REPORT
CENTRAL LAKE ONTARIO CONSERVATION AUTHORITY

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APPROVED BY C.A.O.

S.R.: 5538-17

MEMO TO: Chair and Members, CLOCA Board of Directors

FROM: R. Perry Sisson, Director, Engineering and Field Operations
Chris Jones, Director, Planning and Regulation

SUBJECT: **Lake Ontario Shoreline Management at Port Darlington, Municipality of Clarington**

Purpose

This report describes matters related to Lake Ontario shoreline management and makes recommendations, specifically with respect to the Port Darlington area, in the context of the reimergence of shoreline management issues due to the historically high Lake Ontario water levels experienced this year, and associated resolutions taken by the Council of the Municipality of Clarington and issues raised by affected residents. The finalization of the *Port Darlington (West Shore) Damage Centre Study* is recommended in order to provide a science-based analysis upon which the consideration of further actions to address shoreline management issues in the Port Darlington area may be evaluated.

Background and Historical Context

Environmental Setting and Natural Hazards

The Port Darlington area that is the subject of this report is located along the north shore of Lake Ontario in the Municipality of Clarington. Both the Westside Creek watershed and Bowmanville Creek watersheds drain into Lake Ontario along this stretch of shoreline. The Westside Creek flows through the Westside Provincially Significant Coastal Wetland Complex (Westside Marsh) before passing through a barrier dynamic beach system and then to the lake. Similarly, the Bowmanville Creek flows through the Bowmanville Provincially Significant Coastal Wetland Complex and along a barrier dynamic beach before entering Lake Ontario via the Port Darlington harbour entrance. Portions of both barrier dynamic beaches and the Bowmanville Marsh are recognized as a provincially significant Area of Natural and Scientific Interest (ANSI). CLOCA's Bowmanville/Westside Conservation Area contains the majority of the coastal wetland areas. (Attachment No 1. to this report provides a context map for the area.)

This ecologically important landscape also contains several significant, overlapping and cumulative natural hazards to people and property endemic to the interface between riverine systems and Great Lake shorelines:

Flooding Hazards:

The *Watershed Flood-Risk Assessment* (CLOCA, 2017) evaluated 92 flood damage centers within the CLOCA watershed including the West Beach and Cedar Crest Beach communities within the Port Darlington area. The Flood-Risk Assessment evaluated each flood damage center based upon vulnerability to flood damage, likelihood of flood damage, social impacts, business disruption, and environmental impacts. Both of the Port Darlington communities have above average flood-risk scores and were ranked as 6th and 19th out of the 92 total damage centers in the CLOCA watershed. These communities are prone to flooding from both riverine and Lake Ontario sources.

- Riverine Flooding: Both the Westside Creek and Bowmanville Creek will inundate upstream valleylands, the coastal wetland areas, and the barrier dynamic beach areas in the event of a regulatory flood – and at more frequent and less severe flooding events as well. Depths of flooding at a regulatory storm, as mapped by CLOCA's engineered flood plain mapping, indicate that flood depths along the developed barrier dynamic beaches along Cedar Crest Beach Road and West Beach Road range from 0.7m to 1.5m.

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- Lake Ontario Flooding: Lands adjacent to Lake Ontario along the developed barrier dynamic beaches, and the coastal wetland further beyond inland, are vulnerable to inundation from Lake Ontario water levels. In addition, high water levels causing flood impact may be worsened along the shoreline due to Wind Setup (prevailing wind direction facing the shoreline that further elevates water levels) and Wave Uprush (wave action at the shoreline that also further elevates water levels). Lake Ontario flooding is based on the 100-year peak instantaneous water level plus and allowance for wave run-up. At Port Darlington, the 100-year flood limit value is 76.27 meters, International Great Lakes Datum. The developed barrier dynamic beaches along Cedar Crest Beach Road and West Beach Road are at elevations between 76 and 77 meters, resulting in flood depths of 0 to 0.3 meters.

Erosion Hazards:

- Dynamic Beach and Barrier Dynamic Beach Hazards: Dynamic beaches are beaches that are constantly changing due to wave and water level conditions. Long-term erosion of a beach occurs when the volume of beach sediment being supplied to the area is less than the volume of sediment being removed from the area. Beach shorelines can recede and accrete over the short-term due to changes in the wave climate and water levels. In these instances, beach material is temporarily eroded from the beach and deposited in the nearshore and will be returned to the beach over time. This dynamic aspect of beaches can be considered differently from the long-term erosional effects.

  Any development within the dynamic beach, including structures to protect buildings on or along the dynamic beach, will interfere with the natural ability of the beach to adjust to its natural processes. In the Port Darlington area there are two types of dynamic beaches: Barrier Dynamic Beach Systems and a Dynamic Beach backed by a Cliff or Bluff.

  The Barrier Dynamic Beaches are the most hazardous form of dynamic beach and are located along Cedar Crest Beach Road and West Beach Road. The spatial extent of the dynamic beach extends from the Lake Ontario bed landward to the toe of slope within the coastal wetland, meaning that all of the private residential lots on these two roads are completely within the dynamic beach hazard.

  Along Cove Road there are sections of dynamic beach, which are backed by a bluff and table lands further inland. In this area, the dynamic beach hazard ends at the toe of the bluff.

- Bluff Erosion: Portions of the Port Darlington area that contain bluffs are subject to the gradual erosion of the bluff slope due to the action of water over time. The extent of the erosion hazard is determined by calculating a stable slope allowance plus an average annual recession rate of the slope projected to allow for 100 years of future slope recession. Any development within this area is vulnerable to erosion hazards.

The physical features and processes described above are recurring and somewhat predictable in the Great Lake shoreline and riverine environments that exist in the Port Darlington area. Historic development patterns make these areas natural hazards that pose significant risk to human life and property.

Historic development patterns in Port Darlington

Subdivision of the original Township of Darlington survey lots for shoreline residential development in the Port Darlington area west of the harbour entrance began in the early 20th Century with the registration of Plan No. 106 in March 1917. Registered Plan 106 created 11 lots and a 'beach reserve' block along the shoreline at what is now the south side of Cove Road immediately west of West Beach Road. Subsequent plans of subdivision were registered in 1921, 1922, 1924, 1932, 1933 and 1962. The registration of these plans had the effect of creating a continuous band of residential lots along Lake Ontario between the Waverly Road allowance in the west to the Port Darlington harbour entrance in the east. It is understood that lots were initially developed as seasonal recreational dwellings. Over time, most lots have been redeveloped with larger dwellings, accessory structures and have become permanent residences.

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Of note is the fact that each plan of subdivision, with the critical exception of Registered Plan 318—which created the lots along the south side of Cedar Crest Beach Road in 1932—did not establish residential lot boundaries directly abutting the surveyed water's edge. These plans provided for open space blocks, beach blocks, or beach 'reserves' between the shoreline and the rear lot boundary thereby allowing some buffer against changes to Lake Ontario water elevation and beach configuration.

Over time, some owners have encroached upon the littoral zone associated with the Lake Ontario shoreline by acquiring the former beach reserve blocks by extending their lots to the water's edge (a process that uses a mid-19th Century Common Law precedent related to riparian rights outside of normal *Planning Act* controls for lot additions). This has had the effect of increasing the vulnerability of the lots to flooding and erosion hazards associated with the lake.

Currently, there are approximately 39 dwellings on Cedar Crest Road, each with shoreline protection works of some kind extending along the length of properties at the shoreline except for one parcel. There are 17 dwellings facing the shoreline on Cove Road, with two parcels having shoreline protection works. On West Beach Road there are approximately 22 dwellings facing Lake Ontario, none of which appear to have shoreline protection works.

In addition to shoreline residential development, significant industrial development has taken place in the Port Darlington area with the establishment and expansion of the St. Marys Cement facility (now operating as Votorantim Cimentos/St Marys Cement). Operations began in 1967-68 with lake filling for a docking facility taking place between 1974 and 1979 under approval by senior levels of government. Expansions to both the shoreline docking facility and the quarry took place in the 1990's following further approvals by senior levels of government. Related agreements to facilitate the retention of a portion of Westside Marsh and transfer were secured through an agreement known as the *Principles of Understanding Between Blue Circle Canada Inc. and the Municipality of Clarington on the Implementation of the Recommendations of the Waterfront Regeneration Trust Report on Westside Marsh*. This document outlined arrangements for the diversion of the Westside Creek, enlarged extraction limits within West Side Marsh and the establishment and operation of a Marsh Overflow Channel, which was designed and implemented to compensate for the reduction in marsh floodwater storage as a result of the expansion of the extraction area into the marsh. The development and enlargement of the docking facility has changed the configuration and location of the Lake Ontario shoreline, whereas the enlargement of the extraction area and overflow channel has changed the configuration and location of the regulatory storm flood plain associated with Westside Creek.

Previous Shoreline Studies

Numerous studies have been commissioned in the past to study the northern shoreline of Lake Ontario at various scales, including the Port Darlington area, by public sector bodies.

Royal Commission on the Future of the Toronto Waterfront

At the federal level, in 1988, The Honourable David Crombie was appointed to lead a Royal Commission on the Future of the Toronto Waterfront. He was appointed at the provincial level for the same purpose in 1989. The provincial appointment included a mandate "to inquire and recommend waterfront related initiatives to preserve and enhance the quality of the environment and the quality of life for people residing in the greater metropolitan area extending from the eastern boundary of the Region of Durham to the western boundary of the Region of Halton." The final report, entitled *Regeneration*, called for a Greater Toronto Area-wide shoreline regeneration agency and plan along with an ecosystem focus for land use planning across the region. The report also made specific recommendations related to each local geography along the northern Lake Ontario shoreline.

For Clarington, *Regeneration* recommended that the municipality update its Official Plan and comprehensively study the waterfront area to address shoreline development, as the municipal Official Plan at that time did not include policies

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or land use designations for the waterfront. With respect to CLOCA, the commission recommended "…CLOCA … continue to review relevant documents including official plans, secondary plans and other waterfront-specific plans to ensure they incorporate [an] ecosystem approach…and participate in preparing the proposed [Greater Toronto-wide] shoreline regeneration plan. With respect to St. Mary's Cement, the report noted the concerns of nearby residents to the development, including storm drainage as well as shoreline erosion. Finally, the report prescribed "constraints on certain development activities in order to ensure a healthy, resilient, productive shoreline with increased aesthetic, social and economic value to the community."

Lake Ontario Shoreline Management Plan (Sandwell Report)

CLOCA in partnership with the Ganaraska and Lower Trent Conservation Authorities commissioned a coastal engineering study to provide shoreline management direction for their respective reaches of Lake Ontario Shoreline. The consulting firm of Sandwell Swan Wooster Inc. was retained to prepare the *Lake Ontario Shoreline Management Plan*, which was completed in December of 1990 (Sandwell Report).

The Sandwell Report: inventoried existing structures on the shoreline; reviewed coastal processes on the shoreline; defined flood and erosion limits for the study area; identified concentrations of natural hazards in conflict with existing development in specific shoreline 'Damage Centres;' reviewed environmentally sensitive areas; shoreline protection concepts and land use considerations. The report made 11 specific conclusions and recommendations, which are reproduced as Attachment No. 2 to this report.

The Port Darlington area was identified in the Sandwell Report as a specific shoreline Damage Centre. The report made specific recommendations related to potential responses including construction of a dyke, beach widening and/or acquisition of the entire beach area. However, these 1990-era recommendations must be qualified in that they were made in the absence of the required local site-specific study and before the provincial Great Lakes shoreline natural hazard policy statements existed. Attachment No. 3 to this report reproduces the text in full.

CLOCA is currently working with the Ganaraska Region and Lower Trent Region Conservation Authorities on a National Disaster mitigation Program funding proposal to conduct an update to the Sandwell Report. See Staff Report #5536-17 in the agenda package for reporting related to this project.

Draft Port Darlington (West Shore) Damage Centre Study

In furtherance of the Sandwell Report analysis, and subsequent to the issuance of Great Lakes natural hazard policy direction issued under the *Planning Act*, in November of 2003 CLOCA commissioned the coastal engineering firm of Aqua Solutions to study the Port Darlington area shoreline damage centre. The aim of the study was to gain a more precise and specific understanding and spatial delineation of the various natural hazards present. The report was also intended to articulate the provincial Great Lakes natural hazard policy directions for dynamic beaches, shoreline flooding and erosion in the Port Darlington context to assist in the development and implementation of a practical approach for detailed CLOCA regulation policies for the area.

A draft report was completed in March of 2004, which was presented to the Board at its meeting of April 20, 2004 and received for information. The draft report reviewed and described each of the Great Lakes shoreline natural hazards present in the context of the *Provincial Policy Statement*, 1997 and made draft policy recommendations that were intended to be finalized and used to inform CLOCA's decision making on development proposals. However, the *Port Darlington (West Shore) Damage Centre Study* was never finalized and was never brought before the Board for adoption and subsequent implementation.

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Waterfront Regeneration Trust Report on Westside Marsh

At the request of the Municipality of Clarington and St. Marys Cement Corporation, with the support of the Port Darlington Community Association and CLOCA, the Waterfront Regeneration Trust helped find a resolution to St. Marys Cement's approved plans for the excavation of the entire Westside Marsh as a limestone quarry. The Waterfront Trust held a series of community meetings and subsequent working groups of stakeholders to explore options and hear expert information. After two years of work, the Waterfront Trust's plan, in summary, provided for:

- Protection of most of the Marsh and achievement of "no net loss" of overall habitat;
- Moving the CBM stone crushing plant away from residents;
- Creating 120 acres of open space dedicated to CLOCA out of lands previously zoned Industrial for the quarry and other industrial uses; and,
- Closing Waverley Road and providing another access to Cedar Crest Beach residents from Cove Road.

All parties involved in this compromise to save the most productive portion of the Westside Marsh and to reduce major irritants for area residents then worked for another two years to detail the implementation plans and obtain senior government approvals for construction. The solution was a great benefit to save a key natural heritage features that came at a significant expense to Clarington and St. Marys Cement.

Evolution of Great Lakes Shoreline Natural Hazard Policy and Regulation

Provincial Land Use Planning Policy

The Province of Ontario first issued Great Lakes shoreline natural hazard policy via the *Comprehensive Set of Policy Statements* in 1994, which took effect for the purpose of decision-making under the *Planning Act* in March 1995. These policies introduced a prohibition on development within the dynamic beach hazard, limited development within the shoreline flooding and erosion hazards and, with modifications, have been carried forward in the subsequent *Provincial Policy Statement* of 1996-7, 2005 and 2014.

The current *Provincial Policy Statement, 2014* establishes a strong obligation on development decision-makers for the protection of public health and safety with the following statements of provincial policy for Great Lakes shoreline natural hazards (emphasis added):

"Ontario's long-term prosperity, environmental health and social well-being **depend on reducing the potential for public cost or risk** to Ontario's residents **from natural or human-made hazards**.

Development shall be directed away from areas of natural or human-made hazards where there is an unacceptable risk to public health or safety or of property damage, and not create new or aggravate existing hazards.

Accordingly: development shall generally be directed to areas outside of: hazardous lands adjacent to the shorelines of the Great Lakes… which are impacted by flooding hazards, erosion hazards and/or dynamic beach hazards; hazardous lands adjacent to … stream … systems which are impacted by flooding hazards and/or erosion hazards…

Development and site alteration shall not be permitted within: the dynamic beach hazard; … **areas that would be rendered inaccessible to people and vehicles** during times of flooding hazards, erosion hazards and/or dynamic beach hazards, unless it has been demonstrated that the site has safe access appropriate for the nature of the development and the natural hazard; **and a floodway regardless of whether the area of inundation contains high points of land not subject to flooding**.

Planning authorities **shall consider the potential impacts of climate change that may increase the risk associated with natural hazards**."

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CLOCA Regulatory Authority

CLOCA's regulatory powers under Section 28 of the *Conservation Authorities Act* prior to 2006, as implemented through the former Ontario Regulation 145 were not specifically designed for the Great Lakes shoreline and were focused on flooding hazards associated with riverine systems (in this context flooding associated with the Westside Creek and Bowmanville Creek). Under the former Ontario Regulation 145, the tests for approval did not include dynamic beaches and were limited to "the control of flooding or pollution or the conservation of land."

In the spring of 2006 with the enactment of CLOCA's current regulation, Ontario Regulation 42/06, CLOCA's regulatory powers were enhanced to deal specifically with Great Lakes shoreline hazards and to more closely align with provincial natural hazard management imperatives established under the *Planning Act* and *Provincial Policy Statement*. Ontario Regulation 42/06 establishes a prohibition on development in the absence of a permit on all lands adjacent or close to the shoreline of Lake Ontario based on the shoreline hazard mapping prepared as part of the Sandwell Report. Presently, CLOCA has the ability to evaluate development proposals against the following expanded set of statutory tests: "the control of flooding, erosion, dynamic beaches, pollution or the conservation of land."

Previous CLOCA Permits

Many owners of shoreline properties in the Port Darlington area have previously obtained permits from CLOCA for development activities associated with structural improvements/enlargements to dwellings, replacement dwellings, and the construction of accessory buildings, such as garages and the establishment or repair of shoreline protection works. These permits have been approved by CLOCA's Board of Directors directly or through delegated staff authority within the context of municipal zoning that authorizes single detached dwellings and accessory structures on the lands. CLOCA's objectives in providing permit approvals have been to mitigate the risk to people and property to the extent possible given the hazardous context by ensuring that new construction is flood protected from both riverine and lake regulatory flood levels and by siting new construction away from the shoreline to the extent possible. Most permit approvals have included a requirement that owners agree to 'save harmless' CLOCA for the approval in recognition that permits did not eliminate risks to people and property from natural hazards, including the lack of safe access for the area.

CLOCA Planning and Regulation Policy

CLOCA obtained comprehensive board-endorsed policies for the review of development applications and permit applications in April of 2013 when the Board approved the *Policy and Procedural Document for Regulation and Plan Review* (PPD). The PPD consolidated previous CLOCA planning and permit review practices that had evolved over time into one document for the purpose of guiding CLOCA's review, commentary and advice on planning applications and environmental assessments. The PPD was also designed to provide policy directions for decision making for permit applications under the newly expanded regulatory authority provided by Ontario Regulation 42/06.

Chapter 4 of the PPD provides policy direction for Great Lakes shoreline hazards. Policy direction was incorporated into the PPD specifically for the Shoreline Flood Hazard, the Shoreline Erosion Hazard, the Dynamic Beach Hazard and Lake Ontario Shoreline Protection Works (such as seawalls and revetments) using policy guidelines for conservation authorities established by the provincial government and Conservation Ontario.

The policy direction established in the current PPD seeks to identify and manage risks in a pragmatic fashion, particularly where existing development is present. For example, minor additions to existing buildings/structures may be permitted in the Shoreline Erosion Hazard "if it has been demonstrated to the satisfaction of CLOCA that: there is no feasible alternative site outside of the erosion hazard" in addition to the application of several other criteria. With respect to dynamic beaches, the PPD provides that "new development" is only permitted in accordance with section 4.1.5 of the policy document, which only permits reconstruction of an existing building/structure within the shoreline dynamic beach hazard, subject to conditions that among other maters ensures that the reconstruction will result in a lower risk of hazards.

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For Great Lakes shoreline hazards, the PPD provides 'generic' policy direction for the entire Lake Ontario shoreline within CLOCA's jurisdiction and does not make specific geographic distinctions, such as for the Port Darlington area, where there are multiple overlapping natural hazards present with a long history and intensity of established development patterns.

Municipality of Clarington Planning and Regulation Policy

Both the Municipality of Clarington Official Plan and Comprehensive Zoning By-law are critical tools with respect to Great Lakes shoreline natural hazards and have been amended over time in this respect. The first zoning by-law for Darlington Township, approved in 1959 and the first zoning for Bowmanville, approved in 1957, zoned the waterfront lands in Agricultural/Rural zones. In addition to agricultural uses, single detached dwellings were permitted. In addition, the Darlington Township zoning by-law permitted seasonal cottages.
The first zoning bylaw enacted after amalgamation under Regional government was Comprehensive Zoning By-law 84-63, which was approved by Council on September 10, 1984.

During the preparation of the draft By-law, the majority of the shoreline was initially placed within an Environmental Protection or "EP" zoning classification, which is intended to avoid development. Within the Port Darlington area, both barrier dynamic beaches and residential lots along both Cedar Crest Road and West Beach Road were placed entirely within an EP classification. However, following objections of several landowners at that time, a new Residential Shoreline "RS" classification was created and the final By-law, as enacted, limited the "EP" area to a thin strip along the Lake Ontario Shoreline. This zoning classification, with some modification, continues to the present and is reproduced in Figure 1. Below:

Figure 1: Current By-law 84-63 Zoning Schedule for the west Port Darlington Area

By-law 84-63 provides that within the Residential Shoreline zone, permitted residential uses include a single detached dwelling, a seasonal dwelling and a home occupation use. Further, existing seasonal dwellings may be converted to a single detached dwelling with private servicing.

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Lake Ontario shoreline official plan policies and designations were first established with the Municipality of Clarington Official Plan in January of 1996. The official plan was prepared during the era of the provincial *Comprehensive Set of Policy Statements* and was consistent with provincial directions at that time by providing direction related to a "Regulatory Shoreline Area." Policy 4.6.6 provides that:

> "The Regulatory Shoreline Area is that area along the Lake Ontario Waterfront which is subject to dynamic beaches, flooding or erosion. The extent and exact location of the Regulatory Shoreline Area shall be identified in the implementing Zoning By-law in accordance with the detailed flood and erosion risk mapping of the relevant Conservation Authority."

Further policy direction is provided in subsequent sections of the 1996 plan. It is important to recognize that official plan policy requires implementation through zoning, particularly with prohibitive policies which seek to firmly restrict development such as the policy captioned above. In the absence of implementation, policy directions may have limited utility.

The recently adopted Clarington Official Plan (2016) continues the regulatory shoreline area policies of the Clarington Official Plan (1996) with some modification and conceptually maps the area on Schedule F to the plan. The current version of the policies are reproduced in Attachment No. 4 to this report.

Clarington Planning Services Department has initiated a Zoning By-law Review to update zoning regulations in conformity with the new official plan. Accurate and up to date hazard mapping will be required to support the municipality in this effort.

Roles and Responsibilities in Lake Ontario Shoreline Management

At the federal level:

- The Department of Fisheries and Oceans Canada administers the *Fisheries Act* (Canada). The *Fisheries Act* requires that projects near water avoid causing serious harm to fish unless authorized by the Minister of Fisheries and Oceans Canada. This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery.
- The Department of Transport Canada administers the *Navigation Protection Act.* This Act, regulates interferences with the public right of navigation by regulating works and obstructions that risk interfering with navigation in navigable waters. The Act also prohibits the depositing or throwing of materials that risk impacting navigation in navigable waters and the dewatering of navigable waters.
- The Department of Public Safety Canada administers the National Disaster Mitigation Program. This program seeks to provide funding for significant, recurring flood risk and costs related to risk assessments, flood mapping, mitigation planning, and investments in non-structural and small-scale structural mitigation projects. Funding applications and allocations are routed through the provinces.

At the provincial level:

- The Ministry of Municipal Affairs (MMA) administers the *Planning Act,* which delegates authority for land use planning approvals and sets out in statute planning 'matters of provincial interest' and the associated statements of provincial policy, as currently articulated in the *Provincial Policy Statement,* 2014.
- MMA also conducts the initial screening for proposals under the National Disaster Mitigation Program. Of note is the Ontario requirement that project proposals under the program address the natural hazard polices in the *Provincial Policy Statement* and associated technical guidelines.
- The Ministry of Natural Resources and Forestry (MNRF) is responsible for the preparation of implementation guidelines and technical manuals to explain the content and intent of natural hazards policy.
- MNRF administers the *Public Lands Act,* which is the statute that manages crown land including the lakebed of Lake Ontario and the *Lakes and Rivers Improvement Act*, which regulates the deposition of any materials in a lake. Any works on or near crown land or deposition of materials (such as sand) in Lake Ontario may need permission from MNRF.

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- The Ministry of the Environment and Climate Change (MOECC) administers the *Environmental Assessment Act* including approving Class Environmental Assessment criteria and is the approval authority for environmental assessment studies.
- MOECC also administers the *Great Lakes Protection Act, 2015* and Plan including the funding for local great lakes cleanup and ecological restoration initiatives.

At the local level:

- The Region of Durham provides regional-scale land use planning for the Lake Ontario waterfront in the region and is involved in infrastructure and service delivery along the shoreline such as regional water supply plants, waste water treatment plants, public health monitoring and regional roads. In addition, the region has taken a lead role in local Climate Change mitigation and adaptation planning. The Region of Durham finances both the operational and capital budgets of CLOCA through the municipal levy process.
- Both the Municipality of Clarington and CLOCA share both policy development, regulation and implementation roles in a local and site specific context. The main tools at the municipal level are the Clarington Official Plan and implementing zoning by-law, the *Building Code Act, 1992*, and the various powers under the *Municipal Act, 2001*.
- As designated by the province through MMA and MNRF, CLOCA is the local agent for the interpretation and implementation of natural hazard policy and site-specific regulation of development through Ontario Regulation 42/06.
- Shoreline management planning is also undertaken collaboratively between the region, municipality and conservation authorities.

Capital projects and associated studies:

- The federal and provincial governments, Region of Durham, Municipality of Clarington and CLOCA all have the ability to undertake capital projects should decision-makers decide to plan and budget for such works.

Present Day Context

2017 weather events and shoreline issues

Lake level records dating back to 1860 demonstrate the variable nature of the Great Lakes. Of the two key factors influencing long-term and short-term changes in lake levels, natural factors influenced by climate change, such as rainfall, evaporation, wind, or storms cause the greater amounts of change, measured in terms of *metres of change*, than do human actions such as diversions and water control structures, which can be measured in terms of *centimetres of change*. In 1958 the construction of the Moses-Saunders dam was completed near Cornwall, providing a level of control for release rates from Lake Ontario to the St Lawrence River system. The release of water is regulated by the International Lake Ontario - St Lawrence River Board, under a plan that aims to limit the flooding and erosion impacts of high water levels and flow and protect against the shipping and recreational impacts of low water levels. The operation of the dam has been successful in moderating water levels in Lake Ontario, but does not provide full control against extreme conditions.

The most familiar change in relation to Great Lakes water levels are the seasonal 0.6 m to 1.1m fluctuations normally experienced during the year with highest water levels in June and lowest levels in December. In addition to these seasonal fluctuations are short periods of significantly higher lake level changes caused by winds or storm surges which blow over the lake surfaces pushing the water to the opposite side or end of the lake. More than 150 years of lake level records confirm that large, long-term lake level changes vary up to 30 years and are expected to vary to greater extremes as climate change produces more extreme weather patterns. Changes in lake levels are neither regular, readily predictable, immediate nor short in duration and are instead the direct influence of changes in climate and hydrological patterns across the Great Lakes Basin. Historical records further confirm that high lake levels, which

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normally last for months or even years, pose long-term threats to shoreline residents. These threats are often dramatically heightened when combined with wave impacts caused by storms. The previous period of heightened lake levels and associated shoreline resident impact lead to today's Great Lakes shoreline natural hazard policy directions.

Attachment 5, *Extreme Conditions and Challenges During High Water Levels on Lake Ontario and the St Lawrence River* (International Lake Ontario – St. Lawrence River Board) describes the conditions that led to the record high Lake Ontario water levels during spring/summer 2017.

CLOCA issued a *News Release* in April, identifying the potential for flooding and erosion of our shorelines with the unusually high Lake levels. CLOCA also issued a *Flood Watch* on May 1st, a *Flood Watch Update* on May 3rd, and a *Flood Warning* on May 5th, as Lake water levels, storm surge, waves, and significant precipitation all combined to cause flooding. Residents on Cedar Crest Beach Road experienced water flowing through their lots and flooding crawl spaces on several events. Southerly winds and waves brought Lake floodwater across the low lying lots and flowed into the West Side Marsh, while on other occasions, heavy rainfall resulted in floodwater flowing from the West Side Marsh across Cedar Crest Beach and into the residential lots. The initial events occurred in late April when the Lake Ontario water level reached 75.5 meters. The Lake reached an all-time historical high level of 75.88 meters in May, and continued to recede very slowly. The Lake level fell below 75.5 meters in August, but continues to be about 0.5 meters above average for this time of year.

Beyond the flooding of crawl spaces, the elevated Lake level also compromised the function of septic systems, and posed a risk to contamination of shallow wells. Roadways were also overtopped with flood water, making access and egress difficult.

Climate Change

The Durham community climate adaptation plan, *Towards Resilience*, was completed in 2016 concludes that our local climate in the 2040's will be **Warmer** (4C average temperature increase), **Wetter** (50% increase in one day maximum rainfall, 100% increase in days with more than 25mm of rain, more rain in the summer months and 75% less snow in February) and **Wilder** (More intense rainstorm events, including a 15% increase in the potential for violent storms and a 53% increase in the potential for tornadoes).

The warmer than average winters in 2016 and 2017 caused unstable ice formation in the St Lawrence River and hampered the normal release of Lake Ontario water. This climate anomaly led to higher than average water levels in Lake Ontario in both the spring of 2016 and 2017, and may continue to challenge the management of Lake Ontario water levels,

Milder winters and springs have resulted in less ice cover and more open water on Lake Ontario. The ice accumulations that typically fill the shoreline in the spring are less common, and the shoreline may be more exposed to spring storms.

Resident Requests for Environmental Assessment

In June of 2017, CLOCA received a resident request for CLOCA to evaluate the shoreline erosion and flooding problem in the Port Darlington area by undertaking a *Class Environmental Assessment for Remedial Flood and Erosion Control Projects*. A Class Environmental Assessment is a specific planning and design process for conservation authorities, approved by the Minister of the Environment and Climate Change under the *Environmental Assessment Act,* which ensures that environmental effects are considered when undertaking remedial flood and erosion control projects. Staff analysis with respect to the applicability of this process is discussed below.

Staff met with Cedar Crest beach residents on July 6, 2017 to discuss CLOCA's roles in planning, development and shoreline management as well as options to address the hazardous conditions experienced earlier this year.

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Council of the Municipality of Clarington Resolutions

At its meeting of July 3, 2017 and in response to delegations and municipal staff reports related to the impacts from the unprecedented Lake Ontario water levels experienced earlier this year, the Council of the Municipality of Clarington resolved:

Resolution #C-203-17

> "…that the Municipality of Clarington request the federal and provincial government, and CLOCA to work together to develop an entire waterfront plan including Port Darlington channel, and the beach waterfront, and work towards a cost sharing agreement for the study and work and that St. Marys and other interested parties be invited to participate.
>
> That staff be directed to call these parties together with representatives of the resident community to form a working committee to clarify jurisdictional roles and responsibilities and secure funding and contribution agreements, such that a viable shoreline erosion control and beach restoration plan can be implemented as soon as possible; and
>
> That staff and working committee representatives present the plan to Council by October 2017."

This report provides the first opportunity for the CLOCA Board of Directors to consider the request of the Council of the Municipality of Clarington through the staff analysis and recommendations contained herein,

Staff Analysis

Completion of the *Port Darlington (West Shore) Damage Centre Study*

Given the urgent requests from residents and the Council of the Municipality of Clarington, the overlapping natural hazards present and the need to precisely define current coastal processes associated with the hazards at a site-specific scale, staff recommend that the previously initiated *Port Darlington (West Shore) Damage Centre Study* be completed as soon as practicable.

CLOCA staff have been in consultation with Aqua Solutions and have confirmed the availability of the original coastal engineer and author, Judy Sullivan, to re-initiate the project.

CLOCA staff propose to complete the *Port Darlington (West Shore) Damage Center Study* with several updates including considerations for climate change, recent historic water levels, updated provincial shoreline natural hazard policy, updated mapping and further analysis of potential options to address the risks from natural hazards.

The study would be conducted under the guidance of CLOCA and Clarington staff, but will seek input from the proposed working committee including Port Darlington Resident's Association and St. Mary's Cement, with opportunity for public input at a facilitated public information session.

Funding for the project will be provided through a Port Darlington reserve held by the Municipality of Clarington. The project has an upset limit of $50,000.

Next Steps

The completion of the study will provide an analysis by a qualified coastal engineer and supporting professionals. The completed report will identify priority hazardous zones and assess both short-term remedies and longer-term solutions to manage flooding and erosion. The study will also provide planning and policy guidance for future development within the damage center informed by the most recent information available regarding climate change, recent historic water levels, sediment transport, current provincial policy direction and updated mapping.

Cont'd

With a completed report, staff would be in the position to report back to the Board of Directors with options for implementation that are informed by current analysis that is science-based and in conformity with current provincial Great Lakes Shoreline natural hazard management policy directions.

Implementation Options / Environmental Assessment

Implementation options may be proposed at various scales from property-specific to the regional Lake Ontario shoreline. Implementation options could include policy and regulatory changes/improvements to direct physical interventions related to land acquisitions and capital works projects or a combination of both. Any publicly-initiated physical projects would likely be an "undertaking" within the meaning of the *Environmental Assessment Act* and would therefore need to follow the *Class Environmental Assessment for Remedial Flood and Erosion Control Projects*. Implementation agents could include: senior levels of government, the Region of Durham or Municipality of Clarington, CLOCA, individual or groups of landowners or a combination, and similarly, possible funding sources for the undertaking will need to be investigated. This is consistent with the Municipality of Clarington resolution to "… call these parties together with representatives of the resident community to form a working committee to clarify jurisdictional roles and responsibilities and secure funding and contribution agreements, such that a viable shoreline erosion control and beach restoration plan can be implemented as soon as possible."

Decisions with respect to accepting and moving forward with any recommendations will rest with each agency involved. Following completion of the *Port Darlington (West Shore) Damage Center Study* and acceptance of implementation options, the next major step would be for each stakeholder to obtain the funding that may be needed.

Conclusion

Moving forward with the completion of the *Port Darlington (West Shore) Damage Centre Study* is a first step response to Clarington Council Resolution #C-203-17 and the request for a Class Environmental Assessment that will allow for a property-specific understanding of each shoreline natural hazard present. A completed report will provide a science-based platform upon which subsequent decisions related to shoreline management may be made by the Council of the Municipality of Clarington, CLOCA, residents and other stakeholders.

CLOCA staff have been working closely with Municipality of Clarington staff in the advancement of our understanding and management of issues pertaining to natural hazards and the Port Darlington shoreline community. Clarington staff have been provided an opportunity to review this staff report and they concur with the recommendations provided. Staff therefore make the following recommendations, which have regard to the request of the Council of the Municipality of Clarington's Resolution C-203-17 to the extent possible.

RECOMMENDATIONS:

THAT staff take the necessary actions to complete the Port Darlington (West Shore) Damage Centre Study in consultation with the requested working committee as soon as practicable;

THAT the firm of Aqua Solutions be retained to complete the study work as per the previously approved Terms of Reference, amended to address issues associated with Climate Change, recent historic water levels, Sediment Transport, Current Provincial Policy Direction, Updated Mapping and further assessment of potential options to address risks associated with natural hazards;

THAT CLOCA staff be directed to report back to the Board of Directors with the completed study with options for implementation in conformity with the recommendations of the study and provincial Great Lakes shoreline natural hazard management policy;

THAT the Council of the Municipality of Clarington be so advised in response to Resolution C-203-17.

RPS/CJ/bb
Attach.


John Scott Avenue
Baseline Road W
Baseline Road E
Martin Road
Spicer Square
Waverley Road
Simpson Avenue
401
Bowmanville Creek
Liberty Street S
Lake Road
Soper Creek
Duke Street
Energy Drive
Waverley Road
Westside Creek
West Beach Road
Port Darlington Road
Cove Road
Bowmanville Marsh
Westside Marsh
West Beach Road
Cedar Crest Beach Rd
Lake Ontario
0
150
300
600 Meters
1:13,000

12.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the analysis carried out through this study, a number of conclusions have been drawn and appropriate recommendations are listed below. In total, these recommendations provide policies to be used by the relevant conservation authorities and municipalities in managing the shoreline area.

1. Municipalities should recognize the hazard land characteristics of the shoreline, its aesthetic features and public amenities through appropriate official plan and zoning provisions.

2. Measures should be taken to protect environmentally sensitive areas along the shoreline. In particular, development proposals should not destroy or conflict with the protection of these sensitive features. The impacts of protecting updrift areas on the environmentally sensitive features must be assessed before approving protective works.

3. Acquisition of the shoreline should be considered by the appropriate agencies, where feasible and practical, because it is generally the most effective means of minimizing private property damage and risk to life resulting from shoreline hazards. It can also protect the public amenity and recreational value of the shoreline.

4. As a minimum, when acquisition is utilized as an alternative to shore protection, the area acquired should extend to the limits of the erosion and/or flooding setback of the area in question, with additional bluff lands to be set aside for open space purposes as may be required by the relevant approval agencies.

5. Acquisition of additional lands to protect sensitive areas or for recreational and aesthetic purposes should be considered by appropriate agencies as necessary and as budgets permit.

6. The implementation of shoreline protection structures must be examined on a site specific basis with regard given to potential impacts on adjacent and downdrift areas. Specific recommendations are given for various reaches in Table 12.1.

7. Prior to the implementation of any major shoreline structure, including any where it is proposed that setback limits be reduced, site specific coastal engineering studies must be completed to demonstrate their long term effectiveness and to identify potential impacts on updrift and downdrift properties. These studies must conclusively demonstrate to the satisfaction of the approving agencies that the proposed structure will function as intended.

12.0 CONCLUSIONS AND RECOMMENDATIONS (Cont'd)

8. Conservation Authorities through the province should establish "fill" and "construction" regulations for the shoreline which will be structured to allow authorities to control filling and construction within the setback limits and construction of shoreline protection works.

9. Prior to the establishment of any conservation authority capital works programs within the damage centres, further coastal engineering studies should be completed to further refine the design of proposed works.

10. Conservation Authorities should continue to operate the existing shoreline monitoring stations and establish those additional stations as defined in this report.

11. Site specific recommendations as to the applicability, or not, of implementing shore protection structures should be referred to in Table 10.1.

8.0 DAMAGE CENTRES (Cont'd)

8.1.3 City of Oshawa Lot 8, Concession BF
Damage Centre C3 (Map 2.3) (Reach #10)

The shoreline west of Lakeview Park rises to form a steep bluff which protrudes into the lake. A number of houses are located on the headland which extends westward for approximately 100 metres before the shoreline drops off again. Because this feature protrudes into the lake, it is a natural focal point for wave energy.

Some filling has been done in the past and concrete slabs provide some protection. However, unless the shoreline is properly protected, it will continue to erode. It should also be noted that a long-term acquisition program is being pursued by the City of Oshawa subject to budgetary conditions.

8.1.4 Port Darlington Beach
Damage Centre C4 (Map 2.7) (Reach #17)

The beach west of Port Darlington can be described as a sand spit backed by marshland, located at the mouth of Bowmanville Creek and adjacent to Westside Creek. The marshland is a designated environmentally sensitive area. Approximately 50 houses are located on this spit (Cedar Crest Beach Cottage Development) which has a maximum elevation of approximately 76.5 metres IGLD. The area is at risk from flooding of the river as well as from flooding due to wave activity on Lake Ontario.

The major problem with protecting this shoreline is the cost. Because the shoreline must be protected from both sides the cost is at least double what it would normally be and this may be too much for most property owners.

Ideally, the properties should be protected from river flooding by a clay dyke. On the lakeward face, a beach widening scheme should be implemented. This would involve importing and placing sand on the beach and containing the sand between hardpoints or behind offshore breakwaters. Detailed studies would be required to ensure that widening of the beach would not lead to a siltation problem in the harbour approach channel.

There is currently an acquisition plan that covers a part of this beach. The appropriate agency may consider acquisition of the entire beach area.

Excerpt from Clarington Official Plan (2016)

Natural Environment and Resource Management Policies

Regulatory Shoreline Area

3.7.6 The Regulatory Shoreline Area as identified on Map F, is that area along the Lake Ontario Waterfront which is subject to dynamic beaches, flooding and/or erosion. The extent and exact location of the Regulatory Shoreline Area shall be identified in the implementing Zoning By-law in accordance with the detailed Lake Ontario Flood and Erosion Risk Mapping of the relevant Conservation Authority.

3.7.7 The construction of new buildings or structures of any type within the Regulatory Shoreline Area shall not be permitted.

3.7.8 Once a dwelling located in the Regulatory Shoreline Area is destroyed or demolished by whatever reason, and reconstruction is not recommended within 24 months, the existing residential use is deemed to cease.

http://ijc.org/greatlakesconnection/en/2017/08/extreme-conditions-challenges-high-water-levels-lake-ontario-st-lawrence-river/

Extreme Conditions and Challenges During High Water Levels on Lake Ontario and the St. Lawrence River

IJC GLC - August 7, 2017 - By Rob Caldwell, International Lake Ontario-St. Lawrence River Board

US Army National Guard members deploy a water-filled cofferdam by Sodus Point, New York, to help control Lake Ontario floodwaters. Credit: US Army National Guard

There has been much speculation and many theories put forth as to what factors contributed to the high-water crisis on Lake Ontario and the St. Lawrence River this year, from rain to snow, water levels and regulation Plan 2014. The truth is there were many factors. But as a colleague recently summed up, the main ones were “Rain, rain, and more rain!”

Of course, this is an over-simplification, but in retrospect, the high water levels stemmed mainly from four rain-related factors: an unusual mild and wet winter, above-normal inflows from the upper Great Lakes, a record-setting spring freshet in the Ottawa River basin, and heavy rainfalls across the Lake Ontario and the St. Lawrence River system that have continued through spring and early summer.

This unprecedented combination of climate conditions presented the International Lake Ontario-St. Lawrence River Board with a most difficult challenge. Let’s take a closer look at how things unfolded during the first half of 2017, including the factors leading to the record-high levels and how the board has taken into consideration these exceptional conditions in its decision making.

Watershed basin map with outlet locations. Credit: Environment & Climate Change Canada

2017 Brings New Plan

On Dec. 8, 2016, the International Joint Commission issued a Supplementary Order, replacing Plan 1958-D and adopting Plan 2014 as the new regulation plan effective Jan. 7, 2017. Plan 2014 prescribes a new set of rules that the board must ordinarily follow in setting the outflows from Lake Ontario through the St. Lawrence River, which are controlled at the Moses-Saunders generating station at Cornwall, Ontario and Massena, New York.

At the time Plan 2014 was implemented, Lake Ontario’s water level was 6 centimeters or 2.4 inches below its long-term (1918-2016) average for that time of year, and at about the same level as each of the past two years. The upper Great Lakes, including Lake Erie, which supplies about 85 percent of the total inflow of water to Lake Ontario via the Niagara River and Welland Canal, were somewhat above average, but not significantly so and also at similar levels to

recent years. Finally, at the start of January, ice was already forming on the St. Lawrence River in the Beauharnois Canal (located between Moses-Saunders and the city of Montreal further downstream on the St. Lawrence). The board had already reduced outflows from Lake Ontario to the rate required for ice formation, which applied under the old and new regulation plans, allowing a seamless transition.

A Mild and Wet Winter Season (January to March)

When ice starts forming at critical locations in the St. Lawrence River, outflows must be temporarily reduced to ensure the formation of a safe and stable ice cover. Doing so reduces the risk that the ice cover will collapse or that the fast-moving water will generate what's known as frazil ice (ice crystals suspended in water that is too turbulent to freeze solid), possibly resulting in an ice jam. Such an occurrence would significantly reduce outflows, causing immediate flooding upstream, and rapidly declining levels downstream. Once a stable ice cover has formed, the board can safely increase outflows.

By Jan. 17, the Beauharnois Canal was half-covered with ice and the unusual winter weather began. Unseasonably mild temperatures combined with a number of heavy precipitation events in January caused much of the precipitation to fall as rain, particularly in the more southerly parts of the basin. Much of the snow that fell also melted with the mild weather, running off into local streams and tributaries, and making its way to Lake Ontario and the St. Lawrence River.

Notably, daily high temperatures were above freezing for about a week straight from Jan. 16-23. With an extensive, prolonged thaw under way, the ice that had formed in the Beauharnois Canal began to disappear, and eventually receded to the point that Lake Ontario outflow was safely increased back to values previously passed during the open-water season. But by Jan. 25, following another period of colder weather, ice had started forming again and the flow was reduced again on Jan. 28. But mild weather returned, and so flow was again increased on Jan. 31.

This cycle of freezing and thawing continued in February, and flows were adjusted six times that month in response to fluctuating temperatures and ice conditions. A few days of typically cold winter weather at the start of February were followed by several days of milder, but below freezing temperatures, allowing ice to form slowly. However, the last half of the month was exceptionally warm: daily high temperatures recorded at Dorval, Quebec, near Beauharnois, were above freezing for 13 straight days from Feb. 18 through March 2 and reached 14.5 Celsius (58 Fahrenheit) on Feb. 25. The ice cover was gone by Feb. 26, and this permitted the board to increase the flow several times by month's end.

At the same time, water levels throughout the system began to increase gradually as snowmelt and wet weather continued. Lake Ontario rose significantly more than normal in February, as inflows were above average and outflows were restricted by fluctuating ice conditions. St. Lawrence River levels near Montreal also gradually edged upwards until suddenly shooting above average on Feb. 26 as snowmelt combined with rare February thunderstorms and rainfall.

Normally, by February, a solid ice cover has formed on the St. Lawrence River and remains in place, while occasionally, milder temperatures cause the ice cover to melt during this month. Either condition allows flows to be safely increased thereafter. At no time in recorded history had ice begun forming in March, and the board had no reason to believe this year would be any different. But between March 4 and March 30, substantial ice cover formed and disappeared twice in the Beauharnois Canal during what were two of the coldest stretches of weather seen all winter. As a result, Lake Ontario outflows varied considerably, being reduced as ice formed during a good part of the first half of the month, and then increased four times by a total of 18 percent from March 17- 22. Once increased, flows remained relatively stable for the rest of March.

Overall, the winter saw five periods of ice formation punctuated with thaw cycles in between, the most ever seen in the St. Lawrence River.

While highly variable ice conditions restricted outflows at times, the main driver of rising water levels throughout the Lake Ontario-St. Lawrence River system during the first three months of 2017 was the above-normal amount of water the basin received. This water came from precipitation, snowmelt and runoff from within the basin, and above-average and increasing inflows from Lake Erie, which also saw wet conditions and generally rising water levels throughout this period. From January through March, the net total water supply (i.e., total inflow) to Lake Ontario was above average, and the 12th highest for this three-month period since records begin in 1900. At the end of March, water levels

were where they were in 2016, and the mid-March 90-day forecasts from Canada and the US suggested average precipitation was expected in April, May and June.

Record Ottawa River freshet (April and May)

The unusual wet winter transitioned quickly to an exceptionally wet spring. Water levels on Lake St. Louis, located on the St. Lawrence River just upstream of Montreal, generally rose quickly throughout the first three weeks of April following a significant thaw event marked by thunderstorms and rainfall. This event, while relatively large, was not entirely unusual; the Ottawa River enters the St. Lawrence at this location and at this time of year snowmelt and rainfall tend to rapidly increase flows out of this large basin. Nonetheless, the peak flow of 6,877 cubic meters per second (242,900 cubic feet per second) on April 20 was a record for this date, and the highest Ottawa River flow since 1998.

From April 1-5, the Plan 2014 rule curve flow was followed. Thereafter, a series of rainstorms passed through the region, with areas to the north and east of Lake Ontario and into the Ottawa and St. Lawrence River basins being particularly hard-hit. This led to two dozen adjustments to Lake Ontario outflows during the month of April in response to the rapidly rising and highly variable Ottawa River and local tributary flows.

These adjustments were done in accordance with the Plan 2014 "F-limit," which was designed to mimic the board's decision making strategies under the previous regulation plan, Plan 1958-D, during high-water events in the 1990s (whereby flooding and erosion risks and impacts upstream on Lake Ontario and in the 1000 Islands were balanced with those downstream from Lake St. Louis through Lake St. Peter). During periods of wet spring conditions, as levels on Lake Ontario reach higher and more critical values, this multi-tiered rule also allows increased levels downstream at Lake St. Louis, which acts as somewhat of a barometer for other areas downstream, and Lake Ontario outflows are adjusted accordingly. The total inflow to Lake Ontario during the month of April was the second highest recorded since 1900.

While the wet weather continued, Lake Ontario and St. Lawrence River levels continued to rise, reaching record high levels and resulting in flooding and related impacts throughout the system. Lake Ontario's end-of-week level reached what is known as the criterion H14 upper trigger level on April 28. Criterion H14 is another rule, again part of Plan 2014, that when exceeded, authorizes the board to follow an alternative strategy and release outflows to provide all possible relief to riparians living along the shorelines of the entire system. There are four upper trigger levels per month (48 per year) and these thresholds can be expected to be exceeded 2 percent of the time, by definition, given historical water supplies. However, at the time, given the exceptional conditions, the board consensus was that the best way to balance the effects of water levels upstream and downstream and minimize flood and erosion impacts to the extent possible throughout the system was to continue to follow the "F-limit" of Plan 2014. As a result, deviations from the plan were not employed.

Unfortunately, as conditions remained critical, the wet weather only worsened in May. The total inflow to Lake Ontario during the month was the highest recorded since 1900. The month began with a so-called "perfect storm." There were two extremely large and slow-moving storm systems that passed through the region, the first on April 30 and the second from May 4-8. These storms combined to dump a minimum of 75 millimeters or 3 inches of rain over most of the Lake Ontario, Ottawa and St. Lawrence River basins, while some areas around Lake Ontario received twice that amount. Heavy rain also fell upstream of Lake Ontario on Lake Erie, where water levels also were rising and inflows to Lake Ontario increased to well above average values.

As a result, during the first third of May, water flowed into Lake Ontario at record-high rates and about 25 percent higher than any release the board can physically pass down the river. At the same time, the daily mean Ottawa River outflow (at Carillon Dam) peaked at 8,862 m^3/s (313,000 cfs) on May 8 – a new all-time record maximum, which resulted in significant flooding in many parts of the Ottawa River basin, in the Montreal area and in many areas of the St. Lawrence further downstream.

In response, outflows from Lake Ontario were reduced quickly and significantly over the first week of May to moderate the sharp rise in St. Lawrence River levels near Montreal. As Ottawa River flows subsided, the Lake Ontario outflow was increased rapidly, rising from a low of 6,200 m^3/s (219,000 cfs) on May 7 to a high of 10,200 m^3/s (360,200 cfs) on May 24 (i.e., raised 35 percent in 17 days). In so doing, the board continued to balance upstream and downstream levels according to the "F-limit," exceeded the Plan 2014 flow and initiated major deviations in accordance with criterion H14 to provide all possible relief to riparians upstream of the dam.

The flow of 10,200 m^3/s (360,200 cfs) was equivalent to the record-maximum weekly mean values passed under Plan 1958-DD in 1993 and 1998 and also equivalent to the maximum "L-limit" value, another rule within Plan 2014. This limit defines the maximum outflow that will maintain adequate levels and safe velocities for navigation in the International Section of the St. Lawrence River when Lake Ontario levels are very high – from above 75.70 meters until 76 meters (248.36 feet until 249.34 feet). The St. Lawrence Seaway imposed several mitigation measures to ensure safe vessel transits remained possible.

Despite these record high releases, inflows also remained well above normal seasonal values, and Lake Ontario levels remained high and peaked near the end of May at 75.88 meters or 248.95 feet, a new all-time record value. Montreal area levels, after their rapid rise toward record values throughout the first third of May, generally declined slowly thereafter as Lake Ontario outflows were increased, but Ottawa River outflows decreased at a faster rate.

In total, Lake Ontario outflows were adjusted 23 times in May.

Heavy Rainfalls Continue (June and July)

By June 2, water levels on Lake St. Louis had started to decline. On June 14, the board initiated additional major deviations from Plan 2014 flows, increasing the Lake Ontario outflow to 10,400 m^3/s (367,300 cfs). This was a new record-maximum weekly flow, the highest ever released from Lake Ontario. The St. Lawrence Seaway imposed further mitigation measures and undertook an assessment of this higher outflow for several days, concluding that it was the absolute maximum outflow possible to maintain adequate levels and safe velocities for navigation in the International Section of the river. After some deliberation regarding the impacts of increasing the outflows further, the board decided to maintain this outflow for the remainder of the month and into July.

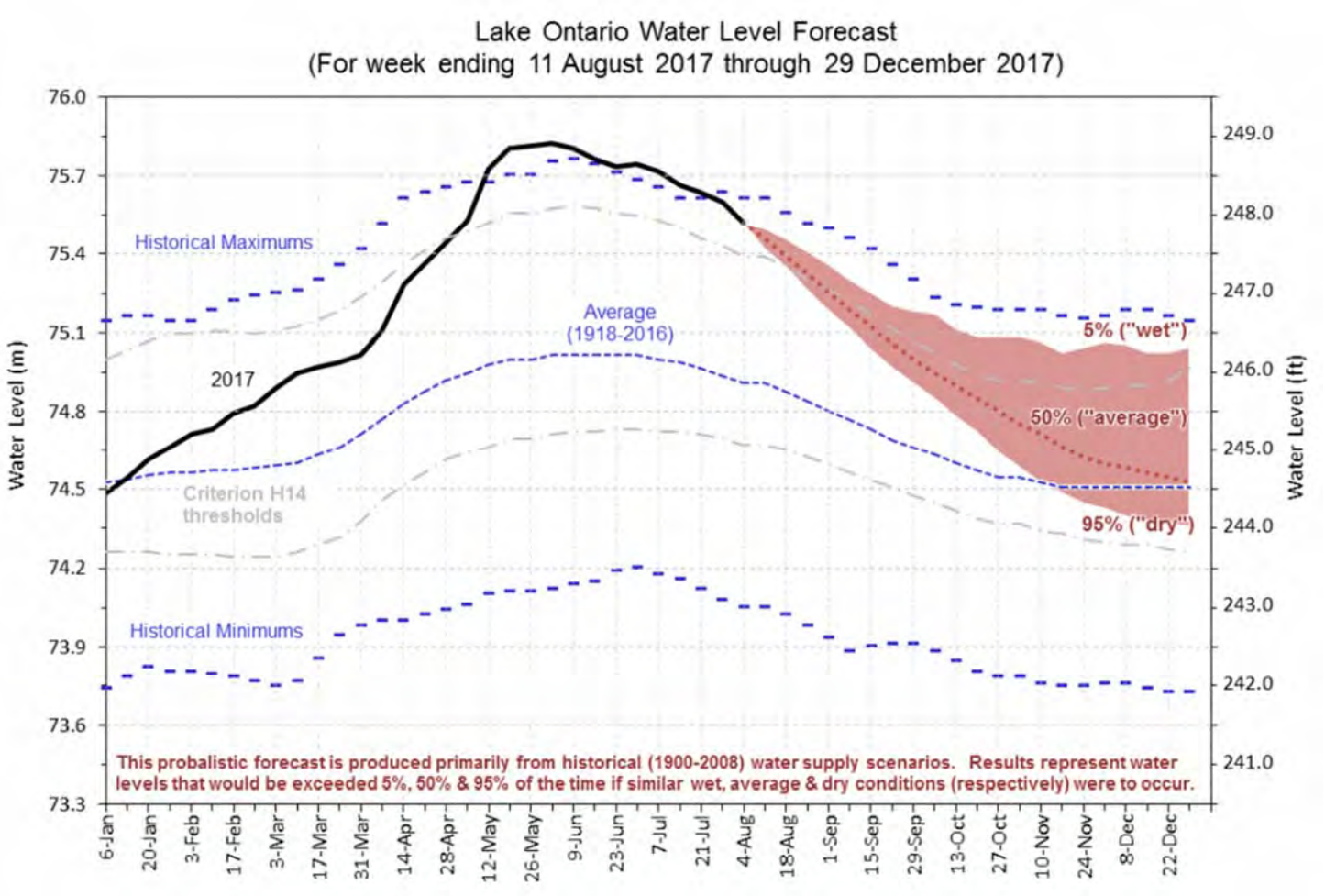
The monthly mean outflow from Lake Ontario in June averaged 10,310 m^3/s (364,100 cfs), 38 percent above the June long-term average (1900-2016) and a new record-high value for any month, exceeding the previous record of 10,010 m^3/s (353,500 cfs) set in May and June of 1993.

Wet weather continued in June. A particularly noteworthy storm on June 23 dropped 20.5 mm or 0.8 inches of rain on the Lake Ontario basin. After gradually declining for most of the month, Lake Ontario levels rose slightly as a result. The total inflow to Lake Ontario during the month was the second highest recorded in June since 1900. Nonetheless, the record-high outflows allowed Lake Ontario levels to fall 9 cm or 3.5 inches overall in June – much more than the typical 1 cm or 0.4 inch decline, and the 11th highest June decline on record. By the end of June, Lake Ontario was 10 cm or 3.9 inches below the peak level recorded on May 29. About 6.6 cm or 2.6 inches of that water was removed from Lake Ontario, owing to major deviations undertaken since May 23. The remainder was due to high outflows prescribed by Plan 2014 and the fact that inflows, while still high, had begun to decline.

Montreal area levels generally fell through the middle of June as Ottawa River outflows declined, but rose slightly at the end of June and even further during the first week of July, reaching high levels and flooding similar to that seen earlier in the spring.

The board agreed to continue releasing 10,400 m^3/s (367,300 cfs) into July. Despite these efforts, the continuing wet conditions sustained the high levels and severe impacts to Lake Ontario and St. Lawrence River property owners, recreational boaters, businesses and tourism. Lake Erie remained well above average, and combined with significant rainfall during the past month, the total inflow to Lake Ontario remained high.

Decisions and the Path Forward



Lake Ontario water level forecast through end of 2017. Credit: Environment & Climate Change Canada

The first several months of 2017 have been an especially challenging time for those living and working throughout the Lake Ontario-St. Lawrence River system. Many have been impacted by the exceptionally high water levels. While levels have begun to decline, the effects continue to be felt and may continue for months to come.

For its part, the board has made every effort to address the exceptional weather conditions and reduce levels to the extent possible. Outflows were continuously adjusted from January through March during what was a generally wet winter, with highly variable temperatures and challenging ice conditions. As the weather turned from bad to worse, the board continued to adjust outflows in April and May, this time to address the extreme precipitation, record inflows and rapidly rising water levels which have caused severe flooding and associated impacts throughout the system. Since then, the board has increased outflows to record-high values in an attempt to lower the extraordinary levels of Lake Ontario and provide relief to those impacted, while also considering the impacts to riparian interests downstream on the St. Lawrence, and to other stakeholders, including commercial navigation and the industries it supports.

Despite these efforts, wet weather has continued and levels have remained high. There are unfortunately no simple solutions, but the board will continue to consider all possible options, as well as associated impacts, in setting outflows from Lake Ontario. High outflows are expected to continue for several weeks, and as warmer and drier summer conditions continue and evaporation rates increase into the fall. The board expects water levels throughout the system will generally continue to decline, providing gradual relief from the high water crisis of 2017. But keep in mind that water levels may remain above normal for some time to come, and autumn brings a higher chance of damaging storms. Strong winds and wave action can cause significant fluctuations on the lake and river, with temporary changes of more than half a meter (2 feet) in certain locations.

Further information on Lake Ontario flow regulation can be found at the International Lake Ontario-St. Lawrence River Board Facebook page and the board's web site.

Board Reaching Thousands Online

By Arun Heer, International Lake Ontario-St. Lawrence River Board

Since the establishment of the International Lake Ontario-St. Lawrence River Board by the International Joint Commission in 1952, keeping people informed about water level and flow conditions in the lake and river has been a top priority. With the Lake Ontario-St. Lawrence River basin covering such a broad geographic area, including communities in New York, and the provinces of Ontario and Quebec, communication has often been challenging and resource intensive. In the past, the board relied on methods such as in-person public meetings, telephone conferences, and mailing news releases and hard-copy letters to connect with people.

Today, the board is reaching out with modern communication tools such as Facebook, webpages, electronic mailing lists, animated videos, and digital press releases to deliver messages quickly. The board's Facebook page, in particular, has proven to be a great forum for posting information on topics such as water levels, outflow changes and hydrologic forecasts.

The Facebook page had close to 800 "likes" in January, and that number had increased to more than 2,300 as of July 24. Facebook has become a place where the board can interact with the community in real-time, and where members of the public can interact with one another to share and exchange information.

The board encourages everyone to visit its Facebook page for the most up-to-date information on board activities and join the conversation. Additionally, short educational videos, media releases, and other information can be found on the board's website.