

Addendum Report

Gibraltar Point Erosion Control Project

Prepared by the Toronto and Region Conservation Authority

In accordance with Conservation Ontario's Class Environmental Assessment for Remedial Flood and Erosion Control Projects

March 2018



Executive Summary

Toronto and Region Conservation Authority (TRCA), through the Living City Policies, programs and initiatives, continues to work towards ensuring healthy rivers and shorelines, greenspace, biodiversity, and sustainable communities. The design and implementation of shoreline stabilization and erosion control projects along the Toronto Waterfront is an essential component of the mandate of TRCA. Remediation of erosion hazards and enhancing ecological habitat at Gibraltar Point is a matter of public safety, protects essential structures on the Toronto Islands, and enhances key natural areas and community public space.

A severe storm event in 2004 prompted the City of Toronto to engage the TRCA in emergency works on the Toronto Islands, specifically at Gibraltar Point to protect a washroom facility. The ongoing need to protect Gibraltar Point from erosion prompted the Gibraltar Point Erosion Control Class Environmental Assessment. The Gibraltar Point Erosion Control Project - a Conservation Ontario Class Environmental Assessment for Remedial Flood and Erosion Control Projects (Class EA) – was approved by the Ministry of Environment and Climate Change in 2008. The 2008 Environmental Study Report (ESR) identified a preferred concept for the long-term and sustainable erosion control Gibraltar Point. The preferred concept identified in the 2008 ESR was a sand management plan, recognizing that some form of offshore protection may be required to ensure that the sand management plan is both technically and fiscally feasible.

More than five years have passed since EA approval, prompting the need to undertake an Addendum to the 2008 ESR. Following a detailed design process for Gibraltar Point in 2015, TRCA retained Baird Consulting Engineers (Baird) in 2016 to undertake additional studies in order to meet the requirements of the EA Addendum process. The Addendum process commenced in 2016 following approved funding and additional consultation with the Community Liaison Committee members, members of the public, agency representatives and Indigenous community representatives.

This Addendum reconfirms the preferred concept and the existing conditions of the study area, outlines the circumstances necessitating a change to the 2008 ESR, discusses the potential environmental effects of the proposed change, and documents measures planned to mitigate any negative environmental effects. This Addendum also describes the project area, the extensive project history including decades of studies and assessments, and documents the decision making process for the revised preferred concept.

Through the Class EA Addendum process initiated in 2016, the original preferred concept has been re-confirmed and modifications have been made to the engineered component of its design (hereafter referred to as the revised preferred concept). The revised preferred concept consists of an adaptive sand management program, a shore-connected semi-circular shallow flat reef (“nearshore reef”), and a groyne at the west end of Manitou Beach.

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Appendix F: Nearshore Reef Design Technical Report, 2018, Baird
Appendix G: Pre-Addendum Preliminary Detailed Design Consultation Activities
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1 Introduction

Section one describes Conservation Ontario's Class EA process and the purpose of undertaking an Addendum to the Class EA for erosion control at Gibraltar Point. This section also provides a summary of the additional consultation activities that have been completed for the Gibraltar Point Erosion Control Project Addendum.

1.1 Class Environmental Assessment Process

TRCA is defined as a public body in section 3 of Regulation 334/90 in the *Environmental Assessment Act* (R.S.O. 1990), and as such, must conduct its remedial flood and erosion control projects in accordance with the *Environmental Assessment Act*. Recognizing that common elements exist in addressing flood and erosion problems, a coordinated approach to environmental assessment was developed by Conservation Ontario for all Conservation Authorities known as the *Class Environmental Assessment for Remedial Flood and Erosion Control Projects*. Projects within this Class EA are defined below.

"Remedial Flood and Erosion Control Projects refer to those projects undertaken by Conservation Authorities, which are required to protect human life and property, in previously developed areas, from an impending flood or erosion problem. Such projects do not include works which facilitate or anticipate development. Major flood and erosion control undertakings which do not suit this definition, such as multipurpose projects, lie outside the limits of this Class and require an Individual Environmental Assessment." (Conservation Ontario, 2002, amended 2013).

The Class EA approach for dealing with flood and erosion control projects is an effective way of complying with the *Environmental Assessment Act* requirements while offering a self-approval process for Conservation Authorities. Approval of the Class EA allows Conservation Authorities to carry out these types of important remedial projects without applying for formal approval under the Environmental Assessment Act, on the condition that all other necessary federal and provincial approvals are obtained.

1.2 Rationale for Undertaking an Addendum

An Addendum to the 2008 Environmental Study Report (ESR) for the Gibraltar Point Erosion Control Project (TRCA, 2008), is required because the project was not implemented within five years of project approval under the requirements of the Conservation Ontario Class EA framework.

Additional detailed design studies were completed following approval of the ESR in 2008, including the analysis and detailed design of a preferred concept, however funding for implementation of the project was not approved until 2016. At this point, TRCA initiated the Gibraltar Point Erosion Control Project EA Addendum. The Addendum prompted the TRCA to re-visit the project study area and reconfirm existing conditions, including the detailed studies completed following approval of the 2008 ESR. The Addendum has been prepared to meet the requirements of Section 3.8 of the *Class Environmental Assessment for*

Remedial Flood and Erosion Control Projects (amended 2013), or Class EA. The passage of time, and innovations in shoreline protection, enables the TRCA to re-visit the preferred concept and ensure the original project objectives are met. Baird Consulting Engineers (Baird) were retained by the TRCA to investigate potential innovative improvements in the design of the preferred concept.

A detailed screening of potential effects and benefits of the revised preferred concept are included in **section 4.0** of this Addendum.

1.3 Purpose of Undertaking the Gibraltar Point Erosion Control Project

The purpose of the Gibraltar Point Erosion Control Project remains the same - to develop a long-term, sustainable solution to halt further erosion of the Toronto Islands around Gibraltar Point, which will protect existing infrastructure and public safety, and both preserve and enhance aquatic and terrestrial habitat (TRCA, 2008). The approved 2008 Environmental Study Report for the Gibraltar Point Erosion Control Project EA is provided in **Appendix A**.

Erosion at Gibraltar Point has been documented since 1879; however, it was not until 1972 following significant storm damage that remedial works were given any serious consideration. Ports Toronto (formerly Toronto Harbour Commission) completed two separate studies recommending long-term solutions. Despite these recommendations no major remedial actions were financially supported. Attempts were made to protect the local shoreline at Gibraltar Point however, these attempts failed to influence the large-scale coastal processes affecting the site.

A severe storm event in February 2004 caused significant damage to an existing washroom building and associated infrastructure. This prompted the City of Toronto to request assistance from Toronto and Region Conservation Authority (TRCA) to develop a long-term solution to address the shoreline erosion around Gibraltar Point. After completing emergency shoreline protection works in the immediate vicinity of the washroom building (following the storm event), TRCA initiated the Gibraltar Point Erosion Control Project under the *Class Environmental Assessment for Remedial Flood and Erosion Control Projects*.

Implementation of the Gibraltar Point Erosion Control Project is a remedial solution for long-term public safety and the ongoing protection of significant environmental and socio-economic resources for the City of Toronto. Strong wind storms in the winter of 2016-2017, along with record high lake levels in Lake Ontario in 2017, have combined to further exacerbate the erosion problem observed at Gibraltar Point and it is estimated that the shoreline is eroding at a rate of approximately 4m/ year (Baird 2018).

1.4 Public and Indigenous Consultation

Consultation for the Gibraltar Point Erosion Control Project continued throughout the stages of detailed design (2010 - 2015) and during Commencement and Notice of Filing of the Addendum Report (2016). **Appendix B** and **Appendix C** include a record of public and indigenous engagement respectively,

including copies of the Notice of Intent issued to formally initiate the Addendum project, and presentation materials used at a public meeting on the Addendum, held on November 16, 2017. A Notice of Filing will be released in the local newspaper (The Mirror, Beaches) on March 22, 2018, individual letters will be sent to members of the CLC, to persons who have expressed interest in the project, and to Indigenous communities. TRCA will be accepting comments from interested persons until April 12, 2018.

Following approval of the 2008 ESR, and prior to the commencement of the Addendum, TRCA engaged the Community Liaison Committee (CLC) at meetings held on March 24, 2010 and June 16, 2010 to discuss the detailed engineering and construction approach for the Gibraltar Point Project. Additional meetings with City of Toronto divisions and the Ministry of Natural Resources and Forestry occurred between 2010 and 2013. Due to lack of funding for implementation, the project was suspended after completion of a preliminary detailed design report in 2015.

Once funding for the project was secured, a Notice of Intent was distributed (August 2016) to the public, to members of the Community Liaison Committee (CLC) and to Indigenous Communities. TRCA staff also held a meeting with the CLC on September 27, 2017 at Artscape Gibraltar Point (on the Toronto Islands) to present the Addendum project timelines and next steps. Additional information was provided with respect to the review and reconfirmation of the preferred concept identified in 2008.

In November, 2017, a notice for a public meeting was released in the local newspaper (The Mirror, Beaches) and individual letters were sent to members of the CLC and Indigenous communities, with the details of a public meeting for the Gibraltar Point EA Addendum. Details on the information received at the public meeting are provided in section 1.4.2 of this Addendum.

Comments from members of the CLC were collected using a comment form (**Appendix B**). Overall, members of the CLC were supportive of the project and expressed a level of urgency with undertaking construction of the project. CLC members also requested that the TRCA monitor the project and consider impacts to natural features with respect to land based access during construction.

1.4.1 Indigenous Consultation

TRCA provided individual letters to representatives of various Indigenous communities with an interest in the study area. Additional invitations were submitted to attend the Public Information Centre on November 16, 2017. A detailed record of Indigenous consultation activities completed throughout the EA Addendum process is provided in **Appendix C**.

The marine archaeological assessment completed for the Addendum report identifies the study area to be within the traditional territory of the Mississaugas of the Credit First Nation (MCFN, formerly Mississaugas of the New Credit First Nation). TRCA has initiated engagement with Indigenous communities and no issues have been brought forward to date.

1.4.2 Public Meeting and Online Engagement

A public meeting was held on November 16, 2017 at the Harbourfront Centre in Toronto. Due to substantial interest in the extreme high lake levels of 2017, the public meeting for the Gibraltar Point Addendum was held in collaboration with the City of Toronto and Environment and Climate Change Canada (ECCC). The meeting included project specific presentations related to Gibraltar Point as well as other related Toronto Island work undertaken by the City of Toronto. The public meeting included high-level discussions related to flooding and erosion. Approximately 40 members of the public attended the meeting on November 16, 2017 and were provided information in the form of display panels, an information handout, a comment form, a detailed presentation about the Gibraltar Point Addendum Project, and a moderated panel discussion featuring a question and answer period with members of TRCA, the City of Toronto and the coastal engineering consultants Baird.

All materials presented at the public meeting were posted to the project website, including information related to the project. Copies of public consultation materials are provided in **Appendix B**.

2 Reconfirmation of Study Need

2.1 Study Area

The general location of the study area has not changed since approval of the 2008 ESR. The study area is located along the southwestern side of the Toronto Islands in the City of Toronto (**Figure 1**). The surrounding area is designated parkland, connecting the Toronto City Centre Airport to the west, with Centre Island to the east. There are several important features near the study area, one of the most well-known being the historic Gibraltar Point Lighthouse. Other notable features include the former Island Public and Natural Science School, now known as the Gibraltar Point Centre for the Arts, and Hanlan's Beach to the northwest – a popular tourist and recreation destination for sunbathers. The study area also contains a public washroom building, picnic areas, a system of paved pathways, the Toronto Island Filtration Plant, and the west end of Manitou Beach (the shoreline to the east of Gibraltar Point).



Figure 1. Study Area

2.2 Historical Context

The Toronto Islands formed over the last 3,500 to 5,000 years as a result of a number of factors including a dominant northeast to southwest sediment transport process, a supply of sand from the erosion of the Scarborough Bluffs, and the presence of a gently sloping bedrock platform. Formation of the spit began east of the mouth of the Don River and continued in a southwesterly direction until a severe storm event in 1852 breached the spit, interrupting the supply of sand to the Toronto Islands. Despite filling of the breach by the Toronto Harbour Commission, a series of powerful storms over the next several decades worked to reopen and widen the breach until it was almost one mile wide by 1882.

The supply of sand to the Toronto Islands was limited following the construction of jetties, which helped to stabilize the breach and form what is now known as the Eastern Channel. The construction and completion of the Leslie Street Spit in 1978, a man-made headland east of Toronto Island, is seen as the final and permanent step in eliminating the supply of sediment from the northeast. The erosion of lakebed fronting the eastern end of the islands does continue to provide a supply of sand to Gibraltar

Point; however, as the nearshore profile switches from a depositional convex shape to an erosional concave configuration due to the elimination of sediment from the northeast, this supply will also become a negligible source of sand over time.

Erosion at Gibraltar Point has been documented since 1879; however, it was not until 1972 following significant storm damage that remedial works were given any serious consideration. The Toronto Harbour Commission completed two separate studies recommending long-term solutions. Despite these recommendations no major remedial actions were financially supported. Instead, attempts were made to protect the local shoreline at Gibraltar Point with gabion baskets and rubble. These attempts had short-term success as they failed to address the large-scale coastal processes affecting the site. Despite the ongoing efforts and emergency works undertaken in February 2004, a long-term solution to prevent further erosion at Gibraltar Point was required. As such, the Gibraltar Point Class EA was completed in 2008.

2.3 Confirmation of Existing Conditions

The physical and biological conditions of the current study area are similar to the conditions identified and documented in the 2008 ESR (Appendix A). The information presented below affirms that the 2008 mapped data provided in the ESR is representative of the current mapped conditions. Existing infrastructure, including a dredged trench and a City of Toronto Intake Pipe for drinking water are located nearby but will not be negatively impacted as a result of this project (see Appendix D, Figure 4). Recent terrestrial and aquatic habitat surveys of the study area, and any changes that have occurred to the shoreline as a result of erosion since 2008, were also completed as part of the Addendum process. Recent surveys indicate that Gibraltar Point continues to experience significant erosion and a comparative analysis between 2008 and present day conditions demonstrates that the location of provincial wetlands, Environmentally Significant Areas (ESAs) and Areas of Natural and Scientific Interest (ANSI) remain the same and continue to be at risk due to erosion.

2.3.1 Erosion at Gibraltar Point

The formation of the Toronto Islands and the fluctuation in sediment transport and erosion that has led to the formation of Gibraltar Point and Hanlan's Beach is well documented in the 2008 ESR. A photographic record of erosion within the project limits is provided in Appendix A. The Toronto Islands continue to be altered as wind and wave energy erodes the shoreline. **Figure 2** below shows the change in shoreline due to erosion at Gibraltar Point over the last eight decades.



Figure 2. Shoreline Erosion at Gibraltar Point

Additional bathymetric and topographic surveys completed for the detailed design of the nearshore reef structure indicate that there has been a significant amount of lakebed erosion since 2014 (Baird, 2018). The offshore wave energy distribution for Gibraltar Point in 2008 demonstrates that southwesterly waves are a great risk to erosion of the Gibraltar shoreline (Appendix A). **Figure 3** shows the areas where erosion has occurred, with the most severe amount of erosion (between 0.5m – 1.0m), occurring near the shoreline. A similar analysis completed for the 2008 ESR (Appendix A, see Figure 10 and 12) indicates that the overall rate of erosion has remained similar since measurements began in 1993.

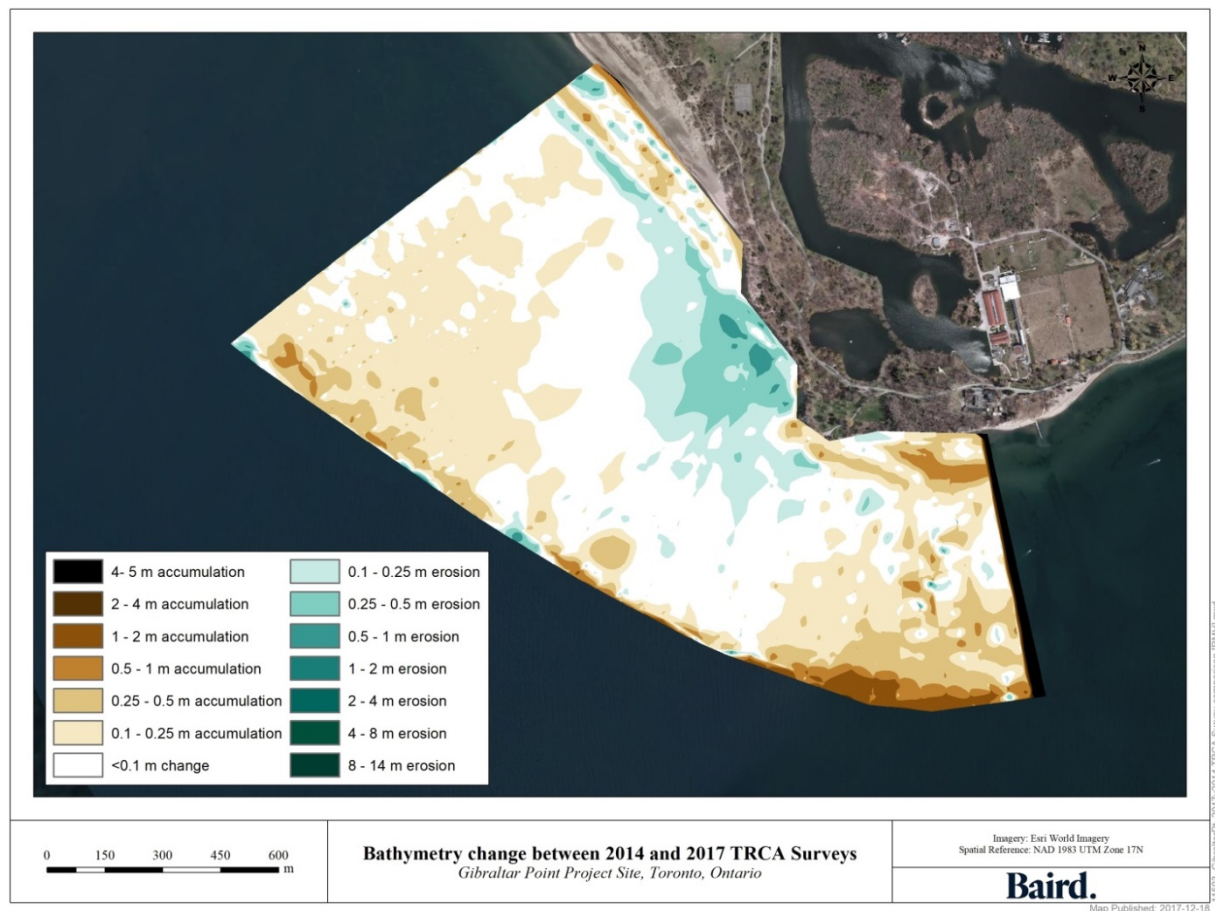


Figure 3. Bathymetric change at Gibraltar Point between 2014 and 2017

2.3.2 Natural Heritage Features

The natural heritage features at Gibraltar Point and Hanlan's Beach make up one of the largest remaining continuous habitats on the Toronto Islands. This includes unique terrestrial habitat on the Toronto Islands, significant natural and provincial habitat features, and a mixed composition of fish species. Habitat types (open water, littoral zone, beach strands, sand dunes, wet meadows, and cottonwood woodlands) have not changed since 2008. Since approval of the 2008 ESR, additional tree and fish monitoring has been completed to verify existing conditions. Although the study area remains relatively the same since approval of the 2008 ESR, advances of spatial mapping software has allowed for more comprehensive mapping.

Terrestrial Habitat

Terrestrial natural heritage includes plants, animals, and the ecological communities found at, and surrounding, Gibraltar Point and Hanlans Beach. Natural features include wetlands and flora and fauna that rely on Gibraltar Point for at least part of their life cycle (such as amphibians and waterfowl). Terrestrial habitat along the southwestern shoreline of the Toronto Islands is similar to the conditions

recorded in 2008 (Appendix A), including habitat linkages and corridors between the study area and Tommy Thompson Park. Vegetation communities consist of marram grass, open fore dunes, eastern cottonwood wooded back dunes, wet meadows, cottonwood woodlands and rare prairie communities dominated by switchgrass, big bluestern, and sand dropseed. A full record of existing conditions including species names is included in Appendix A.

As per TRCA Terrestrial Natural Heritage Strategy, the “target system” in the study area has potential to be enhanced. Target natural heritage areas, “rather than protecting land just for rare species and existing terrestrial natural cover, provides a land base necessary for Species of Concern and other species to recover and to assemble into resilient, evolving natural communities that perform ecosystem services over the long-term” (TRCA, 2007). **Appendix D** contains updated mapping of natural cover and targeted terrestrial cover within the study area and is proposed to be enhanced through stages of detailed design.

Provincially Significant Features

The study area is surrounded by provincially significant features, including wetlands, an Area of Natural and Scientific Interest and an ESA; all of which were identified in the 2008 ESR for Gibraltar Point. **Appendix A** contains mapping that shows the location of provincially significant features in the study area, including the Hanlan Area ESA (#115) which covers 16.7 hectares of southern shoreline from Gibraltar Point to the Toronto Island Airport (full description of species is captured in the 2008 ESR). Other ESA’s in the area surrounding Gibraltar Point include Mugg’s Island ESA (#116), Wildlife Sanctuary ESA (#117), Snake Island ESA #118, and Wards Island ESA (#119).

2.3.3 Aquatic Habitat

The open water and nearshore area of Gibraltar Point and Hanlan’s Beach provide limited habitat due to the exposed nature of the shoreline. Trout Pond, located on the inside of Gibraltar Point where it is sheltered from the cold water input from Lake Ontario, provides critical nursery and juvenile habitat for fishes along the Toronto waterfront. As Gibraltar Point continues to erode this vital habitat is increasingly at risk from cold water intrusion from Lake Ontario.

The present day composition of fish species and habitat found in the study area has not changed substantially since the original 2008 ESR (**Appendix A**). The fish community remains mainly a cold-water fish community in the open coast area while the sheltered embayment of Trout Pond continues to be critical spawning and nursery habitat for fishes that support the Toronto Harbour fish community.

2.3.4 Marine and Terrestrial Archaeology

Marine Archaeology

The marine archaeological assessment (**Appendix D**) covered a length of approximately 600 metres of shoreline and in-water areas. The assessment is comprised of background research and in-water

archaeological assessment extending 250m into Lake Ontario. The field component of the assessment was conducted over a period of several days in September and October of 2016.

Figure 4 shows the location of the area surveyed for the marine archaeology assessment. There were three targets identified as cultural: a wood crib, a ship feature referred to as a hanging knee (identified through a snorkel survey), and an area of three cut pilings. The crib was determined to be of relatively recent vintage and not deemed to have any cultural heritage value or interest. The three cut pilings were believed to be part of an early attempt to stabilize the shoreline in this area and there may be additional pilings located beneath the 20m of armourstone starting at the shoreline and extending lakeward. The three pilings themselves are not deemed to have significant cultural heritage value or interest. The third cultural find is a ship's hanging knee (a form of bracing in boat building). A determination was made that this knee might be from the Jane Ann Marsh of 1868 and that another ship of similar dimensions was shipwrecked in this area. It is a possibility that the remains of the ship may be buried either on land, beneath the armourstone, or buried under lakebed sediments within 100m of where the knee was found during this assessment.



Figure 4. Marine Archaeology Study Area



Figure 5. Location of cultural finds taken from Appendix D, Marine Archaeological Report.

The magnetometer survey identified possible buried ship material beneath the buried lake sediments in the study area. It is also possible that these materials are a result of construction debris or refuse, rather than cultural material, or that buried sediments contain a high degree of ferrous material which caused the magnetometer readings to be so high. The burial of these targets makes it impossible to determine which of the above, or combinations of the above, are valid.

The recommendations of the 2016 marine archaeology study are as follows (**Appendix D**):

- The Marine Archaeological Study Area (MASA) (where magnetometer readings are high) may contain buried cultural material. If development in any of these areas is proposed where bottom sediments will be disturbed (placement of stone would be considered development), these activities would require archaeological monitoring; and if there is to be spoil removed from the area, that the archaeologist observe the spoil for possible cultural materials;
- If cultural materials are located through observation, as detailed in the above recommendation; it is recommended that development activities may be required to be halted to review the material, and any possible exposed material on the lakebed; and to make additional recommendations based on new observations;
- The hanging knee has been transferred to the City of Toronto, Museums and Heritage Services. It is recommended that the hanging knee be retained by the City of Toronto as the possible remnant of the 1868 ship, the Jane Ann Marsh;

- Additional areas are considered clear of any features of significant heritage or cultural interest. It is recommended that those MASA's be considered clear of archaeological concerns, and that no additional archaeological investigations of those areas of the MASA are warranted;
- Compliance regulations must be adhered to in the event that archaeological resources are located during the project development.

Terrestrial Archaeology

Stage 1 and 2 archaeological assessments were triggered by internal TRCA policy outlined in the Archaeology Resource Management Services Guidelines and Procedures (**Appendix E**) in April 2016. Additional review was completed in 2017 (**Appendix E**). No terrestrial archaeological material was recovered during the assessment. As a result, no further terrestrial archaeological assessment of the project area is required.

3 Alternative Concepts Considered for Gibraltar Point

The following section briefly summarizes the alternative concepts assessed for the Gibraltar Point Erosion Control Project Addendum, including the selection of the preferred concept as part of the approved 2008 Class EA.

3.1 The 2008 Preferred Concept

TRCA retained Shoreplan Engineering in 2007 to investigate the coastal processes around Gibraltar Point and assist with the development of alternative long-term solutions (i.e. concepts) to the shoreline erosion problem. The results of the coastal assessment indicated that over the next 100 years, a substantial loss of highly valuable recreational and ecological land is projected, including the potential breaching of the Toronto Islands from Lake Ontario to the Inner Lagoons. Furthermore, a comparison of hydrographic survey data showed a lowering of the lakebed in the nearshore area around Gibraltar Point, consistent with the observed undermining and failure of previous local shoreline protection works to date.

A Community Liaison Committee was formed in order to assist in the development and evaluation of alternative erosion control solutions for Gibraltar Point including public and stakeholder consultation activities (TRCA, 2008). Through a series of meetings where a range of approaches were considered, five alternative options were identified. Three of the five options consisted of offshore protection structures with different lengths of emergent segmented breakwaters connected with submerged sills, in conjunction with different levels of sand management. The fourth option was an emergent breakwater with little to no sand management, while the fifth option would rely exclusively on sand management with no offshore protection.

Based on the outcome of the Class EA process, the preferred alternative concept was determined to be an active sand management approach that recognized the need for some form of offshore structure so

as to make the sand management plan technically and economically feasible. On March 17, 2008 the findings of the Gibraltar Point Erosion Control Project were approved under the Class EA process.

3.2 Additional Detailed Design and Analysis

Following the approval of the 2008 Environmental Study Report, TRCA advanced the detailed design process and completed additional studies for the preferred concept - *'a sand management program, recognizing that some form of offshore structure may be required to make the sand management technically and fiscally responsible'* (ESR 2008). The detailed design process identified an offshore breakwater and groyne as the preferred structural element to support the sand management program. Following selection of the preferred detailed design approach, the offshore breakwater design concept was reviewed with members of the CLC and further analyzed in 2015. Detailed design was halted shortly after consultation as project funding for implementing the design was not secured.

Once funding to undertake the construction of the Gibraltar Point Erosion project was re-instated in 2016, an addendum to the Gibraltar Point EA was required because over five years had passed since EA approval. As part of the addendum process, TRCA retained Baird to complete further analysis and refinement of the preferred concept, including reconfirmation of the design approach. Through this process, innovative refinements to the design were developed to make the erosion control structure more fitting with the natural landscape. The design developed through this process is hereafter called the "revised preferred concept".

3.3 Reconfirmation of the Preferred Concept

The addendum process reconfirms the preferred concept approved as part of the 2008 ESR - a sand management solution recognizing that some form of offshore structure may be required to make the sand management technically and fiscally responsible. Additional studies conducted between 2016 and 2017 reconfirm the preferred design and provide detailed design elements that address the current environmental conditions at Gibraltar Point. The refined preferred concept is described in detail in the following sub-sections, including a description of each of the design elements proposed at Gibraltar point.

3.3.1 Adaptive Sand Management Program

The core component of the preferred concept continues to be an Adaptive Sand Management plan. Adaptive sand management refers to the long-term, strategic placement of sand to replace what has been lost through erosion, replicating the Toronto Islands natural sediment transport and deposition processes that have been altered over the last 100 years. This important element of the refined preferred concept provides ongoing nourishment of Hanlan's Beach and includes a source of sand that must meet the Ministry of Environment and Climate Change guidelines for open water disposal.

Previous studies conducted following the approval of the 2008 ESR recommended placement of approximately 15,000 m³ of sand every 5 years at a location close to the south end of Hanlan's beach

(i.e., immediately north of Hanlan's Point) such that placed sand is distributed naturally to the north along the beach by the action of waves. The source of sand is still to be determined but could be sourced from the existing deposition of sand at the Western Gap Channel or other sand sources as described by Baird (March 16, 2011 Correspondence).

An adaptive sand management approach will account for ongoing changes to existing lake levels. Future lake levels would be one of the key factors defining the impacts to the integrity of Hanlan's Beach and sand dune habitat. Erosion of Hanlan's beach and a loss of sand dune development are expected during periods of higher lake levels. On the other hand, the deposition of sand, and forming of sand dune habitat, is promoted if lower lake level conditions persist for several years. An adaptive sand management scheme based on monitoring is required to balance between nourishment volumes, beach erosion and supply to Hanlan's Beach, and the dune building processes.

3.3.2 Submerged Nearshore Reef

A second core element of the refined preferred concept includes a recommendation for an engineered structure to prevent further erosion at Gibraltar Point. It is estimated that the placement of sand ($D_{50} \geq 0.2$ mm) may be eroded at an approximate rate of 3,000 to 6,000 m³/year, depending on future lake levels (Baird, 2018). Introducing a structural element in the refined preferred design allows for a reduction in the amount of sand that would otherwise be required to protect Gibraltar Point from erosion (about 15,000 m³/5 yrs.) A near shore reef connected to the shoreline at Gibraltar Point (**Figure 6**) is proposed to mitigate shoreline erosion, and provide a large area of enhanced, offshore, aquatic habitat. Much like naturally occurring reef structures, a constructed reef dissipates wave energy and mitigates storm-induced beach erosion by providing a surface for waves to break; it also reduces the impacts associated with high wave heights during a storm event. A submerged stone reef structure also helps to mitigate sand loss and avoids the often undesired visual obstruction of an emerged (out of water) structure such that is seen in traditional breakwater designs.

The crest of the nearshore reef structure will extend to the -1.5 m chart datum (CD) contour and will be approximately 130 m wide at its widest section. Crest elevation would be constant at +0.0 m CD. The average crest width of the proposed reef is approximately 90 m. The lakeward perimeter of the proposed reef will roughly follow the historic shoreline of 1980, as such the proposed reef would roughly occupy the historic land that has been eroded and lost from Gibraltar Point since 1980. The perimeter of the proposed reef will have an approximately 1:5 slope and be built with large stones to protect it against incoming waves. The size of stone placed inshore of the perimeter of the reef structure, decreases as one moves closer to the shoreline, providing a gradient of stone sizing that mimics natural reef conditions. Using the bathymetry from 2017, the proposed nearshore reef covers an area of approximately 37,000 m² requiring approximately 35,000 m³ of stone (65,000 to 70,000 tonnes of stone). An additional 10,000 m³ to 15,000 m³ of sand will then be used to nourish the beach once the nearshore reef is in place.

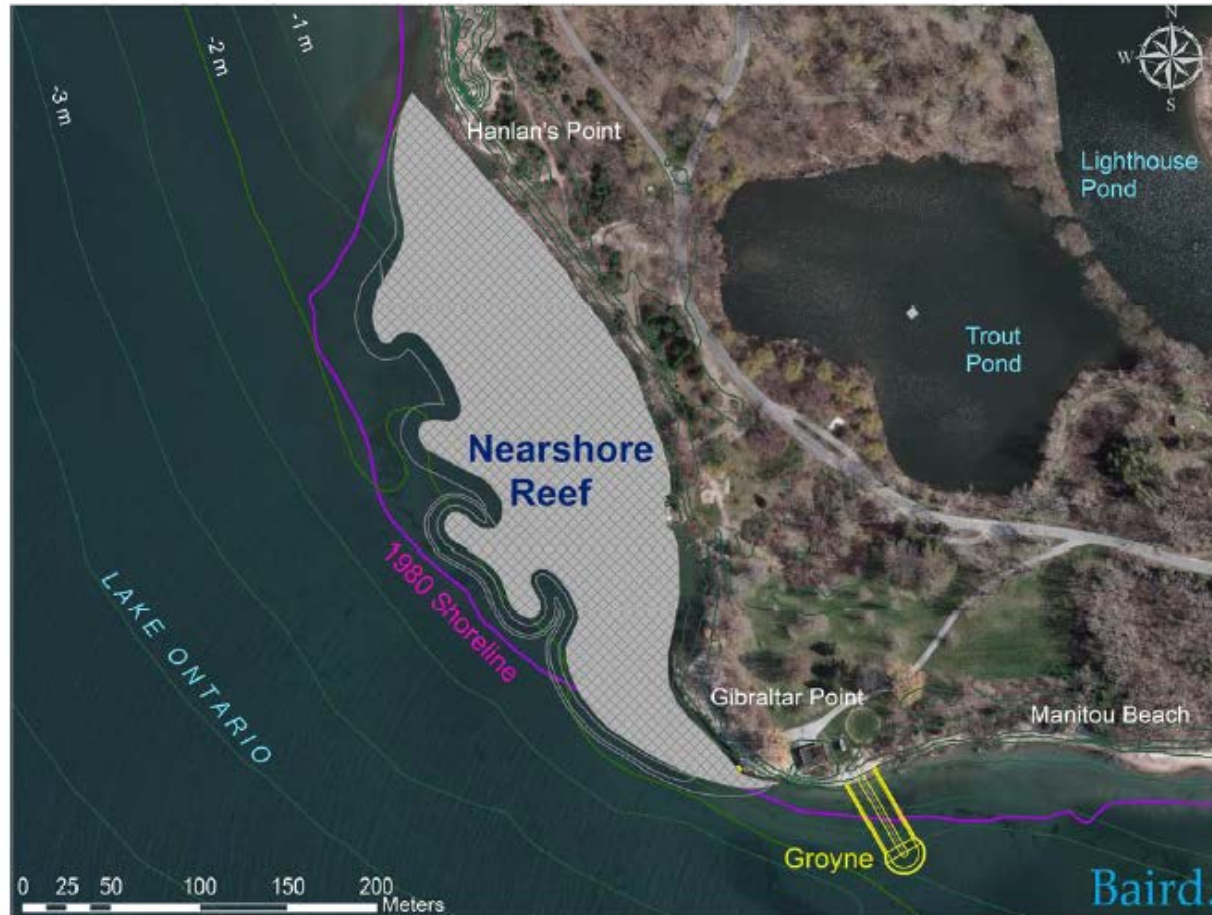


Figure 6. Nearshore Reef and Groyne Concept

3.3.3 Beach Restoration

Given the length of time that has passed since the large storm in 2004 and the Class EA approvals in 2008, the revised preferred concept includes a proposed beach restoration component. Plantings and additional landscape features are proposed at detailed design in order to support the structural element of the submerged nearshore reef.

The beach restoration plan is designed using existing sand dune habitats found on the Toronto Islands as a template and will include improvements to existing dune habitat through the planting of native vegetation. Therefore, the beach restoration plan will also provide added erosion control protection (**Figure 7**).

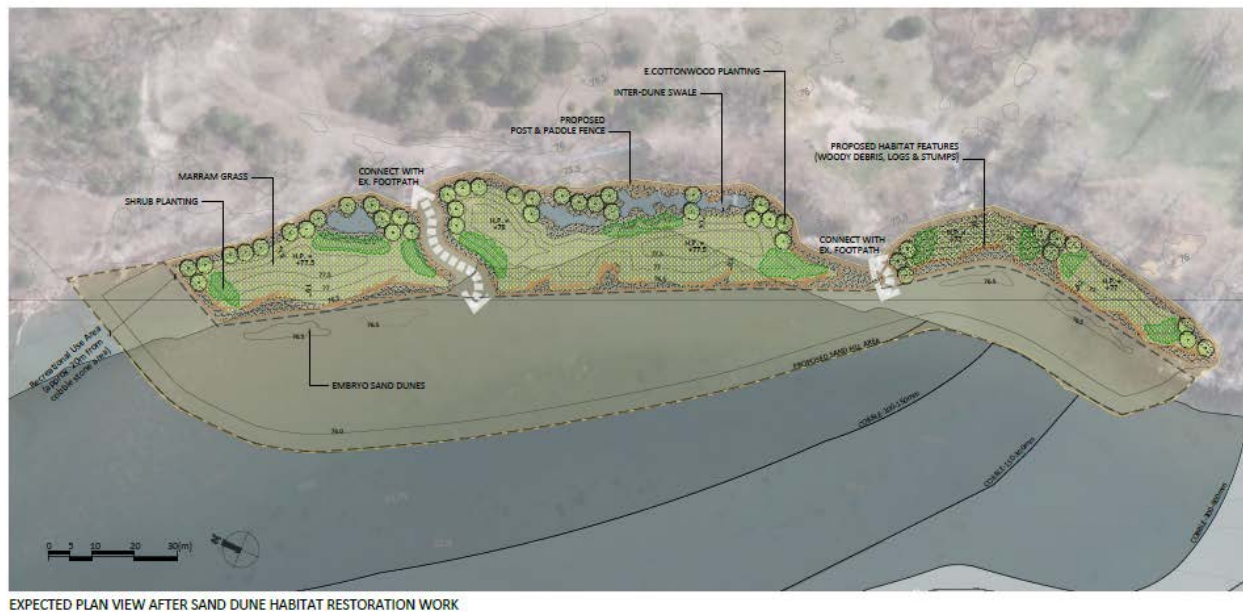


Figure 7. Beach Restoration Concept for Gibraltar Point

3.3.4 Groyne Structure

Erosion of Gibraltar Point has a direct impact on Manitou Beach located east of Gibraltar Point. The Manitou Beach shoreline (west end) is exposed to waves from both easterly and southwesterly storm events. As a result, sand typically moves back and forth along this shoreline under alternating incoming wave directions. Construction of a 50 m long groyne will reduce sand loss at the west end of Manitou Beach and extend out from the shoreline immediately east of Gibraltar Point. A groyne is thus proposed to be constructed as shown in **Figure 6** to reduce sand loss at the west end of Manitou Beach. The proposed groyne will extend out from the shoreline to -1.5 m CD and will be about 50 m long. The proposed groyne will be constructed from armour stone and core stone material with its crest elevation at about +2.5 m CD (approximately the same elevation as the ground around the washroom building shown on the study area map).

4 Environmental Implications of the Revised Preferred Concept

In order to determine the environmental implications of revised preferred concept, a comparative analysis was completed (**Table 1**). Additional studies completed in 2017, examined in greater detail the preferred concept for erosion protection at Gibraltar Point and additional mitigation measures required to implement a nearshore reef structure, a groyne and an adaptive sand management plan. The evaluation of impacts shown in **Table 1**, included both temporary impacts during construction of the undertaking and permanent impacts due to operation and maintenance of the undertaking after construction is complete. Consultation with interested persons was sought during the 2008 Class EA

process and the 2017 Addendum process when identifying and analyzing impacts associated with the revised preferred concept.

The comparative analysis of impacts (**Table 1**) considers the magnitude, geographic extent, duration, frequency, permanence or reversibility and ecological context of the effects, as well as proposed mitigation measures and any residual effects.

For the majority of the evaluation criteria, there is no change in the overall evaluation results as compared with the original Class EA in 2008. However, for those few criteria where discrepancies were noticed, a summary of those changes are outlined in **Table 1** and described below. In summary, a comparison of the analysis completed as part of the 2008 ESR and analysis of the proposed Addendum to the preferred concept, demonstrates an overall improvement in the revised concept for erosion protection at Gibraltar Point. The letter “O” is used to mark the analysis completed in 2008 as part of the EA process and the letter “**X**” in bold, is used to mark the analysis of refinements to the preferred concept as part of the Addendum process.

Table 1. Detailed Environmental Analysis of the Revised Preferred Concept

Screening Criteria	Rating of Potential Effects								
	-H	-M	-L	NIL	+L	+M	+H	NA	Comments
PHYSICAL									
Unique Landforms							X O		Proposed shoreline stabilization and sand management program will preserve the Gibraltar Point shoreline and adjacent beaches/dunes. The proposed revised concept developed as part of the addendum process provides a slightly greater benefit because of the unique nearshore reef and increased habitat in the form of proposed sand dune habitats.
Existing Mineral/Aggregate Resource Extraction Industries								X O	
Earth Science – Areas of Natural and Scientific Interest								X O	
Specialty Crop Areas								X O	
Agricultural Lands or Production								X O	
Niagara Escarpment								X O	
Oak Ridges Moraine								X O	
Environmentally Sensitive/Significant Areas (physical)							X	O	Refinements made to the preferred alternative include a softer engineered approach (i.e. nearshore reef) and placement of sand provides erosion protection and overall benefit to existing sensitive areas over time in contrast to an offshore breakwater that was a hard engineered solution that did not enhance fish habitat.
Air Quality				X O					Mitigative measures will be taken to minimize impacts of equipment use during construction and operation.
Agricultural Tile or Surface Drains								X O	
Noise Levels and Vibration				X O					Mitigative measures will be taken to minimize impacts of equipment use during construction and operation.
High/Storm Water Flow Regime				X O					Design considers effect of extreme lake level, storm influences, and wave conditions.
Low/Base Water Flow Regime				X O					Design considers low lake levels.
Existing Surface Drainage and Groundwater Seepage				X O					
Groundwater Recharge/Discharge Zone				X O					
Littoral Drift						O	X		Protection will reduce transport of sediment into Western Gap.

Screening Criteria	Rating of Potential Effects								
	-H	-M	-L	NIL	+L	+M	+H	NA	Comments
Other Coastal Processes				X O					
Water Quality				X O					Mitigative measures will be in place during construction to protect water quality.
Soil/Fill Quality				X O					Only clean aggregates and/or rubble will be used in construction.
Contaminated Soils/Sediment/Seeps								X O	
Existing Transportation Routes			X	O					Materials will be transported both by water and over land. Every effort will be made to ensure transportation of materials does not adversely affect the road usage by others.
Constructed Crossings (i.e. bikes, culverts)								X O	
Geomorphology								X O	
Other									
BIOLOGICAL									
Wildlife Habitat						O	X		Proposed shoreline stabilization and sand management program will preserve terrestrial habitat currently threatened by erosion.
Habitat Linkages or Corridors				X O					
Significant Vegetation Communities							X+ O		Proposed shoreline stabilization and sand management program will preserve unique vegetation communities currently being lost to erosion. Not only will the refined concept preserve existing terrestrial habitats, it provides significant opportunities to increase and reestablish functional shoreline habitats, due to the existence of the nearshore reef, that have been lost over time.
Environmentally Sensitive/ Significant Areas (biological)						O	X		Proposed shoreline stabilization and sand management program will preserve terrestrial habitat currently threatened by erosion.
Fish Habitat					O		X		Project will improve nearshore habitat conditions for local fisheries as well as protect Trout Pond, an important source of juvenile fish along the Toronto Waterfront.
Species of Concern						O X			
Exotic Alien and Invasive Species				X O					
Wildlife/Bird Migration Patterns					X O				The proposed groyne structure still provides landing location for migratory bird species.
Wildlife Population					O		X		Sand dune habitat restoration and proposed nearshore reef provides significant increase in wildlife habitat and future populations of fish and terrestrial species on the Toronto Islands.

Screening Criteria	Rating of Potential Effects								
	-H	-M	-L	NIL	+L	+M	+H	NA	Comments
Wetlands				X O					
Microclimate				X O					
Life Science Area of Natural and Scientific Interest							X O		Revised preferred alternative will protect areas of the Area of Natural and Scientific Interest currently being lost to erosion.
Unique Habitats							X O		Revised preferred alternative will preserve unique habitats currently being lost to erosion. The 2017 option provides a slightly greater benefit then what was proposed in 2008.
Other									
CULTURAL									
Traditional Land Use				X O					
Aboriginal Reserve or Community								X O	
Outstanding Native Land Claim				X O					
Transboundary Water Management Issues								X O	
Riparian Uses						X O			Prevents further loss of sand beach amenity.
Recreational/Tourist Uses of Water Body and/or Adjacent Land							X O		Prevents further loss of sand beach amenity and provides a greater area of shallow recreational water therefore reducing the potential for conflict with a larger range of water craft vessels.
Recreational/Tourist Uses of Existing Shoreline Access							X O		Prevents further loss of sand beach amenity.
Aesthetic or Scenic Landscape or Views					X O				Proposed reef feature will not obstruct lake views. Groyne may have a minimal impact.
Culturally Significant Resources			X		O				Although the proposed reef and groyne will protect existing infrastructure such as the historic Gibraltar Point Lighthouse, metal sounding readings observed in the marine archaeological report survey were found at the location of the external perimeter of the proposed nearshore reef. In contrast to the 2008 concept, additional archaeological survey and potential mitigation measures are required during the permit process to address these anomalous soundings.
Historic Canals								X O	
Federal Property								X O	
Heritage River System								X O	

Screening Criteria	Rating of Potential Effects								
	-H	-M	-L	NIL	+L	+M	+H	NA	Comments
Other									
SOCIOECONOMIC									
Surrounding Neighbourhood or Community					X O				
Surrounding Land Uses or Growth Pressure					X O				
Existing Infrastructure, Support Services, Facilities							X O		Protects existing infrastructure and services.
Pedestrian Traffic Routes					X O				Materials will be transported both by water and over land. Every effort will be made to ensure transportation of materials does not adversely affect the road usage by others, and any impact will be of a temporary nature only.
Property Values or Ownership					O		X		In contrast to the 2008 ESR, the 2017 addendum revised concept is entirely on City owned property instead of expanding into undifferentiated Crown Lands.
Existing Tourism Operations					O X				
Property/Farm Accessibility								X O	
Other									
ENGINEERING/TECHNICAL									
Rate of Erosion in Ecosystem						X	O		The refined concept is slightly more vulnerable to shoreline erosion during high lake levels and high winds, however, the minor increase in vulnerability to erosion is offset by a significant ecological enhancement to reef and shoreline features in the revised preferred alternative. The adaptive sand management will ensure that shoreline loss is limited.
Sediment Deposition Zones in Ecosystem							X O		Strives to achieve a balance between natural erosion and deposition through protection and sand management.
Flood Risk in Ecosystem				X O					
Slope Stability								X O	
Existing Structures							X O		
Hazardous Lands								X O	
Hazardous Sites								X O	
Other Engineering Projects at this Location								X O	

Note: Screening of potential effects as negative (-), neutral (NIL), or positive (+) and rating them as relatively high (H), medium (M), low (L) or not applicable (NA) (Conservation Ontario, 2002) Implementation of the Revised Preferred Concept. The letter “O” is used to mark the analysis completed in 2008 as part of the EA process and the letter “**X**” in bold is used to mark the analysis of refinements to the preferred concept as part of the Addendum process.

4.1 Detailed Summary of the Evaluation Results Table

The evaluation of environmental and socio-economic impacts between the 2008 preferred concept and the revised preferred concept demonstrate an overall improvement in the Gibraltar Point Erosion Control Project. The Adaptive Sand Management Plan with engineered structures therefore remains the Preferred Concept, as suggested in the 2008 Class EA, however, the refinements provided by undertaking the EA Addendum have improved the evaluation of habitat, erosion control and socio-economic conditions summarized below.

The revised preferred concept offers an overall benefit from what was proposed in the 2008 ESR and is based on affirmed conditions at Gibraltar Point and in the surrounding area. The proposed groyne structure, will be constructed to have a smaller footprint than what was proposed as part of the 2008 preferred concept. A beach restoration plan is a refinement proposed during detailed design and will improve recreational space, amenities, tourism and overall socio-economic benefits for the Toronto Islands.

Physical and Biological Conditions

The proposed shoreline stabilization and sand management program will significantly preserve the Gibraltar Point shoreline and adjacent beaches. The proposed revised concept provides a slightly greater benefit because of the unique nearshore reef habitat for aquatic species and increase in unique habitat (sand dunes for terrestrial species).

The proposed nearshore reef structure offers a significant ecological and visual benefit while offering erosion protection at Gibraltar Point. The spur and groove design creates fish habitat desirable for the area and the nearshore reef structure is entirely underwater, providing a visual benefit when compared to other traditional offshore engineered structures presented in the 2008 ESR. The revised preferred concept provides significantly more aquatic habitat and shoreline enhancement when compared to the 2008 design concept. The proposed groyne structure still provides a landing location for migratory bird species.

Mitigative measures will be taken to minimize impacts of equipment used during construction and operation to further protect the area. The refined concept also considers the ongoing effects of extreme lake level changes (high and low), and storm influences.

Cultural and Socio-economic Conditions

Although the proposed reef and groyne will protect existing infrastructure such as the historic Gibraltar Point Lighthouse, metal sounding readings observed in the marine archaeological report survey were found at the location of the external perimeter of the proposed nearshore reef. Additional archaeological survey and potential mitigation measures are required during the permit process to address these anomalous soundings.

Impacts associated with navigation will be addressed at the stages of detailed design with the inclusion of navigational markers in the area of the nearshore reef, particularly where reef structures are less than 2 m below the lowest water level (ESR, 2008, pp. 81). Analysis of the nearshore reef structure (Baird, 2018) also illustrates how lessened impacts from wave action will reduce the rate of erosion at Gibraltar point and an overall reduction in loss of sand dune habitat over time, protecting significant socio-economic features like the Gibraltar Point Light House and nearby beach amenities. During construction, materials will be transported both by water and over land and effort will be made to ensure transportation of materials does not adversely affect the road usage and use of the Islands by scheduling construction during the off-peak tourism season. In contrast to the 2008 ESR, the 2017 addendum revised concept is entirely on City owned property instead of expanding into undifferentiated Crown Lands.

Through the detailed preliminary design process, it was determined that the nearshore reef with groyne offered an overall improvement to the erosion and provision of public amenities and recreational opportunities, as compared to the original offshore breakwater and groyne concepts suggested in the Class EA and initial preliminary concept refinement process. In the event of high lake levels and high winds, the refined concept is slightly more vulnerable to shoreline erosion, however, the minor increase in vulnerability to erosion is offset by a significant enhancement to ecological reef and shoreline feature presented in the revised preferred concept. The adaptive sand management plan will also ensure that shoreline loss is limited.

4.2 Construction and Approvals

Following a Notice of Filing and Notice of Completion of the Addendum report, circulation of the report to stakeholders, Conservation Ontario, and the MOECC and approval, the TRCA and the City of Toronto will proceed with the detailed design and implementation phase of the project.

After the TRCA has received all necessary approvals, construction activities will proceed in two phases – marine based construction to form the outer reef structure, and land based construction, including temporary stockpiling and storage piles, adaptive sand management, the beach restoration plan, plantings and shoreline protection works. A significant amount of collaboration and communication between TRCA, Toronto Island residents, Ports Toronto, City of Toronto and members of the community will continue in order to ensure that the construction activities and monitoring program are carried out in an efficient, unobtrusive manner.

4.3 Monitoring and Maintenance

Each element of the revised preferred concept will follow a monitoring and maintenance plan outlined in the 2008 ESR. The nearshore reef, and groyne, will be monitored to ensure they are functioning as intended.

4.3.1 Turbidity and Fish Monitoring

To ensure that construction has no adverse effects on water quality, a turbidity monitoring program will be undertaken prior to, during, and post, construction to monitor and mitigate suspended sediments and ensure that the values recorded do not exceed the recognized National Environmental Quality Standards. Standards and monitoring program details for fish and turbidity are outlined in **Appendix A** (2008, ESR, pp. 89-93). Detailed requirements on turbidity monitoring and fish management will be adapted to the requirements of Fisheries and Oceans Canada permitting the construction of the project and additional regulatory requirements.

5 Conclusion

The revised preferred concept offers an overall benefit for protecting Gibraltar Point from ongoing erosion while providing a significant benefit for natural and socio-economic conditions when compared to the 2008 ESR, and is based on affirmed conditions at Gibraltar Point and in the surrounding area.

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