emergency Preparedness Plans should include notification to shoreline property owners of the hazards and risks associated with building and activities that may be subject to natural shoreline hazards.
 - Huron County and its shoreline municipalities should lobby the provincial Ministry of Government and Consumer Services and the Ontario Real Estate Association to implement the recommendation of the **1993 International Joint Commission Report on Extreme Lake Levels** for “real estate disclosure requirements where the seller should be required to disclose to prospective buyers that the property is within a mapped or known flood or erosion hazard area. The buyer should sign an acknowledgement that he or she has been informed of the risk.”
 - Huron County, its shoreline municipalities and conservation authorities consider an application to the 2018 National Disaster Mitigation Program for federal/provincial/municipal funding for rural storm water management to ameliorate flooding and erosion of streams and gullies.
- Engage/inform shoreline property owners and prospective owners of natural hazard designations through conservation authority and local government webpages; shoreline residents' association webpages and communications; direct mail-outs to shoreline property owners of fact sheets; and an aggressively marketed and promoted program on safe and responsible shoreline property management.
- Capitalize on local economic development opportunities in Great Lakes shipping and tourism development in the Town of Goderich and Village of Bayfield, as well as longer tourism seasons likely to result from global warming.
- Promote increased conservation and stewardship capacity through prioritization and coordination of existing programs to address extreme lake level and climate change issues.
 - Consider the Coastal Action Plan being developed by the Lake Huron Centre for Coastal Conservation and the Healthy Lake Huron initiative as examples and potential vehicles to “stack” ad-hoc, fragmented and piecemeal stewardship funding programs in order to target activities/investment where they will have the greatest beneficial impact on Lake Huron coastal environments.

INTRODUCTION

Background

In November 2015, the Graham Sustainability Institute of the University of Michigan approved funding for four integrated assessments (IAs) of variable Great Lake level impacts. The projects are:

1. Inclusion of Climate-Change Effects on Lake Levels in Management Plans of Tribal Fisheries, Lake Michigan.
2. Implementing Adaptation: Developing Land Use Regulations and Infrastructure Policies to Implement Great Lakes Shoreland Area Management Plans with two Michigan municipalities (the City of Grand Haven and Grand Haven Charter Township).
3. Integrated Assessment on Water Level Variability and Coastal Bluff Erosion in Northern Milwaukee County and Southern Ozaukee County, Wisconsin.
4. **Extreme Lake Levels: Issues and Options for Huron County, Ontario.**

This Huron County IA, funded by the Graham Sustainability Institute and sponsored by the University of Toronto's Ecological Modelling Lab, brings together a multi-disciplinary research team, including local experts, with the **Huron County Water Protection Steering Committee** (WPSC) as advisory committee to the IA team. The WPSC was established by the County of Huron in 2004, with representatives from environmental, social, political, and economic interests. The current chair is Central Huron Mayor, His Worship Jim Ginn.

The project/research team includes a graduate student from the University of Toronto's Ecological Modelling Lab, an Environment Canada scientist, two former Ontario senior executives with expertise in legislation and policy development, and a former municipal chief administrative officer. Other expert contributors include staff of the Lake Huron Centre for Coastal Conservation, the Maitland Valley Conservation Authority (MVCA), the Ausable Bayfield Conservation Authority (ABCA), and Huron County's Planning and Development Department. Representatives of the Bluewater Shoreline Residents' Association and the Ashfield-Colborne Lakefront Association played key roles. This Integrated Assessment project has the support of the County of Huron and its local municipalities.

The IA process has several components, each culminating in a report to the Graham Sustainability Institute and the WPSC:

- A 2015 **feasibility study** identifying issues and participants, which resulted in municipal endorsement and letters of support for participation in the IA.
- **IA Phase 1** – November 2015 to May 2016. Research, presentations and a full day workshop with 45 WPSC members and additional invited stakeholders with an interest in lake levels. Phase I background report completed May 3, 2016.
- **IA Phase 2** – May to November 2016. Four public presentations of Phase 1 results; additional research; discussion with key stakeholders on IA findings and development of recommendations for actions. Phase 2 report completed October 30, 2016.

Locality

In Huron County, the 100 kilometres (62 miles) of Lake Huron shoreline include:

- dunes and beaches attracting recreation and tourism, two Provincial Parks,
- harbours requiring dredging and infrastructure capable of handling boating and commercial shipping at either extreme of lake level, and
- 50 km (31 miles) of majestic bluffs with spectacular sunset views lined by shoreline residences that present challenges for emergency preparedness and public safety.

Huron County is a beautiful agricultural area of 60,000 people in south-west Ontario, Canada, attracting an additional 10,000 summer tourists, campers and cottagers annually. The Town of Goderich has the world's largest productive salt mine, and the only deep-water port on the eastern shore of Lake Huron, handling shipping for salt, grain and calcium chloride.

A March 2016 discussion paper on the potential implications from climate change for coastal processes affecting the south-west shoreline of Lake Huron was prepared by Dr. Robin Davidson-Arnott, as part of the ABCA Shoreline Management Plan update process. The discussion paper predicts annual average temperatures increasing by 2 to 7 C by the end of the century, with most resulting from a large increase in winter temperatures and somewhat smaller increase in summer temperatures. This in turn impacts lake temperatures, lake effect snowfall, winter ice cover and fish habitats. Climate change will have the effect of exacerbating the effects of extreme lake levels, including flooding and erosion events. The process of global warming, lake warming and increasing numbers of intense storm events is already being felt on Lake Huron's coastline.

Great Lakes commercial shipping, the potential for tourism cruises, and a longer recreational season may benefit local economies. However, increased erosion from less winter ice protection on the bluff toes and a larger number of intense storms will adversely affect shoreline properties by increasing the recession rate of erosion.

Phase 1 Integrated Assessment findings

This phase of the Huron County project began in late November 2015, with an overview presentation at the WPSC. A full-day workshop was held January 15, 2016 with the WPSC members and other invited participants (45 people). Committee members reviewed and discussed extreme lake level issues and the current status of regulatory and other tools and processes to address them. The WPSC established an **Extreme Lake Levels Subcommittee** to continue work on the project with the research team.

The WPSC workshop identified two areas of extreme water level issues of most significance for Huron County communities:

1. Low water level impacts on economic development, tourism, shipping, ports, and harbours, particularly the Town of Goderich and the Village of Bayfield.
2. High water level impacts on bluff and gully erosion affecting as many as 1,050 shoreline properties. In particular:

- how to ensure prospective buyers of lakefront property on the bluffs are aware of the natural hazard designation and regulatory limits on shoreline property when they purchase their dream cottage;
- ways to engage owners to take advantage of local information resources and professional expertise to evaluate their property; learn the do's and don'ts of bluff stabilization;
- information for property owners about what to do in the event of a bluff slump and emergency situation;
- information for property owners on cottage relocation options.

Issues relating to environment, habitat, invasive species, and coastal resiliency were also discussed, particularly in relation to potential climate change impacts. There was concern about the potentially negative impacts of diverting Great Lakes water, as requested by Waukesha, Wisconsin, and approved in June 2016 by the Great Lakes-St. Lawrence River Basin Water Resources Council, made up of representatives from a group of eight U.S. States. (The Great Lakes and St. Lawrence Cities Initiative, which includes Canadian cities, has challenged the decision).

Phase 2 objectives

- Enhance public awareness and discussion of lake level issues.
- Complement the activities of the local conservation authorities on shoreline management planning and natural hazard mapping updates.
- Complement the activities of municipalities on emergency planning for hazard lands.
- Support the conservation and stewardship activities of the Lake Huron Centre for Coastal Conservation (LHCCC).
- Identify local economic development opportunities and municipal infrastructure issues and challenges.
- Identify potential federal and provincial legislation, funding programs and tools that could be useful to Huron County, its municipalities and conservation authorities for actions to adapt to extreme lake level impacts.

Phase 2 efforts

Phase 1 research and findings were the basis for presentations, discussions and further research during the spring and summer of 2016 as follows:

- May 14- Ashfield-Colborne Lakefront Association communication coordinators meeting.
- May 17 - Graham Sustainability Institute, University of Michigan - presentation and discussions with advisory committee members.
- May 27 - "Is the Coast Clear" conference presentation, LHCCC.
- June 4 - Bluewater Shoreline Residents' Association annual meeting presentation.
- June 15 - Coastal Zone Canada conference in Toronto – attended workshops on "Nature and Nature-Based Structures" for erosion control.
- August – email circulation of Phase 2 findings and recommendations to WPSC Extreme Lake Levels Subcommittee members for comment; email and telephone discussions.
- August 26 – meeting with LHCCC executive director, Matthew Hoy and Erinn Lawrie, Coastal Stewardship Coordinator -- discussion of findings and recommendations.

- August 27 – Bluewater Shoreline Residents’ Association meeting re ABCA Shoreline Management Plan consultant’s report presented by Geoff Cade, attended by almost 100 residents.
- September 23 – meeting with WPSC Extreme Levels Subcommittee to review and finalize Findings and Recommendations for Phase 2 report.
- October 30– Phase 2 report completed for submission to Graham Sustainability Institute.

Status/ next steps

This report concludes the Huron County Extreme Lake Levels Integrated Assessment. The Extreme Lake Levels Subcommittee submits this report for implementation consideration to Huron County and its shoreline municipalities, conservation authorities, residents’ associations, non-profit organizations, federal and provincial ministries and departments.

A webinar will be broadcast November 17, 2016 to profile the Huron County Extreme Lake Levels IA.

The Graham Sustainability Institute will complete a paper by April 17, 2017, on the four IAs, highlighting transferrable learnings.

POLICIES AND ADAPTIVE ACTIONS

New legislation

The *Great Lakes Protection Act, 2015* is new legislation to protect and restore the ecological health of the Great Lakes-St. Lawrence River Basin; and to create opportunities for individuals and communities to become involved in protection and restoration. It establishes an advisory Great Lakes Guardians Council (first meeting was in March 2016), and establishes tools including provision for “geographically focused initiatives (GFIs)”. The Act requires regular monitoring and a report to the legislature every three years.

Activities to protect the Great Lakes that could be addressed with GFIs would:

- protect natural heritage or hydrologic features,
- coordinate efforts to improve beaches,
- reduce excessive algae.

Geographically-focused initiatives could be developed by a municipality, conservation authority or the Province.

Recommendation #1: Huron County explore the potential advantages of establishing a Geographically Focused Initiative under The *Great Lakes Protection Act*. A GFI could be an important tool for Huron County, its conservation authorities and other organizations for the purpose of addressing the impacts of extreme lake levels through protecting natural heritage, hydrologic features and Lake Huron water quality with enhanced storm water management and other infrastructure improvements.

Climate change funding opportunities

The federal Public Safety Minister Ralph Goodale in January 2016 announced **climate change funding for infrastructure** in an interview with the Canadian Press. As part of its multibillion-dollar commitment to invest in a variety of infrastructure projects, the Liberal government has promised to spend money on “climate-resilient public works”. **Disaster readiness** will ensure communities are better able to deal with floods, fires, drought and ice storms, extreme weather events and **extreme lake levels**.

The Public Safety Department is working with provinces, indigenous peoples and municipalities to develop a comprehensive action plan that allows Canada to better predict, prepare for and respond to weather-related emergencies and natural disasters. Department officials are working on a comprehensive set of indicators of vulnerability and resilience to identify high-risk areas in advance of disasters, as well as the kinds of adverse events that severely strain a community.

Recommendation #2: Huron County communicate to the federal and provincial authorities Huron County’s bluff and gully erosion risk status, and the urgent need to prepare for potential disaster situations from bluff erosion, to ensure this scenario is included in the federal funding program indicators, and to identify the Huron Bluffs as a high-risk area for funding.

Recommendation #3: County of Huron seek to engage with the federal and provincial governments, the Association of Municipalities of Ontario and The Federation of Canadian Municipalities, on development of indicators and action plans for federal infrastructure funding for climate change disaster readiness.

Recommendation #4: County of Huron and local municipalities pursue funding applications under federal/provincial/municipal grant programs (such as the National Disaster Mitigation Program) for storm water management systems and municipal drains capable of dealing with 100 year storms, access road and bridge infrastructure improvements to adapt to extreme lake levels and extreme weather events resulting from climate change.

The linkages among climate change, lake levels, soil erosion and water quality have been noted in a number of policy documents, including a discussion paper recently released by the Ontario Ministry of Agriculture, Food and Rural Affairs. “**Sustaining Ontario’s Agricultural Soils: Toward a Shared Vision, 2016**” is described as an integral part of achieving the goals set out in other key Ontario initiatives, including Ontario’s Climate Change Strategy and Great Lakes Strategy.

The discussion paper comments that average agricultural land erosion rates between March and August have increased 10 to 20 percent per decade over recent decades. A single intense storm in summer or winter can now account for 60 percent of annual erosion. In Huron County, storm water rushing across farm fields, through streams and gullies into Lake Huron, exacerbate bluff erosion as well as impact lake water quality.

The paper describes erosion control measures as follows: “windbreaks, buffer strips and grassed waterways help reduce gully erosion and filter runoff. In recent years, many existing fencerows and windbreaks have been removed as many farmers sought to increase their crop acreage at a time of higher commodity prices. Installing water and sediment control basins and controlled drainage are measures that can help manage runoff and drainage to reduce negative impacts when used with other Best Management Practices (BMPs). The cost and complexity of installing structural measures can be significant.” (pg. 26)

OMAFRA and other partners use a variety of tools to help farmers adopt soil-related BMPs, including risk assessment, planning, education and incentives. The Environmental Farm Planning process helps farmers identify risks to soils and match BMPs with the issues identified. Growing Forward 2 offers funding for planning and implementation of soil BMPs, such as cover crops and erosion control. The new **Great Lakes Agricultural Stewardship Initiative** (GLASI) offers support for advice and planning for soil health actions through the Farmland Health Checkup. GLASI provides financial support for adopting all the major soil-related BMPs for farms in the Lake Erie and Lake Huron watersheds.

Recommendation #5: County of Huron and its farm organizations aggressively encourage farmer participation in soil erosion control measures to preserve the local farmland resource and economy; benefit shoreline tourism; protect shoreline residences; and improve Lake Huron water quality and the nearshore environment.

Ontario's policy framework for extreme lake levels

Ontario's policy framework (Provincial Policy Statement 2014, *Planning Act*, *Conservation Authorities Act* and regulations) is sufficiently flexible to accommodate future lake level uncertainties by providing a sufficiently large buffer **for new development**. In particular, the 100-year time horizon for recession rates and a 100-year flood elevation for lake level and storm surge should provide sufficient protection against existing hazards as well as accommodating potential changes due to climate change. (Dr. Robin Davidson-Arnott, pg. 11, **Climate Change Impacts on the Great Lakes**, Discussion paper for the Ausable Bayfield Conservation Authority).

While preventing new development on hazard lands is relatively straightforward under Ontario's policy framework, dealing with **existing development** presents a daunting challenge to municipalities and conservation authorities. In general, municipalities are responsible for people, buildings and their safety; conservation authorities are responsible for protecting the features and functions of river valleys, flood plains, great lakes shorelines, dynamic beaches and wetlands.

To do this, conservation authorities provide hazard land mapping to provincial policy standards, and they monitor/forecast potential riverine/lake effect flood events. They ensure that proposed development or site alteration does not affect flood control, erosion, pollution, or conservation of land.

Conservation authority (CA) jurisdiction for Huron County's Lake Huron shoreline is split between the Ausable Bayfield Conservation Authority (ABCA) and the Maitland Valley Conservation Authority (MVCA).

The ABCA is in the process of updating its Shoreline Management Plan. The Consultant Recommendation report was posted online for 90-day public comment on September 1, 2016. The report includes updated mapping of hazard land areas as well as recession rates along the ABCA jurisdiction shoreline that will greatly improve local shoreline property owners' ability to assess their individual property erosion risks.

As the ABCA updates its natural hazard mapping and policies over 2016/17, it needs to consider the policies of the MVCA to ensure that situations under the jurisdiction of one CA will be treated similarly to the same situation across the CA jurisdiction line.

Recommendation #6: The ABCA and MVCA work to harmonize their mapping and policies to ensure consistent information for property owners.

The Township of Ashfield-Colborne-Wawanosh on October 4, 2015, passed a Shoreline Tree Protection Bylaw, under section 135 of the *Municipal Act* which authorizes a local municipality to prohibit or regulate the destruction or injuring of trees.

The By-law prohibits clear cutting and protects living trees along and near the Lake Huron shoreline, for the purpose of:

- Regulating and controlling the removal, maintenance and protection of trees;
- Protecting significant and sensitive natural areas;
- Maintaining water quality;
- Maintaining and enhancing natural habitat;
- Preventing soil erosion and water run-off; and
- Protecting, promoting and enhancing the aesthetic values within the Township.

Recommendation #7: The Municipalities of Central Huron and Bluewater consider passing similar Shoreline Tree Protection By-laws, and that the County of Huron consider a county-wide tree protection by-law.

Emergency planning

In Huron County, a major concern for emergency management is **coastal bluff erosion** and its threat to **existing development**. Huron County has 50 km of bluffs, the only bluffs on the eastern side of Lake Huron, cut by more than 130 gullies and ravines, which are also subject to erosion. Heavy rain has impacts that start well inland and surges through gullies and ravines into Lake Huron, exacerbating erosion and affecting lake water quality.

Erosion is a natural, cyclic process of dynamic coasts and has beneficial impacts to down shore areas, renewing dunes and beaches, important to the local tourism economies of Huron County and quality of life for everyone.

The MVCA has identified some 550 existing structures at “imminent risk” of being swept down 100 foot-high slopes if the bluff on which they are perched collapses. The ABCA has jurisdiction for bluffs that include an additional 500 or more residences within 15 metres of the top of the lake bank. 100-year recession rate analysis is underway as part of the ABCA Shoreline Management Plan update.

In the 1950’s and 60’s, when the majority of cottages were built along the Huron bluff, many were set well back from the bluff edge, but erosion over the ensuing years has caught up with them. In addition, many cottages north of Goderich were constructed on the bluff and on the beach at the toe of the bluffs, with no properly designed systems for controlling storm water runoff, and accessed by private roads cut into the bluffs which were not subject to engineering design.

The nature of shoreline development has also changed over time. Original cottages were 400 to 800 square foot simple structures on concrete blocks. Over time, some of these have been redeveloped to 3,000 square foot permanent residences with basements.

Should a cottage be occupied at the time of a slope slump, the risk of human tragedy is high, with very little that first responders could do to provide aid because of the danger to their safety on the shifting soils and debris. This is particularly an issue with rural fire departments which don’t have the equipment and experience for this type of search and rescue.

The *Emergency Management and Civil Protection Act* requires each municipality to develop, implement, and maintain an emergency management program. The primary reason for an emergency management program is to improve public safety through a coordinated and pre-identified process for responding to critical situations. The emergency management program is intended to assist in protecting lives, infrastructure, and property, protect the environment, promote economic stability, and help ensure the continuance of critical assets and government.

Conservation authorities provide flood status, low water status and bluff erosion risk alerts on their webpages. Unlike flooding and drought, bluff erosion is particularly difficult to predict, as it is not necessarily triggered by storms. To date, there seems to be no way to predict a bluff erosion event in order to evacuate residents who may be affected by it, although there may be small signs that property owners may notice, if they know what to look for.

Recommendation #8: Municipalities include notification to shoreline land owners of the hazards and risks associated with building and activities that may be subject to natural shoreline hazards, as part of their Emergency Management Planning. Since shoreline properties can change ownership, and to ensure that all affected property owners receive the notification, municipalities may want to consider sending a hazard land notice to affected property owners with their municipal tax bill.

In 2014, MVCA facilitated an erosion emergency exercise with the Township of Ashfield-Colborne-Wawanosh, which has 550 shoreline residences within the 100-year recession rate for hazard land designation. There are plans to do a similar exercise with the Municipality of Central Huron, which has an additional 500+ residences which may be at risk. These exercises give local First Responders an opportunity to test their emergency plans and to fine tune their responses in the event of a disaster. In emergency planning, not only the immediately affected areas have to be considered, but also the larger community in the event of utility disruption, hospital capacities, and other consequences with broader impact. Lessons learned from the erosion emergency exercises are included in the municipal Emergency Management Plan.

Recommendation #9: Municipality of Central Huron to participate in an erosion emergency exercise in 2017; Municipality of Bluewater schedule a similar exercise. Bluff erosion scenarios be included in their municipal emergency management plans. Both conservation authorities continue to work with municipalities and first response organizations on preparedness, and promote awareness among shoreline residents of what they can look out for and what they should do in the event of a bluff slump.

There are situations where the only municipal road into a shoreline neighbourhood runs adjacent to a gully which is subject to erosion and flooding, which could cut off or wash out the road, eliminating ingress and egress. Emergency vehicles would be unable to get to residents in the event of a disaster, and residents would be unable to get out to safety.

Recommendation #10: The Township of Ashfield-Colborne-Wawanosh, the Municipality of Central Huron and the Municipality of Bluewater review their **municipal road access** to shoreline residential areas to ensure there is more than one road in and out of each residential

area, and that access roads are secure from flooding and erosion. Residents with cottages on **private roads** or laneways should be reminded as part of annual hazard land status notification that they are responsible for maintaining their roads.

Engage shoreline property owners

Recognizing that property owners need to understand what causes bluff erosion and why they should adhere to regulations, governments and conservation organizations have issued guidelines, manuals, websites, and held public meetings to provide useful information.

Shoreline residents' associations post links to information and work to keep their memberships informed. However, such education needs to be continuous because of population turnover, and many Huron County shoreline residents seem largely unaware of bluff erosion issues despite the availability of excellent information and the efforts of their associations. At a Bluewater Shoreline Residents Association meeting in August, for example, one-third of the 100 attendees indicated they were new property owners, and attending for the first time.

The question of how to inform and engage property owners elicits the greatest frustration among key stakeholders, and time and again was the top priority on the part of workshop and public event participants during this Integrated Assessment.

Public engagement is important because the activities of property owners may actually increase the rate of erosion (e.g. vegetation removal and hardscaping) while appropriate vegetation and landscaping can augment slope stability. Homeowners may be unaware of actions they could take to assess the risk to their individual properties and many don't know what to do in the event of an emergency, or the signs that an emergency may be imminent.

Educating private property owners is an ongoing process that needs to be repeated every time a property is bought and sold. In Huron County, local authorities have noticed a marked increase in sales of shoreline residences each time lake levels peak and erosion becomes more noticeable. It is unlikely that the rate of erosion or land conservation are top of mind when a potential buyer is looking at their dream cottage overlooking the lake. However, it becomes an issue once the new owner wants to renovate or notices waves washing away the bluff toe or tension cracks appearing in the yard.

Real estate agents have a key role to play since they are the first point of contact with buyers. Some, but not all, do advise prospective purchasers that a shoreline residence may have hazard land designation. Others stay silent, preferring a quick sale to an ethical sale. In real estate law, bluff erosion falls under the category of a "known defect" – this means it is something that should be obvious to the purchaser, (similar to the likelihood that a very old house will have very old and possibly faulty electrical wiring), so the real estate agent does not have to point it out.

However, disclosure of features affecting the property is a safety issue as well as a matter of ethics. If a dangerous situation is not disclosed, the agent could be liable. This issue was noted as early as the **1993 International Joint Commission Report on Extreme Lake Levels**, which recommended: "real estate disclosure requirements where the seller should be required to

disclose to prospective buyers that the property is within a mapped or known flood or erosion hazard area. The buyer should sign an acknowledgement that he or she has been informed of the risk.” (pg. 44)

Recommendation #11: The County of Huron, local municipalities and conservation authorities lobby their local M.P.P, the Provincial Minister of Government and Consumer Services, Emergency Management Ontario, and the Ontario Real Estate Association, for mandatory disclosure requirements of natural hazard designation when properties are sold.

Local municipalities could also do more to ensure public awareness of bluff erosion risks. To date, however, they have been unwilling to intervene with hazard land signs or public notice of the erosion risk, (although the Township of Ashfield-Colborne-Wawanosh has passed a Shoreline Tree Protection Bylaw in an attempt to protect slope stability, and has participated in a bluff collapse disaster scenario for emergency planning). Municipalities are in a difficult position because they gain as much as one-third of their tax revenues from shoreline residential property taxes, yet are responsible for Emergency Planning, first response and public safety in the event of a slope disaster.

The January 15 workshop attended by 45 WPSC and invited representatives of Huron County shoreline interests posed the following questions:

- How to ensure prospective buyers are aware of properties with hazard land designations, so they understand, and can be prepared for, potential risks.
- Ways to assist current owners to evaluate their individual property risk situations.
- Ways to engage property owners to take advantage of local resources.
- Information for property owners about what to do in the event of a slump.
- Information for property owners on cottage relocation approaches.

Recommendation #12: Shoreline municipalities, to annually mail to the **home** addresses of owners of properties within the 100-year bluff recession line, a “Do You Know” fact sheet advising of their property’s bluff erosion and hazard land status (see ABCA Shoreline Slope Stability Risks and Hazards fact sheet for property owners), together with url links to resources including:

- the MVCA policies and hazard land mapping; ABCA shoreline management plan and recession mapping; regulations affecting shoreline properties; advisory services and staff contacts;
- ABCA discussion papers on Climate Change and Erosion of Cohesive Bluff Shorelines by Dr. Robin Davidson-Arnott;
- “Shoreline Slope Stability Risks and Hazards” fact sheet for property owners prepared by Terraprobe Inc for the ABCA;
- Lake Huron Centre for Coastal Conservation’s “Bluff Erosion Geo-Hazard Checklist” and Guide; Extreme Lake Levels position statement, Climate Change fact sheet;
- Website and Facebook links to the Bluewater Shoreline Residents’ Association and the Ashfield-Colborne Lakefront Association;
- The MVCA presentation, “Bluff Erosion, Public Safety and Emergency Planning”, presented by Steve Jackson at the January 2016 Integrated Assessment workshop;

- “Stabilizing Coastal Slopes on the Great Lakes” by Gene Clark, University of Michigan Seagrant;
- Local contacts for bluff stability landscaping and geo-technical and engineering consultants.

Recommendation #13: Shoreline municipalities, CAs and the Lake Huron Centre for Coastal Conservation aggressively market to shoreline property owners their expertise and no-cost availability to provide individual property risk assessments, relevant land-use planning and regulatory/permitting requirements; climate change information, lake level and bluff erosion trends; do’s and don’ts for landscaping to augment bluff stability; local landscaping tips for bluff stability planting; local geo-technical consultants, what to watch for and what to do in the event of erosion.

Recommendation #14: The Ashfield-Colborne Lakefront Association and the Bluewater Shoreline Residents’ Association continue tracking and informing their residents of the shoreline management plan and mapping update processes and related information.

Recommendation #15: Shoreline residents in the ABCA jurisdiction be encouraged to review and comment on Shoreline Management Plan update mapping and policy proposals over the next year. The updated mapping will be particularly valuable to residents, providing them with a better idea of erosion rates (low, medium, substantial) that may affect their properties.

Shoreline protection structures

Some shoreline property owners are upset that there has been no action by government to establish shore protection structures to buffer the shoreline from wave action. Unfortunately, such structures may delay erosion to some extent, but lake forces always win against hard structures over time. The **Shoreline Management Plan 2016 Consultant Recommendation Report**, posted on the ABCA website, includes photographs and descriptions of ineffective and deteriorating shoreline protection structures installed some years ago by local property owners. It should be noted that CAs have no authority to require property owners to maintain these structures, once built.

Some property owners want to protect their individual properties as they see fit, which has in some cases accelerated the erosion of neighbouring properties, resulting in court cases requiring removal of the original structure. However, there may be cases where a geotechnical coastal engineering assessment could determine that an individual property could benefit from shoreline protection without adversely affecting neighbouring properties. It must be recognized that the cost would be high for the landowner, and the benefit would not be permanent.

To be effective even for a time, shore protection structures need to be considered for larger stretches of shoreline, not just individual properties, and may have unintended consequences further down coast. For example, protecting bluff areas from erosion can result in sand starvation for the important tourism beaches down-drift in the Pinery Provincial Park and Grand Bend.

Staff of the Lake Huron Centre for Coastal Conservation attended workshops on “nature and nature-based features” for erosion control at the 2016 Coastal Zone Canada Conference in Toronto in June and are monitoring new approaches in that field. The conservation authorities are the key experts and authorities for any shoreline structural changes as their mandate is to protect hydrologic function and natural shoreline processes. They must be contacted by property owners considering these approaches. It should be stressed that the science and past experience of shoreline structures increasingly points to adverse environmental consequences, high cost for short term benefit, and negative impacts on neighbours that can have legal consequences.

Recommendation #16: CAs to compile, as a resource for property owners, a contact list of consultants who do geotechnical analysis, as well as shoreline protection guides and information on various shoreline protection approaches, together with a summary of their regulations governing shore protection structures.

Cottage relocation

During the January workshop and during public presentations, there was interest in further research and discussion of possible ways to help homeowners interested in considering a relocation of their home – moving the house or cottage to a safer location further back from the edge of a bluff.

The ideal situation would be a coordinated approach with the federal and provincial governments to buy out the properties at most risk and make the eroding shoreline public land. This has been the approach in some situations where the number of properties was relatively small and the government jurisdiction had deep pockets. For Huron County, however, financial realities make a buy-out of shoreline properties within the hazard land designation extremely remote. The value of shoreline property just within the MVCA jurisdiction has been estimated at about \$366 million. With an additional 500 residences at risk in the ABCA bluff jurisdiction, the total cost could exceed \$700 million.

For property owners, where the bluff has eroded putting the home dangerously close to the edge, sometimes a managed retreat may be the best alternative. The most common examples are found along ocean coastlines, such as those in Maine and Atlantic Canada, but there have been Huron County property owners who have made the move to lift their homes off their foundations and move them away from the edge of the bluff. Cottage relocation can be a costly proposition for the property owner; however, it may be the only way to save the building and continue using it on another lot.

During the high water levels of the 1990s, there was discussion of the need to plan for "runaway" or “move-back” lots to be established, as not all shoreline lots are deep enough to accommodate a managed retreat option. These would be vacant lots delineated behind 'at-risk' lots so that when erosion becomes an imminent threat, there is a place to relocate the cottage. The idea never went further than discussion, but consideration could be given to identifying potential areas for residential relocations, should property owners be willing to pursue this option. The Huron County Planning and Development Department indicates that there is a supply of land designated for residential use along the shoreline but behind the 100-year recession rate line, should

property owners wish to pursue purchase of a lot to which to move their cottage, while remaining in the same community.

The advantages of cottage retreat are profound:

- Property owners would save their houses, maintain some equity, and continue to enjoy the splendid Lake Huron sunsets. (Note: property insurance specifically excludes damage from erosion, so in the event of a slump, a homeowner would lose all value in the home.)
- Municipalities would maintain their tax base, population base and local economies.
- Public safety would be enhanced, and municipal liability reduced.
- Coastal environments, hydrologic features and habitat would be maintained.

Updates of 100-year bluff recession and flood mapping by the conservation authorities will be reflected in the County of Huron land use plans and zoning by-laws in due course. As part of this updating and amendment process, the County's Planning and Development Department, together with local municipalities, could consider reviewing the current availability of land for development, and ensure there is sufficient development land available for "move-back" lots where viable, behind coastal areas most threatened by bluff erosion. The County could also identify potential financial incentives (such as planning fee forgiveness), specifically targeted to property owners undertaking a cottage relocation.

This would be just the first step in a planning and development process that would require willing sellers of land behind current natural hazard land areas, lot severance and/or subdivision process approvals, and shoreline property owners interested in purchasing a "move back" lot for future location of a cottage.

Recommendation #17: Huron County and municipal planning authorities are encouraged to identify, where possible, property behind existing cottage development and beyond the hazard land area, designated for residential development and available for severance, private sale and relocation of cottages currently on the bluff. Planning authorities are also encouraged to identify financial incentives such as fee forgiveness that would provide some help to shoreline property owners considering cottage relocation.

Local economic development

The Town of Goderich is well positioned to benefit with jobs and economic activity from a longer Great Lakes shipping season at its deep water port (the only one on the eastern shore of Lake Huron) as a result of decreased duration and extent of winter ice cover. The non-profit Goderich Port Management Corporation recently completed a 15-year plan to remediate the river wall, piers and breakwalls. A new 15-year plan proposes to landfill next to the existing wharf to permit additional storage and docking space to take into account high and low water levels and resilience to storm events as a result of climate change. Expansion of the port would provide existing users (250 to 280 ships annually) to expand their operations and attract new users.

Goderich's port has been designated an official Seaway Port under the "Highway H2O" program, a government and business initiative to market the Saint Lawrence Seaway and Great

Lakes ports to international customers. Great Lakes shipping companies are investing \$4.1 B in a fleet of new, more efficient freighters. The Town of Goderich is also a tourist centre, and is undertaking a Waterfront Master Plan.

In June 2016, the Conference of Great Lakes and St. Lawrence Governors and Premiers released its “Final Strategy for the Great Lakes-St. Lawrence River Maritime Transportation System”. The Strategy identifies significant opportunities to streamline and grow Great Lakes shipping, should there be sufficient political will to establish a regional governance and regulatory structure and reforms. Of interest to Huron County is the potential for increased economic activity as a result of greater commercial shipping activity, but also the potential for broader tourism activity that could ensue from establishing a Great Lakes tourism cruise industry.

Recommendation #18: The Town of Goderich coordinate its tourism initiatives with Port Authority plans and operations to maximize local economic benefits of each and avoid conflicts. Both Port and Tourism planning will need to consider adaptation to extreme high and low lake water levels and extreme storm events due to climate change.

The Village of Bayfield is poised to build on its charm and lakefront harbour and amenities with the expansion of its sewage treatment capacity, which will support more seasonal and permanent housing. The Ontario Ministry of Tourism, Culture and Sport has designated Bayfield as one of four towns in a large tourism regional west of Toronto to receive assistance for marketing and other “destination development” initiatives. The Town, federal government and marina owners recognize the importance of the river and lake and contribute to dredging when needed, as well as pier repairs and maintenance to reduce the effect of wave action and siltation to the harbour mouth.

Recommendation #19: In developing the Bayfield growth plan, management structure and marketing of the lakefront harbour, amenities and sewage treatment capacity, particular attention needs to be paid to extreme lake levels and climate change impacts, especially with respect to marinas, harbour depth and municipal infrastructure such as roads and bridges.

Conservation, stewardship, environment

There are a myriad of programs and initiatives to promote conservation and stewardship of the environment, with the Great Lakes eligible for, or the focus of, many of them. There have been efforts to establish over-arching coordination for strategic priority setting and funding of actions, but funding continues to be fragmented, small scale and piecemeal with onerous application and reporting requirements.

Huron County established a **Water Protection Steering Committee** in 2004. In March 2016, it celebrated its 2000th funded project, worth more than \$8 million, for conservation and stewardship to protect water quality. Huron County residents have, with support of the **Huron County Clean Water Project grants**, accomplished the following:

- Fenced cattle out of 40 kilometres of streams
- Planted more than 160 hectares of trees

- Established 100 kilometres of windbreaks
- Upgraded 330 private wells
- Decommissioned 430 unused wells
- Decommissioned 75 liquid manure storages
- Completed eight Forest Management Plans
- Completed 500 tree planting projects
- Completed 140 erosion control projects

Recommendation #20: The WPSC review its grant program with an eye to promoting/enhancing storm water management initiatives to reduce gully and bluff erosion and improve Lake Huron water quality.

The Lake Huron Centre for Coastal Conservation is a non-profit organization with a mission of conservation and stewardship for the Canadian shoreline of Lake Huron. The Centre:

- works with communities to produce shoreline conservation plans and empower local volunteer conservation efforts;
- undertakes research and produces reports and position papers on topics such as Extreme Lake Levels and Climate Change impacts;
- provides conservation services to participating conservation authorities and municipalities;
- develops programs like "Coast Watchers" and "Butt Free Beach";
- provides landowner guides to coastal stewardship, Lake Huron Bluff Stewardship Guide, an Erosion Checklist and guides to other shoreline issues such as "Phragmites", other invasive species and species at risk.

The Coastal Centre is undertaking development of a **Coastal Action Plan for Southeastern Lake Huron**. This is the area from Sarnia to Tobermory, inland to the boundary of the "Huron Fringe", a narrow band of unique ecosystem types along the coast of Lake Huron and an important migratory corridor.

The purpose of the Action Plan is to tie together all work being done on the eastern shore; invest in both natural and manmade features; discover what areas are most stressed; understand threats and vulnerabilities; and create a unified vision for conservation and stewardship. The Action Plan will be developed with the participation of the Ministry of Environment and Climate Change, Ministry of Natural Resources and Forestry, University of Waterloo, conservation authorities and municipalities along the shoreline.

Outcomes expected include measurable ecological improvements, increased public awareness and stewardship activities. Development of the Action Plan will include study of ecosystem types: beach and dunes, coastal wetlands, bluffs and gullies, cobble beaches, rivers, woodlands.

The approach will knit together the extensive base of existing data, strategies, and local initiatives, identify local stressors, recommend actions to mitigate threats. Mapping will be done using GIS to identify biodiversity features, potential stressors such as urban development, pits and quarries, invasive species.

Recommendation #21: Lake Huron Centre for Coastal Conservation should consider whether there is an advantage in pursuing a GFI under the *Great Lakes Protection Act, 2015* to help develop and implement its Coastal Action Plan for the south-eastern shore of Lake Huron.

Recommendation #22: As part of its Coastal Action Plan initiative, the Lake Huron Centre for Coastal Conservation examine how the myriad of municipal, provincial and federal funding programs could be accessed in a coordinated manner to fund priority actions along the coastline to achieve ‘the biggest bang for the buck’.

“**Healthy Lake Huron**” is a partnership of Lambton, Huron and Bruce county communities, their health units and conservation authorities, with the Ministries of Environment and Climate Change and Agriculture, Food and Rural Affairs and Environment Canada to address persistent near-shore water quality issues. Watershed action plans have been developed for five priority watersheds along Lake Huron shoreline with targets and actions to improve water quality.

Communities along the southeast shore of Lake Huron requested \$18.8 million over five years from provincial and federal partners to achieve the watershed goals, but consistent funding has been difficult to obtain and implementing the action plans has been slow.

Recommendation #23: The Lake Huron Centre for Coastal Conservation consider including the Healthy Lake Huron watershed action plans as possible components of a Coastal Action Plan. And that both organizations develop a plan to access, or “stack” the myriad of available conservation grant programs to achieve prioritized, strategic goals.

RECOMMENDATIONS ANALYSIS MATRIX

ANALYSIS OF RECOMMENDATIONS FOR POLICIES AND ADAPTIVE ACTIONS					
Recommendation	Priority: High/ Medium/ Low	Gov: Local/ Prov/ Fed	Cost: High/ Mid/ Low	Time: Short/ Long	Considerations
New Great Lakes Legislation and Climate Change Funding Programs					
1. Huron County consider a “Geographically Focused Initiative” under the <i>Great Lakes Protection Act, 2015</i>	L	L/P	?	L	New legislation untested; application process cumbersome; onus on applicant for funding. However, Province will be looking for test case and may expedite a Huron County GFI.
2–4. Identify Huron Bluffs to provincial and federal authorities as high risk area for climate change disaster relief and infrastructure/ storm water management funding	H	L/P/F	H	L	2016 disaster readiness component of federal climate change funding for infrastructure now in development; 2018 National Disaster Mitigation Program funding (a federal/provincial/municipal program).
5. County and agricultural organizations aggressively promote erosion control measures by farmers to reduce gully erosion and Lake Huron pollution.	H	L/P	M	L	Great Lakes Agricultural Stewardship Initiative (GLASI) offers advice and financial support for adopting all the major soil-related BMPs for farms in the Lake Huron watershed.
Ontario’s Policy Framework – Local Government Implementation					
6. ABCA and MVCA update, harmonize shoreline mapping and policies.	H	L	M	S	ABCA update to Shoreline Management Plan, including mapping, underway. MVCA to follow.
7. Local and County municipalities pass Shoreline Tree Protection By-laws to reduce rate of erosion.	H	L	L	S	Township of Ashfield-Colborne-Wawanosh (ACW) passed By-law in October 2016 which can be a model for other municipalities to consider.
Emergency Planning					
8. Municipalities notify shoreline property owners of hazard land status as part of their Emergency Management Planning.	H	L	L	S	Shoreline residents’ associations have suggested most reliable communication method is to include notice with municipal tax bill.

ANALYSIS OF RECOMMENDATIONS FOR POLICIES AND ADAPTIVE ACTIONS					
Recommendation	Priority: High/ Medium/ Low	Gov: Local/ Prov/ Fed	Cost: High/ Mid/ Low	Time: Short/ Long	Considerations
9. Municipalities of Central Huron and Bluewater participate in an erosion emergency exercise in 2017.	H	L	M	S	Township of Ashfield-Colborne-Wawanosh completed erosion scenario in 2015 with MVCA. Include bluff erosion scenarios in municipal emergency management plans.
10. Municipalities review municipal road access to shoreline residential areas to ensure more than one secure access in the event of storms, flooding and erosion.	H	L	M	S	Shoreline private road owners should be reminded, as part of annual hazard land status notification, that they are responsible for maintaining their roads.
11. Mandatory disclosure of natural hazard designation in real estate transactions.	H	L/ P	L	L	The County of Huron, local municipalities and conservation authorities lobby their local M.P.P, the Provincial Minister of Government and Consumer Services, Emergency Management Ontario, and the Ontario Real Estate Association.
Engage Shoreline Residents					
12, 16. "Do You Know" fact sheet for property owners, advising of bluff erosion and hazard land status, together with url links to resources and information.	H	L	L	S	See ABCA Shoreline Slope Stability Risks and Hazards fact sheet; MVCA and ABCA mapping, policies and reports on Climate Change and Erosion of Cohesive Bluff Shorelines by Dr. Robin Davidson-Arnott and Dr. Gene Clarke; contact lists for geotechnical engineers and bluff landscaping experts; LHCCC shoreline property owners' guides, extreme lake levels position paper and other publications.
13. Shoreline municipalities, CAs and the Lake Huron Centre for Coastal Conservation aggressively market to	H	L	L	S	Expertise is available at no charge to property owners for individual property risk assessments, information on relevant land-use planning and

ANALYSIS OF RECOMMENDATIONS FOR POLICIES AND ADAPTIVE ACTIONS					
Recommendation	Priority: High/ Medium/ Low	Gov: Local/ Prov/ Fed	Cost: High/ Mid/ Low	Time: Short/ Long	Considerations
shoreline property owners their expertise and information.					regulatory/permitting requirements, landscaping for slope stability and contacts for geotechnical engineering.
14. Bluewater Shoreline Residents' Association and Ashfield-Colborne Lakefront Association continue to monitor, lobby and communicate between residents and local authorities.	H	L	L	S	Representatives of both residents' associations are members of a wide variety of local government and other committees and work to communicate issues and resources regularly to their members.
15. Encourage ABCA Shoreline residents to review and comment on the Ausable Bayfield Conservation Authority Shoreline Management Plan update mapping and proposed policies.	H	L	L	S	Updated mapping provides residents with a better idea of erosion rates (low, medium, substantial) for their properties.
Cottage Relocation					
17. The County Planning and Development Department, municipalities and CAs do everything possible to help property owners who may want to move their cottages back from an eroding bluff to a safe location.	M	L	L for local authorities; H for property owner	S/ L	Information from Planning authorities on available designated/zoned residential land and existing lots behind shoreline cottages within hazard land designated areas. Information about the process for severance or subdivision, if needed. Contact list of construction firms capable of relocating a structure from one lot to another. Case studies of other land owners who have moved their cottages back.
18. Huron County and municipal planning authorities establish a financial incentive package to encourage	M	L	L	S/ L	Example: waive fees for severance or other land-use planning processes.

ANALYSIS OF RECOMMENDATIONS FOR POLICIES AND ADAPTIVE ACTIONS					
Recommendation	Priority: High/ Medium/ Low	Gov: Local/ Prov/ Fed	Cost: High/ Mid/ Low	Time: Short/ Long	Considerations
shoreline property owners to consider the merits of managed retreat.					
Local Economic Development					
18. The Town of Goderich coordinate its tourism initiatives with Port Authority plans and operations to maximize local economic benefits of each and avoid conflicts.	M	L	L	L	Both Port and Tourism planning will need to consider adaptation to extreme high and low lake water levels and extreme storm events due to climate change. Longer shipping seasons and a longer tourism season may present opportunities
19. Bayfield growth plan, management structure and marketing of the lakefront harbour, amenities and sewage treatment capacity will need particular attention to extreme lake levels and climate change impacts.	M	L	H	L	Bayfield infrastructure vulnerable to lake level impacts, especially marinas, harbour depth and municipal infrastructure such as roads and bridges.
Conservation, Stewardship, Environment					
20. The WPSC review its grant program with an eye to promoting/enhancing storm water management initiatives to reduce gully and bluff erosion and improve Lake Huron water quality.	H	L	M	L	WPSC grants are highly successful incentives to Huron County's private property owners for environmentally sound initiatives.
21. Lake Huron Centre for Coastal Conservation consider a GFI under the <i>Great Lakes Protection Act, 2015</i> .	L	L/ P	?	L	Purpose of GFI would be development and implementation of a Coastal Action Plan for the south-eastern shore of Lake Huron.
22, 23 Lake Huron Centre for Coastal Conservation and the	L	L/ P	M	L	Both initiatives are strategic in nature – identifying actions that will have the greatest impact.

ANALYSIS OF RECOMMENDATIONS FOR POLICIES AND ADAPTIVE ACTIONS					
Recommendation	Priority: High/ Medium/ Low	Gov: Local/ Prov/ Fed	Cost: High/ Mid/ Low	Time: Short/ Long	Considerations
Healthy Lake Huron initiative consider how their initiatives may complement each other.					
23. Lake Huron Centre for Coastal Conservation and Healthy Lake Huron develop a plan to access, or “stack” the myriad of available conservation grant programs to achieve prioritized, strategic goals.	L	L/ P/ F	L	L	Current grant programs tend to be fragmented, small and piecemeal.

ADDITIONAL CONSIDERATIONS

Erosion prediction difficult

The lack of a reliable tool for predicting erosion presents a major concern to Huron County authorities. This is a public safety issue, as people may not be warned in time to exit their houses on the bluff before an event occurs.

Great Lakes water diversion

Concern about potential diversion of Great Lakes waters outside the watershed was raised by several of the subcommittee members, prompted most recently by the request from Waukesha, Wisconsin to divert water from Lake Michigan in order to restore its low and contaminated aquifer. “Under a current regional agreement between eight US. states and Ontario and Quebec, diversions of water away from the Great Lakes-St. Lawrence River basin are banned, with limited exceptions that can be made only when certain conditions are met,” (Mehta, 2016. p. A17). However, in June, a group of eight states that make up what’s known as the Great Lakes-St. Lawrence River Basin Water Resources Council approved Waukesha’s application, making it the first exception to the agreement banning diversion of water. There was no public consultation and Canadian authorities had no say in the decision. Since then, a group of mayors from Canada and the U.S. known as the Great Lakes and St. Lawrence Cities Initiative, is challenging that decision.

Implementation/ next steps

This Phase 2 report will be forwarded by the WPSC to the Huron County shoreline municipalities, the County, the Goderich Port Authority, the two conservation authorities, the board of the Lake Huron Centre for Coastal Conservation and the two shoreline residents’ associations for consideration of its recommendations, as well as to Federal departments and Ontario provincial ministries with an interest.

IA Phase 3 – webinars of the four Integrated Assessment projects will be held in November and December 2016, with the Huron County project webinar on November 17.

The Graham Sustainability Institute will integrate the four projects in a report on the integrated assessment approach and methodology to extreme lake level issues, and identify transferrable learnings, with wrap up by April 2017.

References and Key Resources

Lake Huron Extreme Lake Levels Integrated Assessment Phase I Report, May 3, 2015, by Lynne Peterson. <http://graham.umich.edu/media/files/water-levels-ia-phase-1-report-huron.pdf>

Climate Change Impacts on the Great Lakes, a discussion paper on the potential implications for coastal processes affecting the south-west shoreline of Lake Huron within the jurisdiction of the Ausable Bayfield Conservation Authority. Prepared by Dr. Robin Davidson-Arnott, Draft 31, 2016. http://www.abca.on.ca/downloads/Climate-change-impacts-on-coastal-processes-affecting-shoreline-of-ABCA-DRAFT-March-31-2016_1.pdf

Erosion of Cohesive Bluff Shorelines: A discussion paper on processes controlling erosion and recession of cohesive shorelines with particular reference to the Ausable Bayfield Conservation Authority (ABCA) shoreline north of Grand Bend, July 11, 2016, by Robin Davidson-Arnott <http://www.abca.on.ca/downloads/Discussion-Paper-on-Erosion-of-Cohesive-Bluff-Shorelines-FINAL.pdf>

Shoreline Management Plan 2016 Consultant Recommendation Report, Ausable Bayfield Conservation Authority, August 2016. <http://www.abca.on.ca/downloads/ABCA-DRAFT-Updated-SMP-2016-Consultant-Report-August-2016.pdf>

Shoreline Slope Stability Risks and Hazards, fact sheet for property owners, 2016, Terraprobe Inc. and Ausable Bayfield Conservation Authority http://www.abca.on.ca/downloads/Fact_Sheet_Shoreline-Slope-Stability-Risks-Hazards-LETTER.pdf

Lake Huron Coastal Bluff Geohazard Checklist, 2014, Lake Huron Centre for Coastal Conservation, <http://lakehuron.ca/uploads/pdf/Lake.Huron.Coastal.Bluff.Geo-Hazard.Checklist-2014.pdf>

Climate Change: Adapting to the New Normal fact sheet, Lake Huron Centre for Coastal Conservation, <http://lakehuron.ca/uploads/pdf/Bluff.conservations-climate.change.pdf>

Extreme Water Levels on Lake Huron, position statement of the Lake Huron Centre for Coastal Conservation, 2013 http://www.lakehuron.ca/uploads/pdf/position_statements/LHCCC_position_on_Extreme_Water_Levels_on_Lake_Huron_October-2013.pdf

Lake Huron Bluff Stewardship Guide, Lake Huron Centre for Coastal Conservation, <http://lakehuron.ca/uploads/pdf/Bluff.Stewardship.Guide-low.res.pdf>

Managing your Waterfront Property in a Changing Climate, June 2016 – Federation of Ontario Cottagers' Associations with support from the Ontario Ministry of Natural Resources and Forestry. https://foca.on.ca/wpcontent/uploads/2016/06/FOCA_ClimateChange_ManagingYourShoreline_FINAL_2016.pdf

Stabilizing Coastal Slopes on the Great Lakes, 2014, Gene Clark, University of Wisconsin
<http://aqua.wisc.edu/publications/PDFs/StabilizingCoastalSlopes.pdf>

Sustaining Ontario's Agricultural Soils: Toward a Shared Vision, 2016 discussion paper, by Ontario Ministry of Agriculture, Food and Rural Affairs.
<http://www.omafra.gov.on.ca/english/landuse/soil-paper.pdf>

Final Strategy for the Great Lakes-St. Lawrence River Maritime Transportation System, June 2016, Conference of Great Lakes and St. Lawrence Governors and Premiers website:
www.cglslgp.org

National Disaster Mitigation Program, <http://www.mah.gov.on.ca/Page14903.aspx> 1

Shoreline Tree Preservation Bylaw, Township of Ashfield-Colborne-Wawanosh,
<http://www.acwtownship.ca/wordpress/wp-content/uploads/2016/10/45-2016-Tree-Preservation.pdf>

Appendix 1

Conservation and stewardship funding programs are available from municipal, provincial, and federal governments to support community efforts to improve and protect Lake Huron. Local community-based environmental-groups have received support from:

- **Trillium “Green People” Fund:** grants to encouraging people to support a healthy and sustainable environment through reducing ecological impacts and safeguarding and restoring ecosystems.
- **Huron County Clean Water Program:** \$500 grants are available to landowners from the WPSC Clean Water Program to implement action plans for water quality improvement projects, including storm water management and erosion control.
- **Great Lakes Guardian Community Fund** - part of Ontario’s Great Lakes Strategy, the Great Lakes Guardian Community Fund provides grants of up to \$25,000 to not-for-profit organizations; First Nations communities and organizations; and Métis communities and organizations. ontario.ca/page/great-lakes-guardian-community-fund
- **Environment and Climate Change Canada’s community funding programs** (www.ec.gc.ca/financement-funding):
 - **EcoAction** provides financial support to community-based, non-profit organizations for projects that have measurable, positive impacts on the environment. (www.ec.gc.ca/ecoaction/)
 - **The National Wetland Conservation Fund** supports on-the-ground activities to restore and enhance wetlands.
 - **The Habitat Stewardship Program** funds projects that conserve and protect species at risk and their habitats and help to preserve biodiversity. (www.ec.gc.ca/hsp-pih/)
 - **The Environmental Damages Fund (EDF)** manages funds received as compensation for environmental damage. (ec.gc.ca/edf-fde/)
 - **Great Lakes Sustainability Fund (GLSF)** for restoration projects.

Appendix 2: Project chronology

October 20, 2015: Huron County Integrated Assessment proposal submitted to Graham Sustainability Institute.

October 21: Planning and Development Committee of Huron County votes to recommend Huron County Council endorse use of the Huron County Water Protection Steering Committee (WPSC) as an interdisciplinary advisory committee for the Integrated Assessment project. (See table of WPSC members and affiliations below).

November 4: Huron County Council approves motion by Central Huron Mayor Jim Ginn, to send letter of support for the IA project to the University of Michigan, and to endorse the use of the county's Water Protection Steering Committee as the project's advisory committee.

November 24: IA proposal approved by Graham Sustainability Institute.

November 27: Lynne Peterson presentation to Water Protection Steering Committee.

January 15, 2016: full day workshop on lake level issues with Water Protection Steering Committee members. Committee establishes an Extreme Lake Levels subcommittee.

Presentations by Agnes Richards, Meghan Allerton, Lynne Peterson, Helen MacRae, Tanya Wanio, Steve Jackson, Geoff Cade, Susanna Reid.

January 26 & March 3: Lynne Peterson and Agnes Richards teleconferences with Graham Sustainability Institute and other IA teams re progress, limitations of modelling approaches

April 1: Meeting with the Extreme Water Levels subcommittee of the Water Protection Steering Committee to review draft Phase I report, discuss summer consultation opportunities.

April 4: Draft Phase I report submitted to Graham Sustainability Institute for review

May 3: Phase I report submitted to Graham Sustainability Institute

Teleconferences with Graham Sustainability Institute:

January 26, March 3, June 16, August 10, September 26, 2016

Phase 2 Summer consultation sessions:

May 14: Presentation at Ashfield-Colborne Lakefront Association annual meeting.

May 17: Meeting in Ann Arbor, Michigan, with Graham Sustainability Institute staff and IA advisory committee members.

May 27: Presentation and discussion at "Is the Coast Clear" conference in Port Elgin. Consultation engagement.

June 10: Presentation and discussion at Bluewater Shoreline Residents' Association annual meeting. Consultation engagement.

August 3: Meeting with Matt Hoy and Erinn Lawrie of the Lake Huron Centre for Coastal Conservation

August 4: Lynne Peterson attended Bluewater Shoreline Residents Association meeting

August/September: Lynne Peterson and Helen MacRae telephone and email discussions on draft report with various Extreme Lake Levels Subcommittee members on recommendations. Drafts of options and recommendations circulated for comment and discussion.

September 19: draft Phase 2 report submitted to Graham Sustainability Institute for review.

September 23: Lynne Peterson meeting with Huron County Extreme Lake Levels Subcommittee to review final report recommendations and next steps.

October 30: Phase 2 report submitted to Graham Sustainability Institute.

Appendix 3: IA Team, Students and Huron County Contributors

RESEARCH/PROJECT TEAM		
Name	Area of Expertise	Role/ Project Contribution
George Arhonditsis	P.I. University of Toronto	Project sponsor
Lynne Peterson	P.I. Project lead, integrated policy development	Project management, report writing and editing, presentations and consultation
Agnes Richards	Scientist, Environment Canada; and Adjunct Professor, University of Toronto	Canadian federal legislation and program environment, presentation and report content; project finance management.
Tanya Wanio	Policy development, municipal finance and land-use planning	Bluff erosion case studies; presentation and report content.
Helen MacRae	Policy development, municipal administration and economic development	Economic development, harbor issues, tourism issues and options. Presentation and report content
Kate Procter	Writer, editor, Huron County Farmer	Writer, report editor, researcher
Students		
Meghan Allerton	Student and Research Associate, University of Toronto, Ecological Modelling Laboratory	Impact of lake levels on commercial shipping, presentation and report content
Jocelynn Hudgins	Student and Intern, Elmira College and University of Nipissing (tbc)	Logistics, research and meeting support
Huron County experts and contributors		
Jim Ginn	Mayor, Central Huron, and Chair of the Water Protection Steering Committee	IA water levels meeting chair, project support
Susanna Reid	Planner, Huron County Planning and Development Dept.	Shoreline land-use planning policies and process, presentation and report content
Nina Reynolds	Huron County Planning Dept. Meeting logistics and project support	Meeting facility booking, WPSC and Extreme Water Levels subcommittee group contact.
Geoff Peach	Lake Huron Centre for Coastal Conservation, Project Director	Conservation and stewardship resources, policy papers on climate change and lake levels
Stephen Jackson	MVCA, Project development, Flood and Erosion Safety Services Coordinator	Bluff Erosion: Public Safety and Emergency Planning, presentation
Alec Scott and Geoff Cade	ABCA, Manager of Water and Planning	CA Regulations and Shoreline Management Planning, presentation

Appendix 4: Water Protection Steering Committee

WATER PROTECTION STEERING COMMITTEE	
<p>The Water Protection Steering Committee was established in spring 2004 with 3 goals:</p> <ul style="list-style-type: none"> • To bring together representatives of agencies, groups and municipalities (including Planning, Health Unit, Municipalities, Conversation Authorities, MOE, OMAF, agriculture, manufacturing, tourism, cottage associations, watershed groups, etc.) • To prioritize and recommend implementation measures to participating agencies • To coordinate activities at a broad level, subject to the resources of the participating agencies 	
Agency/ Organization	Representatives
County Council	Jim Ginn (chair) Maureen Cole (South Huron) Art Versteeg (Howick) Neil Vincent (North Huron) Warden Paul Gowing
Clerks and Treasurers Association	Nancy Michie (Morris-Turnberry) Brad Knight (Huron East)
Local Municipal Councillors	Linda Henhoffer (Howick) Jim Nelemans (Morris-Turnberry)
Ausable Bayfield Conservation Authority	Geoff Cade
Maitland Valley Conservation Authority	Deb Shewfelt
Ministry of the Environment	Ted Briggs
Ministry of Agriculture and Food	Jacquie Empson-Laporte
Agricultural Representatives	Jack Kroes (CFFO) Joe Vermunt (HSCIA) Stefan Zehetner (HSCIA) Paul Klopp (HFA)
Huron Manufacturing Association	Jeff Hearn
Huron Tourism Association	Rosemary Davis
Cottage Associations	Roger Watt (Ashfield Colborne Lakefront Assoc.) Jan Purvis (Bluewater Shoreline Residents Assoc.)
Huron County Planning Department	Scott Tousaw Susanna Reid Dave Pullen
Health Unit	Jean-Guy Albert
Ontario Pork Producers	Sam Bradshaw
Huron Federation of Agriculture	Margaret Vincent
Source Protection	Jenna Allain
Lake Huron Centre for Coastal Conservation	Pam Scharfe
Huron Stewardship Council	Rachel White

Appendix 5

EXTREME LAKE LEVELS SUBCOMMITTEE MEMBERS		
Name	Organization	Email
Alec Scott Geoff Cade	Ausable Bayfield Conservation Authority	ascott@abce.on.ca gcade@abca.on.ca
Deb Shewfelt	Maitland Valley Conservation Authority	delbert.shewfelt@gmail.com
Erinn Lawrie Matt Hoy	Lake Huron Centre for Coastal Conservation	erinn.lawrie@lakehuron.on.ca matthew.hoy@lakehuron.on.ca
Geoff Peach	Lake Huron Centre for Coastal Conservation, Project Director	geoff.peach@lakehuron.on.ca
Jan Purvis Sue Haskett	Bluewater Shoreline Residents Association	jdpurvis@rogers.com sue@haskettfh.com
Jim Ginn	County Councillor and Mayor, Central Huron	jginn@centralhuron.com
Myles Murdock	Town of Goderich	mylesmurdock@hurontel.on.ca
Pam Scharfe	Lake Huron Centre for Coastal Conservation	pamela.scharfe@lakehuron.on.ca
Roger Watt	Ashfield Colborne Lakefront Association	rwwatt@uwaterloo.ca
Rosemary Davis	Huron Tourism Association	rdavis@hogerry83.ca
Rowland Howe	Goderich Port Management Corporation	howe@compassminerals.com
Phil Beard Jeff Winzenreid	Maitland Valley Conservation Authority	pbeard@mvca.on.ca jwinzenreid@mvca.on.ca
Susanna Reid	Planning & Development Dept, Planner	sreid@huroncounty.ca

Appendix 6: List of presentations

November 27, 2015: Huron County Lake Levels Integrated Assessment - Presentation to Water Protection Steering Committee, Holmesville, Huron County. By Lynne Peterson

January 15, 2016 workshop presentations:

Federal legislation and programs – Agnes Richards, Environment Canada

Provincial and municipal land-use planning policies and processes – Susanna Reid, Planner,
Huron County

Conservation Authority legislation, regulations and policy role; Shoreline Management Planning
- Alec Scott, Ausable Bayfield Conservation Authority (ABCA)

Bluff Erosion – public safety, emergency planning – Steve Jackson, Maitland Valley

Conservation Authority (MVCA)

Bluff Erosion – case studies – Tanya Wanio

Lake levels impact on commercial shipping – Meghan Allerton, University of Toronto

Ecological Modelling Lab

Harbours and Tourism – economic impacts of low water levels – Helen MacRae

Summer consultation presentations, Lynne Peterson

May 14 - Ashfield-Colborne Lakefront Association

May 27 – “Is the Coast Clear” conference

June 4 – Bluewater Shoreline Residents Association

May 17 – Presentation for Graham Sustainability Institute project meeting, Ann Arbor, Michigan