

# Canadian Great Lakes Coastal Resilience Framework

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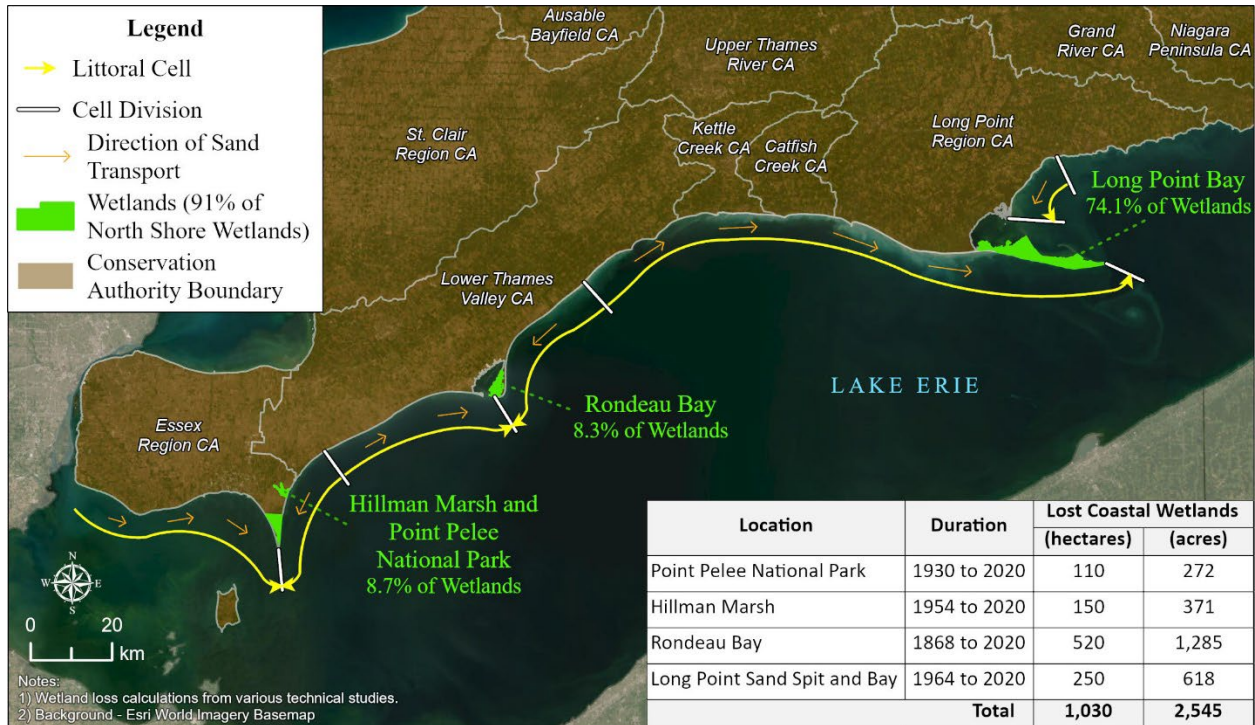
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## Lake Erie North Shore Littoral Cells, Barrier Protected Wetlands, and Wetland Loss



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## THINK TANK MEMBERS

There were a series of Canadian Great Lakes Coastal Resilience Think Tank meetings held from the fall of 2022 to the spring of 2023. Many individuals participated in an expert capacity and the views expressed are not necessarily those of their agency. We are grateful for their thoughtful insights on the Framework development. We acknowledge the following participants as of March 31, 2023:

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## 1.0 INTRODUCTION

The coastal area of the Great Lakes is a complex, dynamic, and interconnected physical, ecological, social, and economic system. Multiple land uses, benefits, and management actions intersect in coastal areas, including residential development, protected areas, economic zones, commercial navigation, recreational pursuits, tourism activities, energy production, land use planning, biodiversity and geodiversity protection, water quality management, and erosion and flood mitigation. No

single entity has an overarching responsibility for governance of the coastal area. Municipal, regional, provincial, and federal jurisdictions have mandates directed to specific sectors. Within this complex governance and land ownership environment, uncoordinated processes have yielded solutions

that can be piecemeal, fragmented, disconnected/disjointed, and counteracting (Zuzek Inc., 2023). Overall, coastal resilience is threatened and decreasing. For example, development continues on hazardous lands, infrastructure is threatened by high lake levels and erosion, extensive shoreline hardening is occurring which disrupts natural processes in littoral cells, and protected spaces, species, habitats, biodiversity and geodiversity are all declining.



An integrated, strategic approach to address these disparate issues together in a coordinated process of decision-making could serve to enhance coastal resilience in the Great Lakes. This report presents a draft Canadian Great Lakes Coastal Resilience Framework (herein referred to as the ‘Resilience Framework’) to 1) create awareness, develop support to manage the coast differently within relevant jurisdictions and at appropriate scales, 2) establish functional and enabling governance structures, then subsequently 3) apply the Resilience Framework which includes engagement and assessment, plan develop, action, and evaluation of outcomes.

The draft Resilience Framework was designed to address current challenges (e.g., development on hazardous lands and degraded coastal ecosystem), and coastal hazards associated with higher and lower lake level extremes, reductions in winter ice cover, and accelerated erosion rates due to climate change. It aims to foster an “all of society approach” where a coordinated coastal governance process enhances coastal planning and management. Mechanisms to work together across jurisdictions, scales (whole lake and regional), and interests are crucial to the success of the Resilience Framework. It will require a high degree of engagement, communication and collaboration between jurisdictions and stakeholders to co-develop solutions respectfully and integrate the full spectrum of physical, social, ecological, and economic aspects of coastal communities.



Development of the Resilience Framework was a collaborative effort led by a Consulting Team under contract to Environment and Climate Change Canada and supported by a Coastal Resilience Think Tank comprised of experts drawn from government and non-government organizations, academia, and industry. Content for the Resilience Framework report was developed by addressing key questions such as, 1) What is a common understanding and shared vision, 2) Who needs to be involved and what are others doing, 3) What are the mutually reinforcing activities, and 4) What is needed in a Coastal Resilience Framework and how do we measure success (see process diagram in Appendix A).

The Resilience Framework was designed to address resilience issues across the coastal areas of the Canadian Great Lakes. The initial development and piloting were focused on the Lake Erie coastal area. In the future, the Resilience Framework and the lessons-learned can be applied to the other coastal areas of the Canadian Great Lakes.

## 1.1 Coastal Resilience Defined

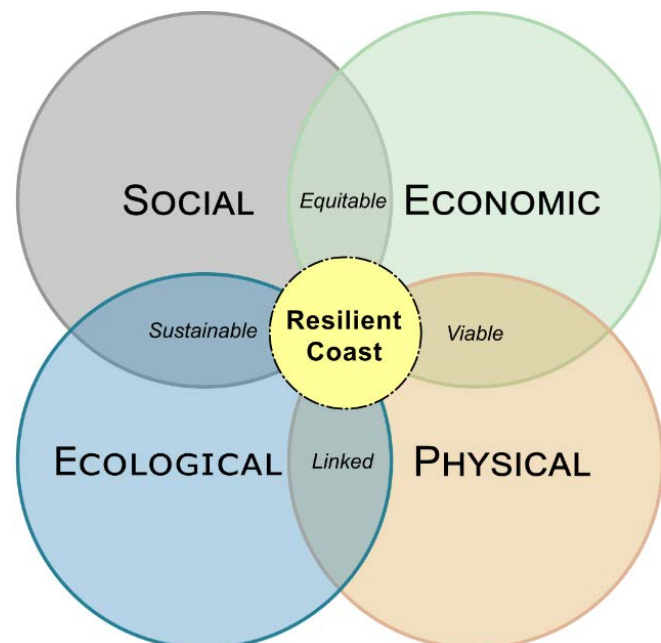
The Resilience Framework strives to build resilience for coastal communities and ecosystems to climate-induced changes (increased water level variability, increased intensity of storms, reductions in ice-cover), species loss, invasive species, development pressure, new and emerging threats.

The Think Tank definition for coastal resilience, which recognizes the inter-related nature of the social, economic, ecological, and physical systems in the coastal areas of the Great Lakes, is as follows:

[Coastal] Resilience is the capacity of social, economic, ecological, and physical systems in coastal areas to cope with a hazardous event, trend, or disturbance, responding and reorganizing in ways that maintain their essential function, identity, and structure, while also building capacity for learning, innovative and equitable adaptation, and transformation.

A resilient coastal area features a healthy coastal environment that protects against natural hazards, the impacts of climate change, and strives to maintain dynamic coastal processes.

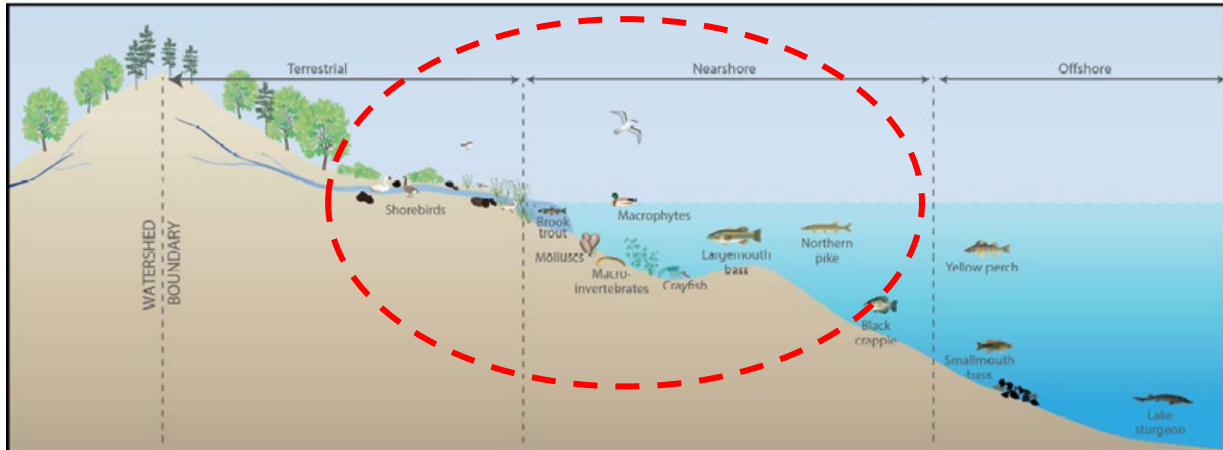
*[Footnote: This definition builds on the Intergovernmental Panel on Climate Change (IPCC) (2018) and the Arctic Council (2013).]*





## 1.2 Coastal Areas of the Great Lakes

The coastal area in the Resilience Framework integrates the nearshore of the lake (interaction of wave energy and shoreline processes with the lake bottom and sediments), the land-water interface, and the upstream influence of lake level fluctuations and storms in creeks and rivers, as depicted in Figure 1.1.



**Figure 1.1 Cross-section of the coastal area highlighted with red oval**

This coastal area definition, presented in plan view in Figure 1.2, is consistent with the spatial extent of the Nearshore Framework regional units (ECCC, 2022a). The offshore boundary is the 15 m depth contour in Lake Erie, for example. Given the shallow depths at the western end of Lake Erie, then entire Canadian portion of the western basin is a regional unit for the Nearshore Framework and thus part of the coastal area. However, given this spatial definition, the Resilience Framework also recognizes the zone of influence (e.g., upper watershed) might extend beyond the zone of impact in coastal areas. Therefore, the intent of the coastal area boundary is to focus solutions on coastal resilience but not necessarily limit actions and adaptations to this region.



**Figure 1.2 Lake Erie north shore coastal area**





### 1.3 Scale of the Resilience Framework

Scale is a critical organizing component of the Resilience Framework and influences two management aspects, namely lake-wide governance support and resilience planning at the littoral cell scale.

Focusing on lake-wide governance provides an overarching perspective and integrates the social, economic, ecological and physical challenges of each Great Lake. At this scale, broad coordination and priority setting can occur by a new entity such as a resilience council or a committee or working group linked to the Canada-Ontario Agreement.

At the regional scale, littoral cells represent an innovative, systems-based approach to assessing and addressing complex coastal challenges. Much like the watershed concept, which defines the boundary for water delivery and flow in local tributaries, a littoral cell defines all sources of sand and gravel, transport pathways, and depositional areas crucial to maintaining coastal landforms such as beaches and barrier beaches. These processes and landforms are collectively known as geodiversity (Crofts et al, 2020) and protecting them is referred to as geoconservation. Linking the key coastal processes across the nearshore, land-water interface and tributaries in littoral cells provides the appropriate physical context investigate environmental, social, and economic issues in an integrated manner. This holistic systems-scale approach provides the foundation to advance coastal resilience planning. The littoral cells are nested within the overarching lake-scale governance as highlighted in Figure 1.3.



Figure 1.3 Nested littoral cell resilience plans



## 2.0 INTERNATIONAL BEST PRACTICE

Coastal jurisdictions around the world are responding to the reality and urgency of the current and projected impacts of climate change. They are doing so by developing and implementing resilience frameworks and/or strategies for their vulnerable and threatened coastal areas. An international literature review identified at least 20 extant examples from around the world at the national level (e.g., USA, England, Denmark, China, Australia, New Zealand, Canada), regional scale (e.g., European Union, East Asia, Caribbean), and for sub-national entities (e.g., U.S. states, Tasmania, Prince Edward Island (PEI)). It is important to note, however, that many of these resilience strategies are still in their early stages of development and are yet to be fully implemented, thus we have limited empirical evidence of results to date.

Nevertheless, the emerging state-of-the-art in coastal resilience thinking is centered on a set of common principles and practical guidance approaches which are drawn from well-developed bodies of literature in integrated coastal zone management (ICZM), climate change adaptation (CCA), socio-technical and socio-ecological systems (STS/SES), disaster risk reduction (DRR), and ecosystem-based adaptation (EbA).

These principles and the guidance advice are bolstered by recent and renewed global commitments for adaptation and resilience building including: The United Nations Sustainable Development Goals (SDGs), depicted graphically in Figure 2.1 (particularly SDG 13 – take urgent action to combat climate change and its impacts)<sup>1</sup>; the COP 27 Sharm-El Sheik Adaptation Agenda<sup>2</sup>; the Kunming-Montreal Global Biodiversity Framework<sup>3</sup>; the Decade of Ecosystem Restoration<sup>4</sup>; and the Sendai Framework for Disaster-Risk-Reduction<sup>5</sup>.



Figure 2.1 UN Sustainable Development Goals

<sup>1</sup> <https://sdgs.un.org/goals>

<sup>2</sup> [https://climatechampions.unfccc.int/wp-content/uploads/2022/11/SeS-Adaptation-Agenda-Complete-Report-COP27\\_FINAL-1.pdf](https://climatechampions.unfccc.int/wp-content/uploads/2022/11/SeS-Adaptation-Agenda-Complete-Report-COP27_FINAL-1.pdf)

<sup>3</sup> <https://www.cbd.int/gbf/>

<sup>4</sup> <https://www.decadeonrestoration.org>

<sup>5</sup> <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>



Yet the transformation of coastal resilience thinking and practice must overcome several inherent barriers and challenges for coastal governance to be successful. These include fragmentation in the policy landscape, unclear division of responsibilities in coastal areas, a deficit in communication between science and policymaking, the mismatch between the local scale of coastal governance and the complex multi-scale nature of coastal systems, and power asymmetries among stakeholders. It is also noted that adaptation initiatives are often fragmented, small in scale, incremental, sector-specific, and with a near-term focus. Incremental changes to gradually adapt to the different climate hazards and recover essential functions within society is no longer sufficient; societies need to rapidly accelerate action creating what the IPCC calls transformative solutions and building climate resilient development through a more holistic approach.

In response to these challenges, frameworks and strategies for building and realizing coastal resilience – both as a process and a desired outcome – are commonly organized along the following categories:

### **Systems thinking:**

- Coastal areas must be understood as integrated land-water, physical-social-ecological-economic systems and should be planned and managed holistically as such.
- The land-water interface is the center, not the dividing point, of defining the coastal area to be governed.
- Resilience also means more than infrastructure — it means building adaptive models of management in which agencies across government collaborate on people-centered solutions.
- Resilience frameworks need to be flexible enough to address both chronic and acute hazards.
- To prepare for a climate-resilient future, it is important to create resilient coastal areas by stimulating societal transformation towards a resilient society.
- Overall, preserving the health of coastal ecosystem services makes coastal areas more resilient to natural hazards, and should therefore be a point of focus.

### **Transformative governance:**

- Transformative governance is governance that spans multiple levels and transcends institutional boundaries. It includes legislation, policies, institutions, investments, and programs.
- Many coastal resilience frameworks and strategies are based on a ‘whole-of-government’ approach, transcending jurisdictional and policy divides and incompatibilities.
- More recent thinking calls for a ‘whole-of-society’ approach, wherein all sectors of society – all levels of government, Indigenous organizations and communities, land/property holders, stakeholders with expertise on the local context, research groups/organizations, civil society, and NGOs are all working together as integral and coordinated parts of the process.



- Build an inclusive team and establish an integrated planning & management body (Coordination Group or Council).
- Broad, diverse, meaningful, and respectful stakeholder participation is centrally important and should not be neglected when taking measures to increase coastal resilience. Specifically, the timing of stakeholder engagement and the way in which this is done, are crucial to its success. Technical assistance and capacity building on engagement may be required.
- Underlying risk factors such as gender, ethnicity, or land ownership also come into play and should be considered when pursuing equitable adaptive measures.
- Having a ‘single official voice’ or ‘local champion’ that engages with the public in face-to-face dialogue, listens and keeps them informed of decisions made, builds confidence and trust in the process, and increases the likelihood of policy acceptance is critical for resilience planning.
- Preserving the health of coastal ecosystem services makes coastal areas more resilient to natural hazards, and should therefore be a point of focus within Integrated Coastal Zone Governance.

For additional background on other coastal resilience frameworks and strategies refer to the summaries in Appendix B.



## 3.0 LEGISLATION AND POLICY REVIEW

An important input to Resilience Framework development was a scan of the coastal governance “ecosystem”. The purpose was to develop a “base case” of the “tools” that are currently available for coastal planning and management in the Great Lakes. Think Tank members were asked to identify key “tools” (legislation, policy, programs, strategies, agreements, etc.) that align with their mandate(s) and could be brought to bear within the Resilience Framework to address coastal resilience. Associated with the “tool” were a number of attributes, including: 1) Component addressed in an integrated coastal planning and management approach; 2) Scale (of jurisdiction); and 3) Activity or Outcome promoted by this tool.

### 3.1 Results

The results presented are not comprehensive across all sectors involved in coastal management but reflect the composition of the Think Tank. Yet, insights emerged that inform the design of the Resilience Framework, resilience thinking, and next steps. Additional details are provided as summary tables in Appendix C.

Members collaborated and organized into nine groups reflecting agency affiliation and submitted 88 “tools” (Figure 4.1). Legislation (n=28) and program (n=19) “tools” dominate while policy, agreements, strategy, and priority were equally well represented (see Appendix C).

An important consideration was scale – what was the jurisdiction and/or scope of influence – reflected in nine levels including bi-national (e.g., Great Lakes Water Quality Agreement), federal (e.g., Species at Risk Act), provincial (e.g., Great Lakes Protection Act), Conservation Authority (e.g., Conservation Authorities Act), Municipal (e.g., Voluntary Natural Asset Accounting Guidance), and other (e.g., Great Lakes Guardian Council). Federal, Provincial and Binational tools dominated (see Figure 4.1 and Appendix C) while there were no tools identified at the First Nation, regional or site scale (due to Think Tank membership). The gaps at the regional- and local-scale could be addressed with future littoral cell engagement on the Resilience Framework. The results also indicate that future steps are required on engagement with Indigenous communities that acknowledge their unique perspectives, insights, and Traditional Knowledge for developing resilience plans. Also, there is a need to consult with the business community (e.g., marinas, shipping, industry).

Fifteen components were identified as important factors to integrate into coastal planning and management processes to increase coastal resilience (see Table 3.1 and info graphic in Appendix C). Notably, the dominant components: species and habitats (n=29), land use planning and regulation (n=13), and coastal stewardship (n=9) reflect current priorities and to some degree the membership composition of the Think Tank. In this limited survey, emerging issues such as social justice, equity and mental health as well as economics and livelihoods and private infrastructure currently had limited or no reported role in the coastal planning and management “base case.” However, these components may be of particular importance to local landowners and stakeholders, and could be captured with further engagement on the Resilience Framework development.



**Figure 3.1 Think Tank members' listing of "tools" currently used for coastal planning and management in the Great Lakes (n=88)**



**Table 3.1 Components in an integrated coastal planning and management approach for resilience**

COMPONENT IN INTEGRATED COASTAL PLANNING AND MANAGEMENT	TOTAL (N=88)
Coastal stewardship	9
Coastal processes and geodiversity	3
Coastal hazards	2
Species and habitats	29
Biodiversity	5
Invasive species	4
Nearshore water quality and sediments	5
Land use planning and regulation	13
Economics and livelihoods	1
Social justice, equity and mental health	0
Infrastructure, Public	8
Infrastructure, Private	0
Recreation and tourism	4
Navigation	0
Climate change	5

Each “tool” was assessed for the key (primary) and secondary activity, action, or outcome for its application from 13 activities. Refer to Table 3.2. Dominant key activities were conservation and protection, regulating, and planning which align with the prevalent components identified in the current coastal planning and management process. In the assessment of secondary activities, actions or outcomes, there was a more balanced, diverse selection, and included monitoring, planning, assessment, and outreach and communication although conservation and protection still emerged as dominant. There was limited consideration of funding, research, review, securing land and adaptation in both key and secondary selections.

**Table 3.2 Key and secondary activity, action or outcome from application of a tools**

Activity in shoreline planning and management	KEY N=79	SECONDARY N=73
Regulating	16	6
Planning	11	10
Assessment	5	10
Monitoring	7	14
Research	2	1
Outreach and communication	2	10
Policy development	6	1
Review	0	2
Coordinating	2	5
Funding	3	0
Securing land	0	1
Conservation and protection	24	11
Engineering (Adaptation)	1	2



## **4.0 RATIONALE FOR THE COASTAL RESILIENCE FRAMEWORK**

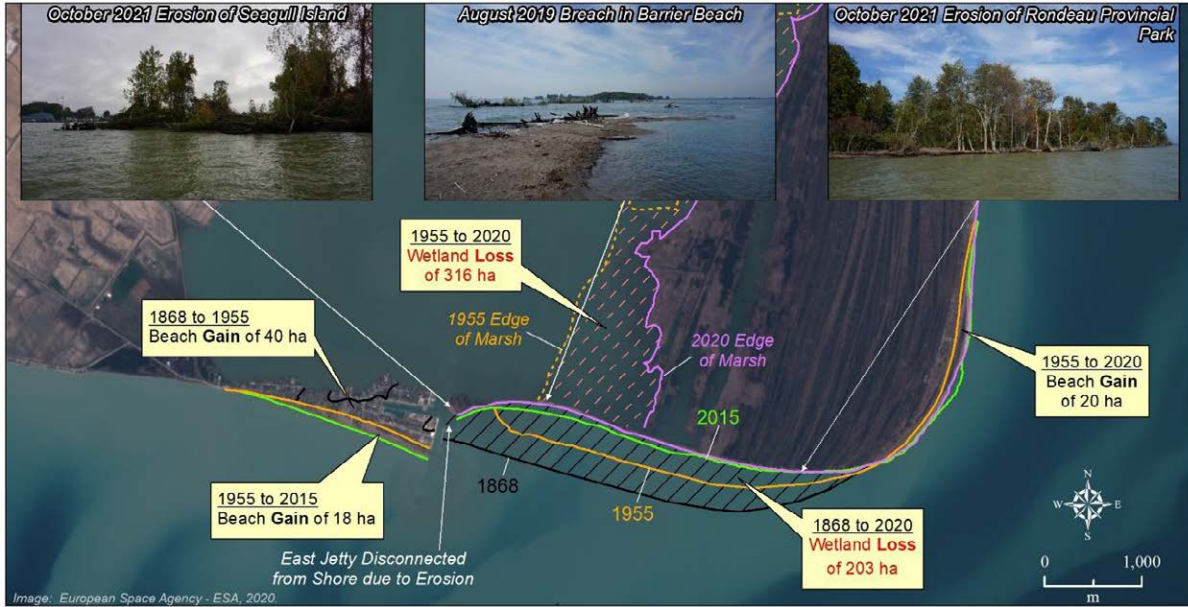
Section 2.0 outlined the need, benefits, and approaches to address coastal resilience in other jurisdictions, while Section 3.0 summarized existing legislation and policy that influences the management of the Canadian Great Lakes. This section builds on this to present the rationale for the Resilience Framework in the Great Lakes, using the north shore of Lake Erie as a proof of concept. First, some current ecological health and resilience issues are summarized to provide context. Next, two divergent scenarios: Business-as-Usual and Pathway-to-Coastal-Resilience are used to contrast the coastal resilience context and associated risks and vulnerabilities that may emerge under different policy directions. Under the Business-as-Usual scenario context, governance, planning, and management carries on without addressing resilience needs. The Pathway-to-Coastal-Resilience scenario represents a solution that highlights some of the benefits of implementing the Resilience Framework to address current hazards/threats and the emerging impacts of a changing climate.

### **4.1 Ecological Health and Resilience of Lake Erie Coastal Areas**

In the latest report on the State of the Great Lakes (Environment and Climate Change Canada and the U.S. Environmental Protection Agency, 2022), Lake Erie's status was assessed as 'Poor and Unchanging'. While the water is safe to drink, fish can be consumed based on published guidelines, and the level of toxic chemicals has generally declined, elevated nutrient concentrations are contributing to toxic algal blooms and beach closures. Population growth, land use and development have resulted in habitat loss, degraded wetlands, impaired water quality, and an overall reduction in ecosystem health. While there are a large number of native species (high richness) in Ontario, the number of species at risk continues to increase as does the number of exotic species (CESCC, 2022).

Environment and Climate Change Canada's 2018 Lake Erie Canadian Nearshore Assessment identified impaired coastal processes as a threat to nearshore health. The cumulative stress from shoreline hardening and littoral cell barriers disrupts natural coastal processes and also poses a threat to barrier protected wetlands and community resilience (ECCC, 2018). Great Lakes coastal wetlands including those along the north shore of Lake Erie are highly vulnerable to climate change impacts related to increased range in lake levels (higher highs and lower lows), ice-free winters, and increased exposure to coastal storms and erosion (ECCC, 2022b). The north shore of Lake Erie has already lost over 1,000 hectares (e.g., almost 2,500 acres) of coastal wetland habitat due to reductions in sediment supply from natural background erosion and disruption of longshore sediment transport by harbours (Zuzek Inc., 2021a). At Rondeau Bay alone, over 500 hectares of coastal wetlands were lost from 1868 to 2020 due to the erosion of the barrier beach system at the tip of Rondeau Provincial Park, which was starved of sediment by a federal navigation channel interrupting longshore sediment transport and greatly reducing sediment available for deposition. Refer to the map in Figure 4.1.





**Figure 4.1 Coastal wetland habitat loss in Rondeau Bay since 1868 due to the navigation channel interrupting longshore sediment transport and reducing deposition**

The recent period of record-setting water levels on Lake Erie also highlighted the high vulnerability of coastal communities to coastal hazards and their overall low resilience, especially when future climate change impacts are considered, such as ice-free winters, higher (and lower) lake levels, and increased storm exposure (Zuzek Inc., 2020; Zuzek Inc., 2021b; Zuzek Inc., 2022). Based on these studies, in Southeast Leamington and the Rondeau Bay area of Chatham-Kent, more than 1,600 buildings with a combined assessed value of \$270 million are vulnerable to coastal flooding. In Chatham-Kent, another 480 buildings with a combined assessed value of \$99 million will be vulnerable to erosion in the next 50-years.

#### 4.2 Business-As-Usual Scenario – Compromised Resilience

The north shore of Lake Erie faces growing challenges related to more severe coastal hazards, continued habitat and species loss, pollution, constrained sediment supply, and damage to coastal infrastructure. Climate change will exacerbate these problems and further reduce coastal resilience. As the air and lake temperatures warm, lake ice cover decreases. For example, under the high emission scenario (RCP8.5) Lake Erie could be largely ice-free by late 21<sup>st</sup> century (Dehghan, 2019). Storm exposure has already increased and will continue to increase in the future. Bluff and beach erosion rates are accelerating, flooding events are more frequent and severe, degraded barrier beaches result in wetland losses, infrastructure maintenance costs are increasing, and irreversible damage is occurring in our parks and protected areas that provide public access to the lake. The health, quality of life, and economic prosperity in coastal communities is negatively impacted by these





hazardous events and our “resilience” – ability to quickly recover and bounce-back – is strained and viable adaptation options decrease with time.

To meet existing challenges and future threats due to climate change, communities and governments could create more resilience outcomes by undertaking coordinated planning and adaptation responses. However, development continues to occur on hazardous lands, and when infrastructure and building assets are threatened, shoreline armoring is the go-to solution for the business-as-usual scenario. Armoring in the littoral cells further reduces the sediment needed to maintain healthy beaches and coastal wetlands. Many jurisdictions struggle with capacity to undertake land use planning that incorporates climate change. In some cases coastal development continues without sufficient consideration of current and emerging hazards.

Historically, government departments and ministries have focused on core mandates, such as water quality or navigation,

resulting in siloed management (Zuzek Inc., 2023). They lack the tools or framework for collaborative management at appropriate spatial scales in our coastal areas. Without a legislative framework (i.e., an Act) or program that facilitates integration, uncoordinated sectoral management will continue, and coastal resilience will continue to decline.



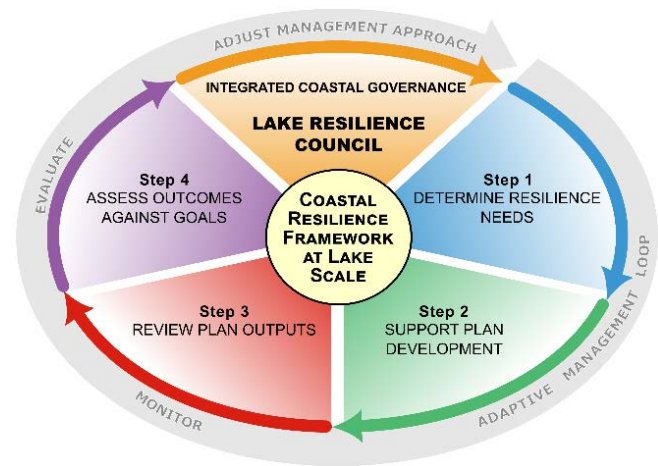
With the status quo, loss of critical habitat such as coastal wetlands will continue, and species will face extirpation (Zuzek Inc., 2021a). Shorelines will continue to degrade, and recreational beaches may disappear in some locations. Infrastructure damages from coastal hazards and costs to maintain and replace this infrastructure will increase (Zuzek Inc., 2020; Zuzek Inc., 2021b). Homes and properties will continue to be damaged by storms. Our current response strategy of shoreline armoring continues to create negative feedback loops, reducing the movement of sediment within littoral cells, resulting in further degradation of our coastal ecosystems and more negative downdrift impacts. Planned retreat for coastal communities may be the only affordable and sustainable option in the future to deal with severe conditions as other adaptation options may no longer be viable (Zuzek Inc., 2020).

### 4.3 Pathway to Coastal Resilience Scenario

In our vision of a more resilient future, Great Lakes stakeholders, landowners, rights holders, and federal, Indigenous, provincial, and municipal governments recognize that the north shore of Lake Erie is a dynamic, integrated social, economic, ecological, and physical system. A “Great Lakes coastal resilience ethos” recognizes the value of and the need for integration in coastal planning, management, coordination, stewardship, and investment in Great Lakes coastal systems in an “all-of-society-approach”.

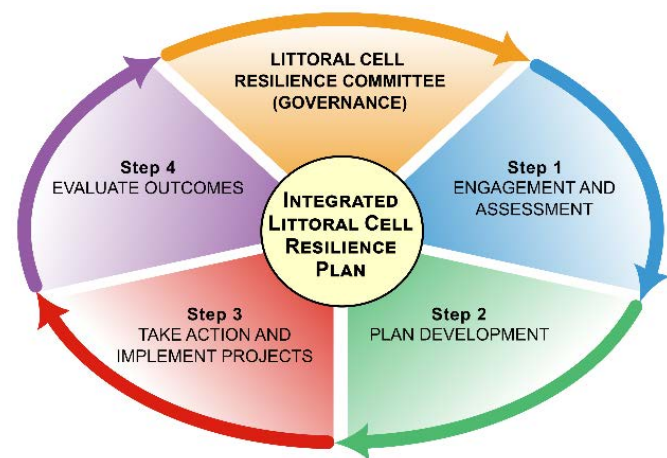


The Resilience Framework facilitates the implementation of this new ethos and result in innovative, strategic, and practical adaptation solutions that increase resilience of coastal communities, businesses, and ecosystems. The Resilience Framework would be implemented at the whole lake scale supported by a Lake Resilience Council specific to each Great Lake, in this example Lake Erie, and at the local scale through Littoral Cell Resilience Committees. At the lake scale, Lake Resilience Councils would lead and coordinate implementation of the Resilience Framework specific to each lake and develop overarching goals, activities, outputs, and outcomes for each lake. At the lake-scale, the Lake Resilience Council would be focused on five key pillars of action: securing funding, data collection and monitoring, research and assessment, stewardship, and building an effective governance structure (potentially including legislative tools) to support development of cell-specific integrated littoral cell resilience plans. A communication and reporting protocol between the lake-scale Lake Resilience Council and Littoral Cell Resilience Committees would be required.



An integrated regional perspective that links nearshore management to the land or coastal area would engage and involve all levels of government, expand expertise and innovation, and build capacity with rights holders, local stakeholders, and communities to make informed decisions and to develop and implement effective actions to address current stressors and future threats in an “all-of-society-approach”.

The Lake Resilience Council would support local leadership in development of nested Littoral Cell Resilience Plans. These plans recognize the inter-connected nature of our social, economic, ecological, and physical systems in coastal areas, leverage new ways of working together, establish coordinated priorities, and take coordinated, collective action to increase coastal resilience. The Resilience Plans would assess the state of the coastal system in each littoral cell, develop short-, medium- and long-term plans, take action on priorities, and implement projects to drive desired outcomes.



The success of the Resilience Framework, including the Lake Resilience Councils and Littoral Cell Resilience Committees, would require an ‘all-of-society’ approach to develop the plan, execute, monitor, and evaluate progress towards stated goals of the Resilience Framework. An Adaptive Management approach would be followed which recognizes that resilience is not only an outcome but an



ongoing process. This requires investment in monitoring, evaluation of progress towards goals, and adjusting the management approach as required.

#### **4.4 Vision and Goals**

The Think Tank developed the following vision for the Framework as well as supporting goals to increase coastal resilience. Resilience targets will be explored in FY25 with the Think Tank and Pelee Coastal Resilience Committee case study, which is focused on the Pelee West and Pelee East littoral cells that converge on Point Pelee National Park.

##### **RESILIENCE FRAMEWORK VISION**

“Promote resilient coastal areas through collaborative development of strategic plans at varying spatial scales and timeframes that respect the complex and interconnected nature of the coastal system and in ways that empower partners.”

##### **RESILIENCE FRAMEWORK GOALS**

Several high-level goals were developed for the Resilience Framework, with anticipated refinement in the future following additional consultation and engagement:

- Promote integrated coastal governance through the development of Lake Resilience Councils for each lake or another suitable governance body.
- Develop coastal resilience plans for littoral cells, or another appropriate management unit, with an all-of-society approach to increase resilience of communities and ecosystems to coastal hazards and climate change.
- Provide opportunities for knowledge transfer including western science and Indigenous Traditional Knowledge (with their free and prior and informed consent), to further resilience planning and prioritize knowledge gaps to provide direction for future research.
- Promote and encourage implementation of adaptation projects at varying scales, including lot or parcel level if appropriate, community to regional scale, and large-scale transformative projects.



## **5.0 IMPLEMENTATION: LOGIC MODELS AND PROCESS DIAGRAMS**

Draft logic models, which summarize inputs, activities, outputs, and desired outcomes, plus draft implementation diagrams depicting the step-wise approach for the Resilience Framework at the lake-wide and littoral cell scale are presented. The diagrams were developed in consultation with the Think Tank and may be refined in the future through further consultation and lessons-learned with the Pelee Coastal Resilience Council.

### **5.1 Function and Actions of the Lake Resilience Council**

The Coastal Resilience Framework was developed for the coastal areas of the Canadian Great Lakes, as outlined in Section 1.2. The Resilience Framework would be implemented separately for each portion of the Canadian Great Lakes (e.g., Superior, Huron, Erie, Ontario) where coastal processes are dominant and supported by a new Lake Resilience Council. Taking advantage of our existing governance structure, the Councils function could be represented by a working group or subcommittee to the Lakewide Annex of the Canada-Ontario Agreement (COA). Further, it is possible one Canadian Lake Resilience Council could support all Canadian Great Lakes coastal resilience initiatives.

The Council(s) would play a facilitating and coordinating role for the Resilience Framework application and implementation, including establishing a lake-specific vision, setting goals, determining coastal resilience priorities, and evaluating progress toward achieving goals over time through an adaptive management implementation approach. Planning and actions are focused on facilitating monitoring, data collection, promoting information sharing on programs, research, monitoring, and modelling to inform management actions, recommending funding priorities through public and private partnerships, supporting coastal stewardship, and providing the backbone governance support for the Littoral Cell Resilience Committees. Refer to Figure 5.1.

The implementation diagram in Figure 5.2 presents the key components of the logic model and the steps for the Lake Resilience Council in a loop diagram, starting with developing a lakewide vision, goals, and resilience targets. In Step 1, the Lake Resilience Council would support the development of Littoral Cell Resilience Committees specific to its geographic region, share information on funding applications for relevant programs, set data collection, research, and information sharing priorities, and support stewardship programs. In Step 2, the Council supports individual Littoral Cell Resilience Committees with plan development as required. Plan outputs are reviewed in Step three, including actions towards increasing coastal resilience. Finally, in Step 4, the Councils would track progress on achieving outputs and outcomes in the short-, medium-, and long-term, and ensure adjustments are made within an adaptive management framework (action, monitor, evaluate, and adjust), as noted in the outer loop of Figure 5.2.



## 5.2 Littoral Cell Resilience Plans

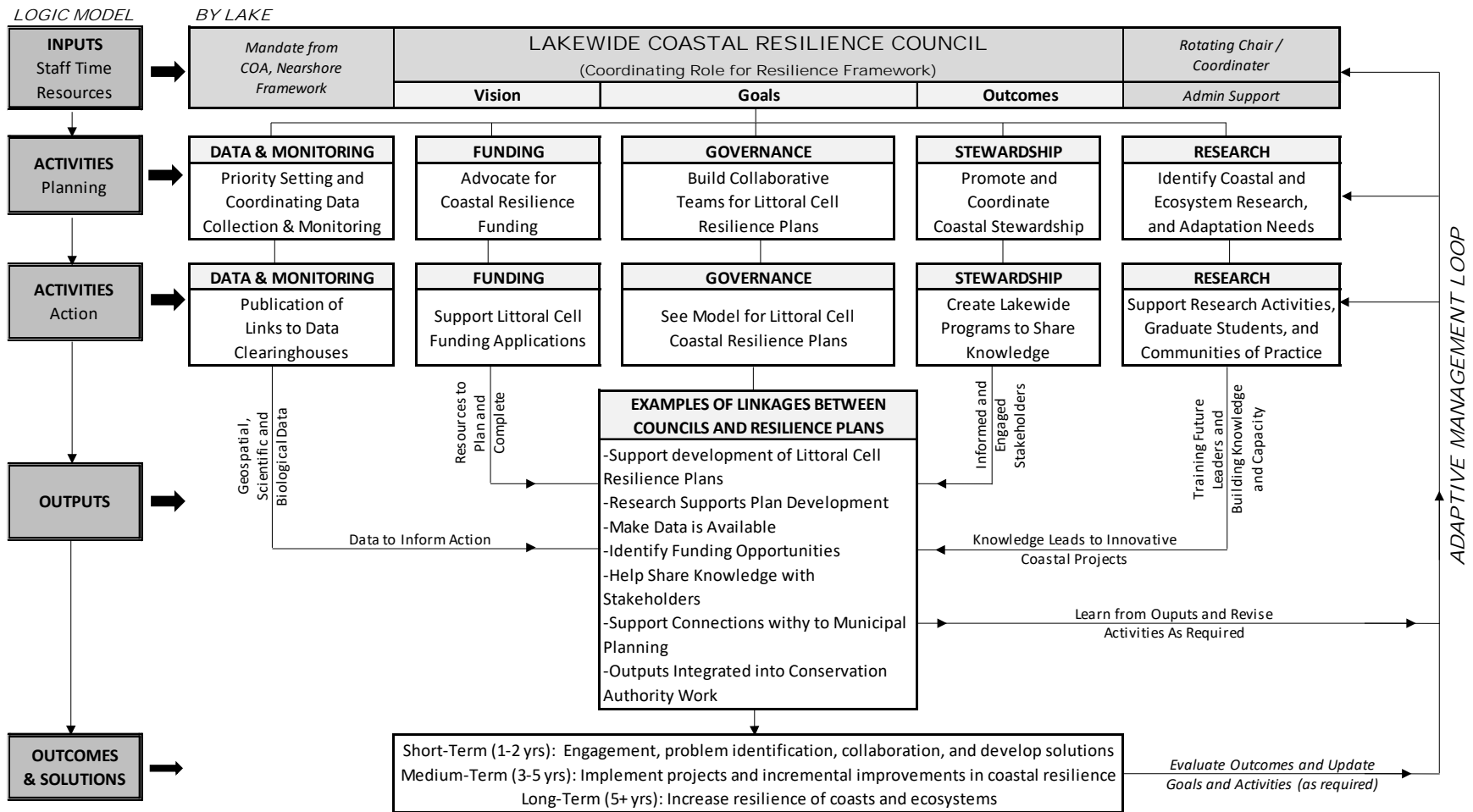
The Resilience Framework features nested coastal resilience planning at a regional scale, such as littoral cells, where the all-of-society approach focused on integration and collaboration is crucial. Figure 5.3 presents the logic model for a Littoral Cell Resilience Committee and the development of Resilience Plans. The Committee would consist of local practitioners, stakeholders, rights holders and community members (First Nations, Municipalities, Conservation Authorities, local citizens, businesses, ENGOs) and members from senior government ministries and departments (with local responsibilities/expertise and relevant programs). They would assume responsibility for governance, Littoral Cell Resilience Plan development and its execution, and would be supported by the Lake Resilience Council.

The Littoral Cell Resilience Committee would refine, as necessary, the high-level lake-wide resilience vision to reflect local conditions and targets for the littoral cell management area under consideration and the interacting stresses and cumulative impacts identified as high priority. Activities identified in the logic model include engagement, inventory and assessment of system state, hazard mapping, vulnerability assessments, and integration of habitat and species and invasive species management in all activities. Potential actions include work on coastal stewardship and adaptation planning. Actions directed to increase resilience would be achieved with projects of various scales, from lot-by-lot activities, reach or community scale, and large-scale transformational adaptations (Figure 5.3). Finally, actions and outputs will be evaluated against the coastal resilience goals and targets established by the Littoral Cell Resilience Committee and reported back the Lake Resilience Council.

These activities are also visualized in the process diagram in Figure 5.4 and include four steps as follows:

- **Step 1 – Engagement and Assessment:** engage all-of society to assess the system state and baseline, evaluate coastal vulnerability and risk, and prepare a report on findings.
- **Step 2 – Plan Development:** pursue funding, start implementing stewardship activities, design solutions at various scales, and document actions in the Littoral Cell Resilience Plan.
- **Step 3 – Take Action and Implement Projects:** continue implementing stewardship programs, support regional planning and regulation activities, implement projects at appropriate scales (e.g., lot, community, or large-scale), and protect and restore habitat to increase coastal resilience.
- **Step 4 – Evaluate Outcomes:** evaluate and document outcomes for short-, medium-, and long-term goals and resilience targets. Report to the Lake Resilience Council on findings.

# LAKEWIDE GOVERNANCE FOR THE COASTAL RESILIENCE FRAMEWORK



**Figure 5.1 Logic Model for Lakewide Governance**

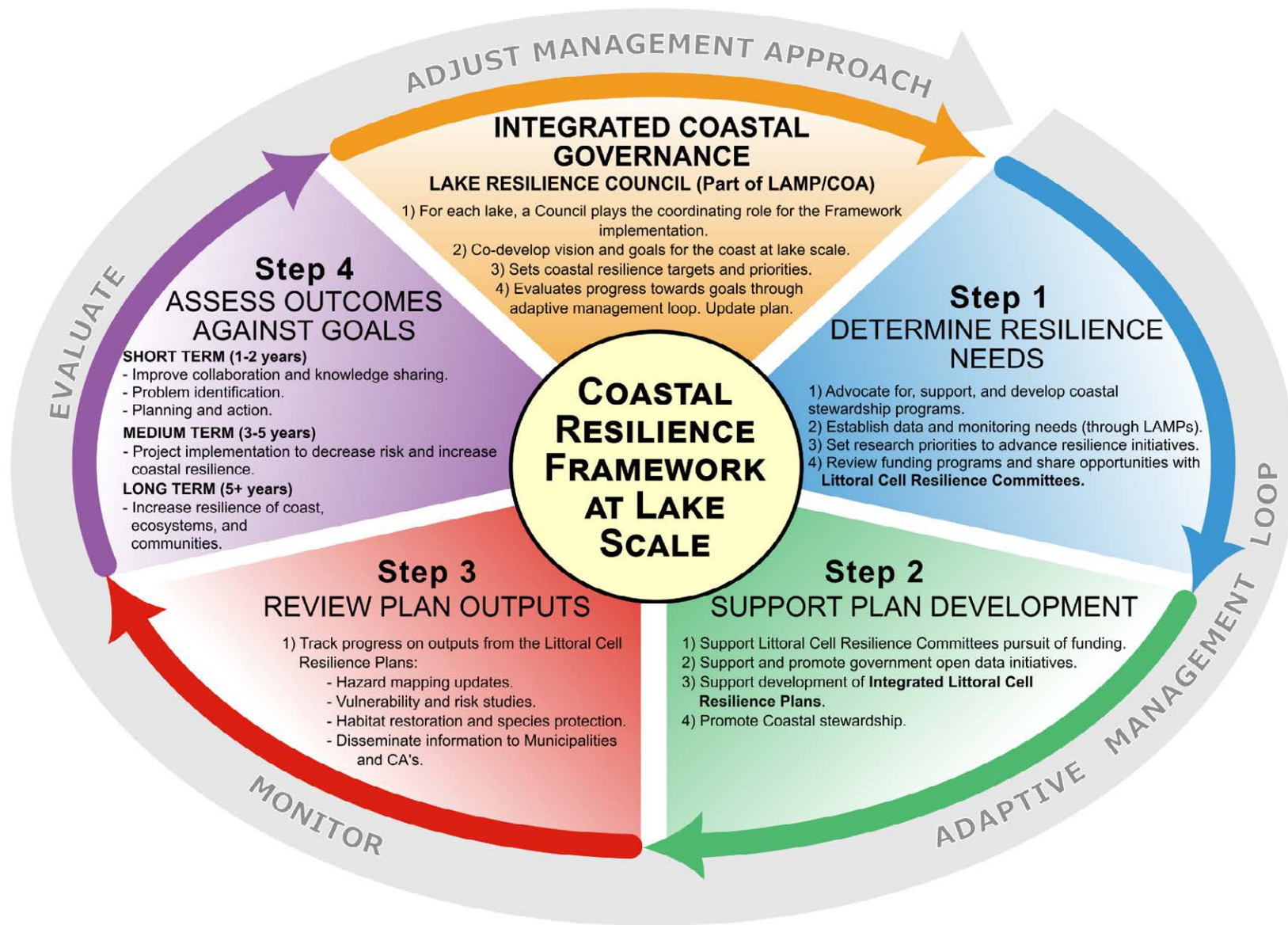
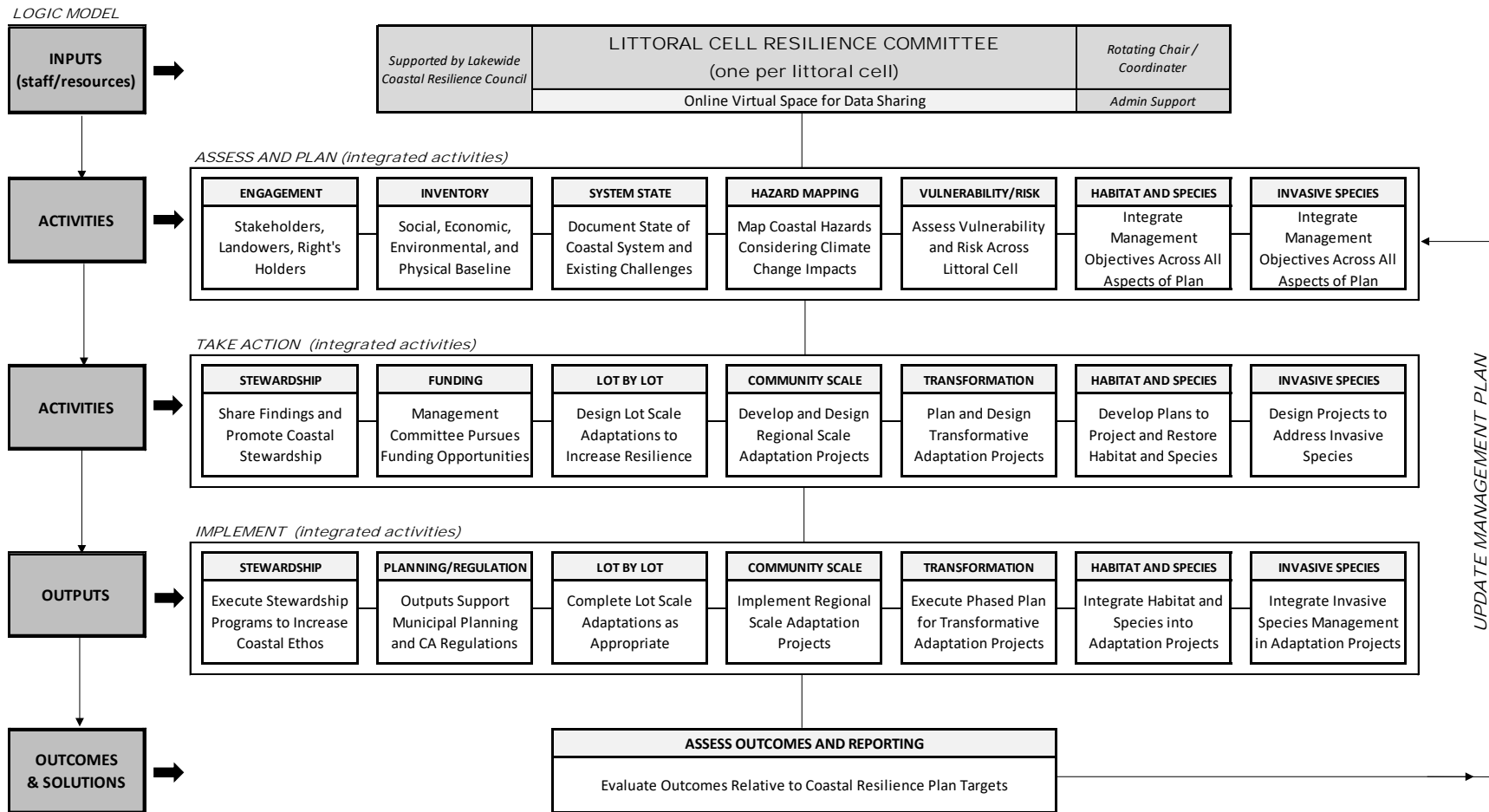


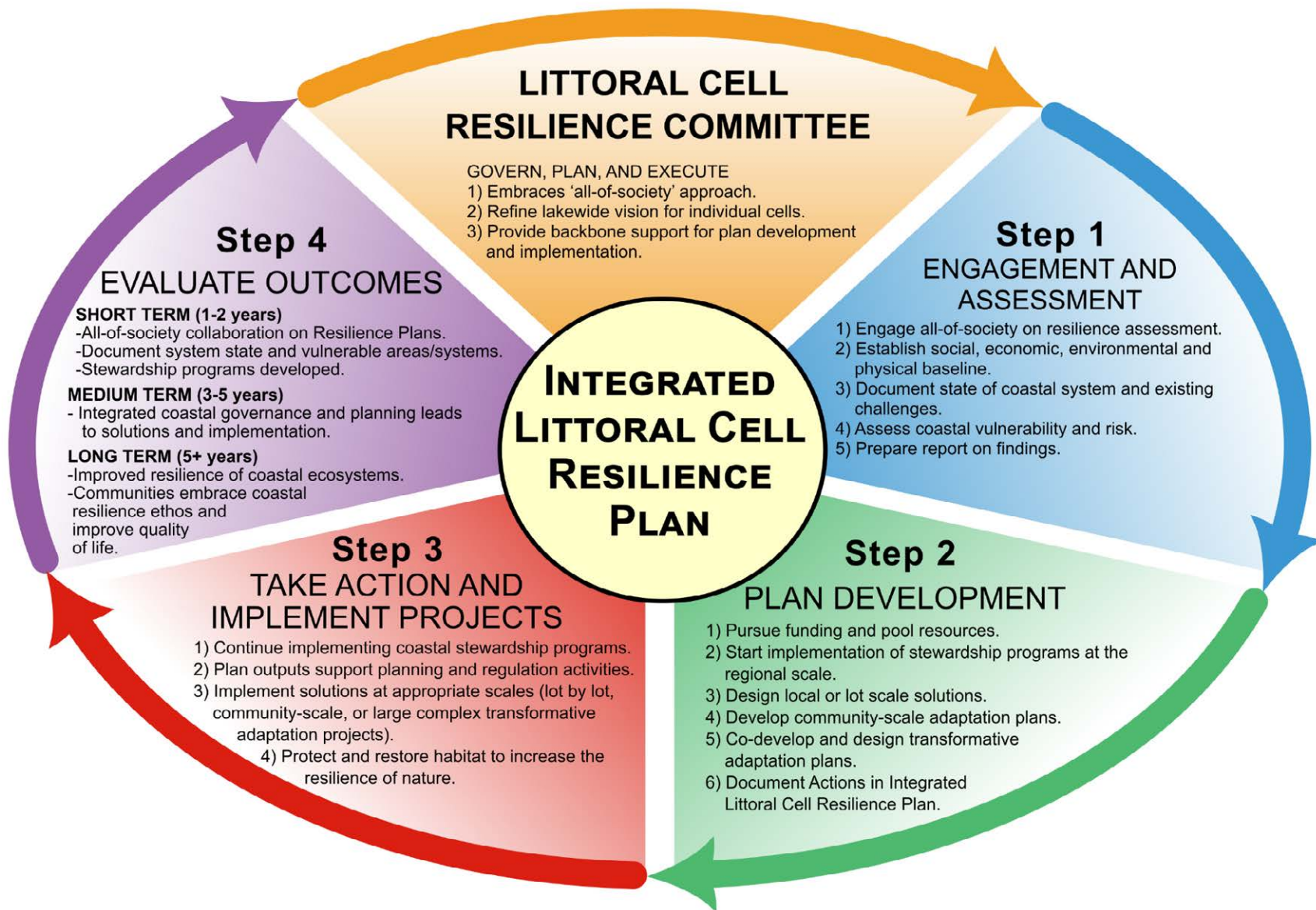
Figure 5.2 Process Diagram for the Lake Resilience Council



## LITTORAL CELL RESILIENCE PLAN



**Figure 5.3 Logic Model for the Littoral Cell Resilience Committee**








**Figure 5.4 Process Diagram for the Littoral Cell Resilience Plans**

## 6.0 POTENTIAL NEXT STEPS

This report presents the draft Coastal Resilience Framework for Canadian coastal areas of the Great Lakes. Framework development to date has focused on and been informed by Lake Erie coastal issues (e.g., Point Pelee Peninsula, Rondeau Bay area, and Long Point Region) but the Resilience Framework has been designed to be applicable for the entire Canadian Great Lakes. Future pilot implementation and testing of the Framework is anticipated in Lake Erie.

The Think Tank participants were engaged as expert practitioners in the development of the Resilience Framework. Next steps will involve government departmental and ministerial review of this draft report and discussions on support for the draft Resilience Framework. This will provide feedback for further collaboration and refinement.

The review of international best practices (Section 2.0) identified stakeholder/community engagement as a crucial step in advancing coastal planning and management. The legislation and policy scan (Section 3.0) identified that Indigenous and coastal communities were not well represented yet. A crucial next step will be the design and undertaking of Indigenous engagements and discussions with stakeholders and landowners in the littoral cells along the north coast of Lake Erie. The first stage/phase of the engagements will involve activities with various levels of participation, from inform to collaborate as per the IAP2 public participation spectrum outlined in Figure 6.1.

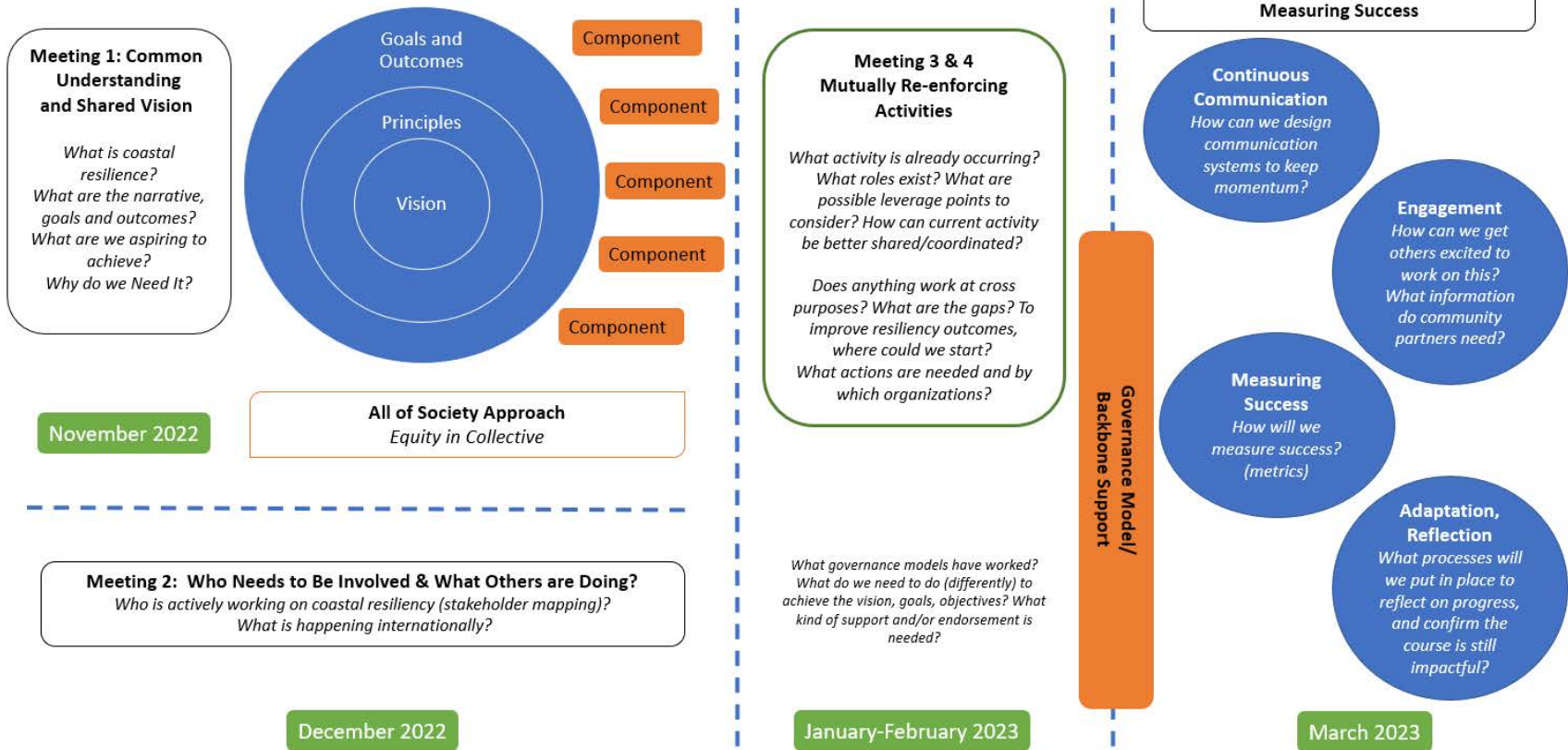
	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
					
<b>GOAL</b>	To provide stakeholders with balanced and objective information to assist them in understanding the problem, alternatives and solutions.	To obtain stakeholder feedback on analysis, alternatives and/or decisions.	To work directly with stakeholders throughout the process to ensure that their concerns and aspirations are consistently understood.	To partner with stakeholders in each aspect of the decision from development to solution.	Shared leadership of community-led projects with final decision-making at the community level.
<b>STYLE</b>	"Here's what's happening."	"Here are some options, what do you think?"	"Here's a problem, what ideas do you have?"	"Let's work together to solve this problem."	"You care about this issue and are leading an initiative, how can we support you?"

**Figure 6.1 Types of engagement with appropriate goals and styles (adapted from the IAP2 Public Participation Spectrum)**

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# **APPENDIX A – FY23 FRAMEWORK DEVELOPMENT PROCESS**



## **APPENDIX B - INTERNATIONAL BEST PRACTICE**

**Background:** Recognizing that progress towards adapting to climate consequences and enhancing resilience is crucially needed, the COP 27 Presidency presented the *Sharm-El-Sheikh Adaptation Agenda* in November, 2022 in Egypt. This agenda portrays a total of 30 global adaptation outcome targets by 2030 that are urgently needed to increase resilience of 4 billion people to accelerate transformation across five impact systems: food and agriculture, water and nature, coastal and oceans, human settlements, and infrastructure, and including enabling solutions for planning and finance.

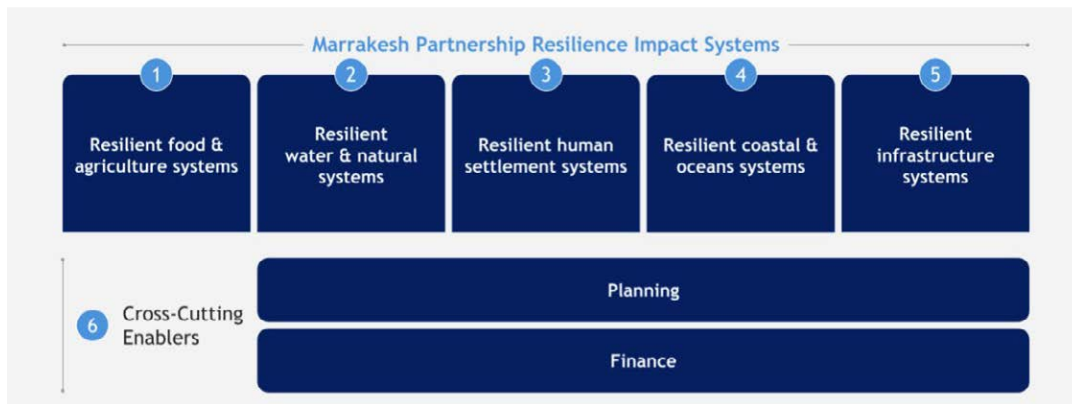
It is the Agenda's aspiration that adaptation and resilience be placed at the forefront of global action. The Champions and the COP 27 Presidency have framed the Sharm-El-Sheikh Adaptation Agenda as the agenda of solutions that bring together the adaptation transformative actions and system level resilience. The Agenda defines the need and opportunity, and provides specific targets at a system level - but with the flexibility for local application. They place people at the centre and are focused on the highest impact solutions that target a large number of the most vulnerable coastal, rural and urban communities by addressing the most pressing climate risk and hazards.

<https://climatechampions.unfccc.int/wp-content/uploads/2022/11/SeS-Adaptation-Agenda-Complete-Report-COP27-FINAL-1.pdf>

**Details of the Integrated Coastal Management and/or Coastal Resilience Framework:**

- The Sharm-El-Sheikh Adaptation Agenda will serve as aspirational adaptation outcomes for global adaptation action towards 2030, and to inform state and non-state adaptation agendas.
- To deliver climate action, whole-scale transformations are needed on two fronts:
  - To get to net zero emissions as soon as possible to prevent incremental damage; and
  - To significantly increase actions and investments to adapt now to the current and unavoidable impacts of climate change, putting people and nature first in pursuit of a resilient world where we don't just survive climate shocks and stresses but thrive in spite of them.
- Recognizing that adaptation implementation and resilience is lagging compared with mitigation, a consolidated action agenda across stakeholders is required. Many different actors across the world are working to deliver adaptation actions and enhance resilience across several thematic priorities, but without common and tangible targets.
- Resilience is needed globally but starts with local adaptation solutions that depend on the specific context of geographies and communities, and takes into account the needs and preferences of the most vulnerable people.
- A set of intermediate milestones are needed to help give direction to these transformative solutions for tangible and attainable outcomes for adaptation of both natural and human systems.
- Five key impact systems were defined to structure Resilience initiatives globally as part of the Climate Action Pathways (see graphic):





- Specific targets have been identified based on science with an emphasis on delivering action by 2030. These targets consolidate the work of existing and new adaptation and resilience initiatives. Collectively, they articulate what key actors must do, and by when, to deliver systems change.
- The Sharm-El-Sheikh Adaptation Agenda is informed by an analysis of the hazards that vulnerable communities face and actions needed to build resilience against those hazards.
- For ocean and coastal systems, the Agenda calls for:
  - halting loss, protect and restore seagrass, marshes, and kelp forests; and
  - urban coastlines are protected by grey and hybrid solutions.
- Radical Collaboration: Cities, regions, businesses, investors, and civil society play a critical role in accelerating adaptation action that builds resilience. Non-State actors provide financing and insurance, implement adaptation solutions with nature, hybrid or hard engineering, build knowledge and capabilities, collaborate in partnerships, support communities and deliver technology to improve risk management, among others.

**Benefits of Integration, Collaboration, and Resilience Planning:**

- Incremental changes to gradually adapt to the different climate hazards and recover essential functions within society is no longer sufficient; societies need to rapidly accelerate action creating what the IPCC calls transformative solutions and building climate resilient development through a more holistic approach.
- The Sharm-El-Sheikh Adaptation Agenda defines attainable outcome targets across the impact systems and cross-cutting enablers. Building on the Global Commission on Adaptation Flagship Report and the UN Sustainable Development Goals, and bringing together global aspirations, these adaptation outcomes present a guiding star for the long-term ambitions of a resilient world.
- The 30 global adaptation outcome targets will continue to be enhanced and refined based on scientific results.

### **Lessons Learned and Relevance for the Coastal Resilience Framework:**

- Adaptation is often fragmented, small in scale, incremental, sector-specific and with a near-term focus. Less than ~20% of countries have comprehensive adaptation and resilience plans. Of the few that do, many have not translated plans to adaptation action.
- We need to simultaneously muster efforts behind adaptation and resilience implementation solutions as millions of people globally are already experiencing the economic, social and ecosystem impacts of climate change.
- Urgent action is needed now at an unprecedented pace and scale. We need coordinated action from different players across economic, natural and social systems to achieve a genuine step-change in progress towards adaptation and resilience.
- Adaptation and resilience transformative solutions are advanced when multiple sectors and actors move in synchronization to deploy ideas and manage climate risks, mutually reinforce sectoral transformations, and enhance innovation on how finance, governance, policy and access to technology and information are delivered.
- When many of these groups of actors across several sectors see each other working towards a common milestone, their actions and progress mutually reinforce to overcome obstacles, break silos, enhance synergies and create catalytic action.
- The transition to a climate resilient world will occur through system transformation across sectors and the harmonized response of multiple actors across multiple levels towards common goals.
- System transformation cannot happen at the pace and scale required if individual entities work in isolation from one another.
- The challenges of competition and inertia often deter ambition, where individual actors cannot make the first move without putting themselves at a distinct disadvantage in the near term.
- Rather, transformative adaptation happens when different actors - across sectors - move in synchronization to support a resilient transition in a way that ultimately benefits them all, including activating the positive ambition loop between State and Non-State actors.
- Achieving adaptation outcomes requires mobilizing partners and initiatives across the ecosystem towards these shared targets.
- Adaptation Outcomes that deliver both for nature and for people living in coastal areas are a key part of building global resilience in a warming world.

**Background:** Despite ongoing efforts, biodiversity is deteriorating worldwide and this decline is projected to continue or worsen under business-as-usual scenarios. The post-2020 global biodiversity framework builds on the Convention on Biological Diversity’s Strategic Plan for Biodiversity 2011-2020 and sets out an ambitious plan to implement broad-based action to bring about a transformation in society’s relationship with biodiversity. The vision of the framework is a world of living in harmony with nature where: “By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people.” <https://www.cbd.int/post2020/>

**Details of the Integrated Coastal Management and/or Coastal Resilience Framework:**

- The framework aims to galvanize urgent and transformative action by Governments and all of society, including indigenous peoples and local communities, civil society, and businesses, to achieve the outcomes it sets out in its vision, mission, goals, and targets, and thereby to contribute to the objectives of the Convention on Biological Diversity, its Protocols, and other biodiversity-related multilateral agreements, processes, and instruments.
- The framework aims to facilitate implementation, which will be primarily through activities at the national level, with supporting action at the subnational, regional, and global levels.
- The framework is built around a theory of change which recognizes that urgent policy action globally, regionally and nationally is required to transform economic, social and financial models so that the trends that have exacerbated biodiversity loss will stabilize by 2030 and allow for the recovery of natural ecosystems in the following 20 years, with net improvements by 2050 to achieve the Convention’s vision of “living in harmony with nature by 2050”.
- The framework’s theory of change assumes that transformative actions are taken to (a) put in place tools and solutions for implementation and mainstreaming, (b) reduce the threats to biodiversity, and (c) ensure that biodiversity is used sustainably in order to meet people’s needs, and that these actions are supported by enabling conditions, and adequate means of implementation, including financial resources, capacity and technology.
- The framework has four long-term goals for 2050 related to the 2050 Vision for Biodiversity. Each 2050 goal has a number of corresponding milestones to assess, in 2030, progress towards the 2050 goals. Those directly relevant to the Great Lakes Coastal Resiliency framework include:
  - The integrity of all ecosystems is enhanced, with an increase of at least 15 per cent in the area, connectivity and integrity of natural ecosystems, supporting healthy and resilient populations of all species, the rate of extinctions has been reduced at least tenfold, and the risk of species extinctions across all taxonomic and functional groups, is halved, and genetic diversity of wild and domesticated species is safeguarded, with at least 90 per cent of genetic diversity within all species maintained.

- Nature's contributions to people are valued, maintained, or enhanced through conservation and sustainable use supporting the global development agenda for the benefit of all.
- The framework has 21 action-oriented targets for urgent action over the decade to 2030. The actions set out in each target need to be initiated immediately and completed by 2030. Together, the results will enable achievement of the 2030 milestones and of the outcome-oriented goals for 2050. Those directly relevant to the Great Lakes Coastal Resilience framework include:
  - Ensure that all land and sea areas globally are under integrated biodiversity-inclusive spatial planning addressing land- and sea-use change, retaining existing intact and wilderness areas.
  - Ensure that at least 20 per cent of degraded freshwater, marine and terrestrial ecosystems are under restoration, ensuring connectivity among them and focusing on priority ecosystems.
  - Ensure that at least 30 per cent globally of land areas and of sea areas, especially areas of particular importance for biodiversity and its contributions to people, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.
  - Manage pathways for the introduction of invasive alien species, preventing, or reducing their rate of introduction and establishment by at least 50 per cent, and control or eradicate invasive alien species to eliminate or reduce their impacts, focusing on priority species and priority sites.
  - Reduce pollution from all sources to levels that are not harmful to biodiversity and ecosystem functions and human health, including by reducing nutrients lost to the environment by at least half, and pesticides by at least two thirds and eliminating the discharge of plastic waste.
  - Minimize the impact of climate change on biodiversity, contribute to mitigation and adaptation through ecosystem-based approaches, and ensure that all mitigation and adaptation efforts avoid negative impacts on biodiversity.
  - Maintain and enhance nature's contributions to regulation of air quality, quantity and quality of water, and protection from hazards and extreme events for all people.
  - Increase the area of, access to, and benefits from green and blue spaces, for human health and well-being in urban areas and other densely populated areas.
  - Fully integrate biodiversity values into policies, regulations, planning, development processes, poverty reduction strategies, accounts, and assessments of environmental impacts at all levels of government and across all sectors of the economy, ensuring that all activities and financial flows are aligned with biodiversity values.
  - Ensure that relevant knowledge, including the traditional knowledge, innovations and practices of indigenous peoples and local communities with their free, prior, and informed consent, guides decision-making for the effective management of biodiversity, enabling monitoring, and by promoting awareness, education and research.

- Ensure equitable and effective participation in decision-making related to biodiversity by indigenous peoples and local communities, and respect their rights over lands, territories, and resources, as well as by women and girls, and youth.

**Benefits of Integration, Collaboration, and Resilience Planning:**

- The framework provides a global, outcome-oriented framework for the development of national, and as appropriate, regional, goals and targets and, as necessary, the updating of national biodiversity strategies and action plans to achieve these, and to facilitate regular monitoring and review of progress at the global level.
- The theory of change for the framework acknowledges the need for appropriate recognition of gender equality, women’s empowerment, youth, gender-responsive approaches and the full and effective participation of indigenous peoples and local communities in the implementation of this framework. It will also be implemented taking a rights-based approach and recognizing the principle of intergenerational equity.
- It will require a participatory and inclusive whole-of-society approach that engages actors beyond national Governments, including subnational governments, cities and other local authorities, intergovernmental organizations, non-governmental organizations, indigenous peoples and local communities, women’s groups, youth groups, the business and finance community, the scientific community, academia, faith-based organizations, representatives of sectors related to or dependent on biodiversity, citizens at large, and other stakeholders.
- The vision of the framework is a world of living in harmony with nature where: “By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet, and delivering benefits essential for all people.”

**Lessons Learned and Relevance for the Coastal Resilience Framework:**

- The framework is a fundamental contribution to the implementation of the 2030 Agenda for Sustainable Development. At the same time, progress towards the Sustainable Development Goals will help to create the conditions necessary to implement the framework.
- The implementation of the global biodiversity framework requires integrative governance and whole-of-government approaches to ensure policy coherence and effectiveness, political will and recognition at the highest levels of government.
- It also assumes that a whole-of-government and -society approach is necessary to make the changes needed over the next 10 years as a stepping-stone towards the achievement of the 2050 Vision.
- As such, Governments and societies need to determine priorities and allocate financial and other resources, internalize the value of nature, and recognize the cost of inaction.

**LOCATION: England**

Townend, I.H., J.R. French, R.J. Nicholls, S. Brown, S. Carpenter, I.D. Haigh, C.T. Hill, E. Lazarus, E.C. Penning-Rowell, C.E.L. Thompson and E.L. Tompkins. 2021. Operationalising coastal resilience to flood and erosion hazard: A demonstration for England. *Science of the Total Environment*. Vol. 783.

**Background:** This paper shows how resilience to coastal flood and erosion hazard could be measured and applied within policy processes, using England as a case study. It presents a decision-making framework and a prototype Coastal Resilience Model that measures resilience as a composite property of a set of coupled ecological, geomorphic, socio-economic and engineered infrastructural systems.

<https://www.sciencedirect.com/science/article/pii/S0048969721019501>

**Details of the Integrated Coastal Management and/or Coastal Resilience Framework:**

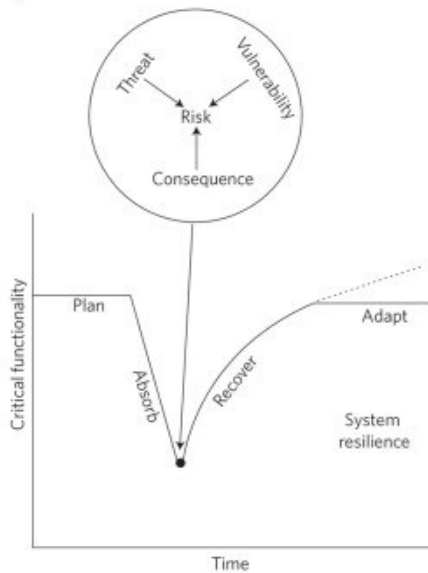
- The first steps needed to develop coastal resilience policies can be summarized as:
  - Establish the decision-making context (policy aims, decision-makers, key stakeholders);
  - Identify clear objectives that are specific, measurable, agreed, realistic and time dependent (i.e. SMART);
  - Define the available options that can realistically address the objective(s); and
  - Design a method to evaluate likely outcomes and measure performance.
- See figures below.

Fig 1. Generalized resilience management framework that includes risk analysis as a central component (reproduced from [Linkov et al., 2014](#)). The dashed line shows that a resilient system can adapt such that its functionality may improve with respect to its initial state, enhancing system resilience to future adverse events; b) Objectives that serve to enhance coastal resilience by maximizing the capacity to cope and minimizing the potential for loss, subject to any local or national constraints.

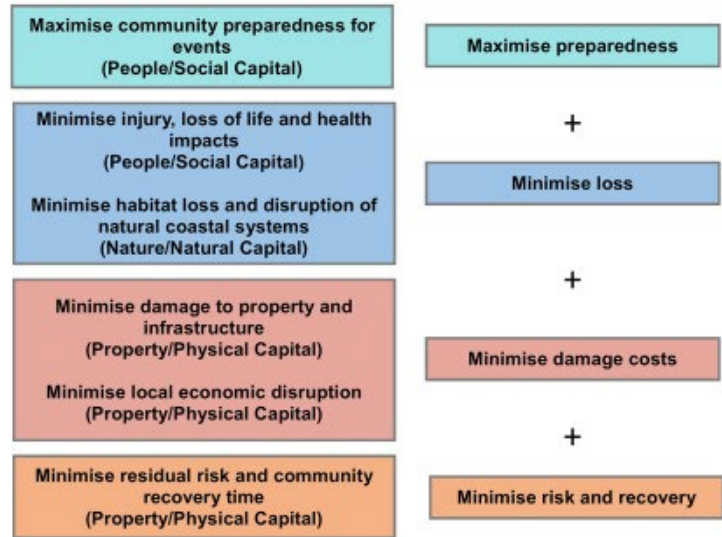
Fig. 2. A set of objectives that need to be maximized or minimized, in order to enhance coastal resilience, and which can be quantified using indicators and associated data-driven metrics. People, Property and Nature refer to the social, economic and environmental dimensions of the system.

**Figure 1**

a)

**Figure 2**

b)



### Lessons Learned and Relevance for the Coastal Resilience Framework:

- Operationalization of resilience as a basis for strategic coastal management remains at an early stage of development.
- Quantifying the resilience of complex systems that incorporate a multitude of physical, biotic, social, and economic components and behaviours presents a greater challenge.
- Working within a resilience paradigm, one seeks to maintain or improve the functionality of the system, and this requires balancing social gains and losses, ideally through consideration of societal preferences.
- Context is also important, and it is essential that the conceptual definition adopted should be framed by the questions ‘resilience against what?’ and ‘resilience for whom?’
- Any framework to measure and use resilience to develop a policy response, therefore, needs to be flexible enough to address both chronic and acute hazards.
- There is a need to be cognizant of the substantial investment in flood defences that has been made in many European countries, including the UK. Abandoning or decommissioning existing defences is an option that is likely to have little, if any, political traction over the short-term. A staged approach is more likely to achieve acceptance within communities and hence lead to political adoption.
- One of the biggest challenges is to develop a strategy for these transitions that is affordable, sustainable, equitable and addresses societal pressures as well as natural system perturbations.

**LOCATION: South Africa**

Celliers, L., S. Rosendo, M. M. Costa, L. Ojwang, M. Carmona, and D. Obura. 2020. A capital approach for assessing local coastal governance. *Ocean and Coastal Management* 183:104996.

**Background:** The role of local governments in addressing climate change is increasingly acknowledged. Coastal governance encompasses not only the actions of the state (which includes local governments), but also of other actors such as communities, businesses and civil society organizations. Solutions to improving coastal governance include the implementation of Integrated Coastal Management which also serves as means to plan and achieve climate change adaptation.

<https://doi.org/10.1016/j.ocecoaman.2019.104996>

**Details of the Integrated Coastal Management (ICM) and/or Coastal Resilience Framework:**

- Local government is a key institution for addressing environmental and climate change.
- Local governments have a wide range of planning, regulatory and service provision mandates. Climate change has important implications for the implementation of these mandates, requiring local governments to consider and integrate climate risks and opportunities in their planning.
- A growing body of literature has emerged on the enabling conditions and constraints to local governments realizing their potential in climate adaptation.
- The Capital Approach Framework (CAF) used in this paper was based on previous work in which risk governance was assessed in the context of climate change.
- It is grounded in the premise that the good functioning of a governance system depends on a combination of different forms of “capitals”; or the assets, capabilities, properties or other components of that system.
- It features *social capital* (relationships, networks and shared norms and values); *human capital* (individual skills and knowledge); *political capital* (governmental processes); *financial capital* (financial resources); and *environmental capital* (ecological goods and services).
- The authors propose a framework based of six factors essential for adaptation to take place: political leadership, institutional organization, adaptation decision making and stakeholder engagement, availability of useable science, funding for adaptation, and public support for adaptation.
- A weakness identified by the CAF assessment is the apparent inability of municipalities, as a collection of different functions and departments, to effectively collaborate to achieve common objectives. It would appear that departmental or line functions are still prioritized over multi-sectorial objectives common to ICM and climate change adaptation (CCA) planning initiatives.



### **Lessons Learned and Relevance for the Coastal Resilience Framework:**

- Constraints include, among others, lack of financial and human resources, lack of expertise and experience to plan and implement adaptation measures, and lack of awareness amongst elected officials and political support for adaptation actions.
- On the other hand, successful cases of local government-driven adaptation planning and action have been shown to be down to, for example, the existence of local climate ‘champions’ or leaders, partnerships with private sector, non-governmental and community-based organizations, supporting legislation and guidance from the national level.
- Ultimately, for many local governments, addressing climate change adds to an already extensive and increasing list of demands and responsibilities in a context of overstretched resources.
- The potential for damage and loss of human life boosts the political priority of disaster risk management. The effect of an insufficient response to short-term intense impacts on coastal communities carries the penalty of diminished voting support.
- The assessment highlighted the fact that coastal managers found it difficult to identify the kind and extent of knowledge required for coastal management, and by extension, climate change adaptation.
- Through their various functions, local governments can play a vital role in driving and facilitating adaptation at the local scale, and therefore complement adaptation efforts at national levels.

**LOCATION: USA**

Herb, J, M. Kaplan, M. Campo, S. Kennedy, A. Wainwright, and H. Berman. 2019. An Overview of State Coastal Zone Management Policies Designed to Promote Coastal Resilience. Prepared for the New Jersey Department of Environmental Protection. New Brunswick, NJ: The Environmental Analysis & Communications Group, Rutgers University Bloustein School of Planning and Public Policy and Rutgers Climate Institute.

**Background:** The New Jersey Coastal Management Program engaged the Rutgers University Bloustein School of Planning and Public Policy and the Rutgers Climate Institute to review science-informed sea-level rise programs and policies in fifteen U.S. states.

<https://doi.org/doi:10.7282/t3-p3mx-bs83>

**Details of the Integrated Coastal Management and/or Coastal Resilience Framework:**

- Overall, the Rutgers Team found that all fifteen of the case study states have significant efforts underway with regard to sea-level rise.
- The nature of these efforts may vary, including development of sea-level rise science, adoption of public policies, guidance and technical assistance, and development of decision-support tools.
- All of the states have some form of stakeholder engagement that may vary in several ways.
- Most of the states are examining the latest climate science and translating it for application in state policies and programs.
- Strategic planning efforts among the states may vary. In some cases, such as Louisiana and Texas, coastal resilience plans identify coastal natural resource restoration priorities for expenditures of public monies. In other states, strategic planning serves to provide an overarching direction for the consistent development of science-informed state programs, funding, policies, and other initiatives.
- The Rutgers Team identified eight states that systematically incorporated state-recognized science-informed sea-level rise values into directed public policy which may include policies that: direct state agency operations and policies, direct or incentivize local jurisdictions, and/or directly or indirectly affect state programs that relate to the private sector such as planning or permitting.
- All of the fifteen case study states are involved in some level of capacity building, which may include: development of guidance, including guidance to state agencies and local governments; creation of state level interagency working groups that facilitate consistent use of science-informed sea-level rise values in policies and programs; development of decision-support tools, such as web-based mapping and visualization platforms; training of local officials, community leaders and others.
- In some cases, state sea-level rise efforts are led through a coastal planning program. In many cases, the sea-level rise efforts are integrated into overall state efforts to address all hazards associated with climate change. In other cases, climate change and sea-level rise efforts are integrated into a state's larger climate change program that includes efforts associated with emissions reduction as well as adaptation.

### **Benefits of Integration, Collaboration, and Resilience Planning:**

Based on the review of efforts in the fifteen states, the Rutgers Team offers the following observations:

- ◆ “Lead up” time to policy adoption - For the states that have integrated state-recognized, science-informed sea-level rise values into policy, there typically has been a lengthy period of time, often a decade or more, leading up to policy adoption.
- ◆ Similarities and differences among the states especially with regard to policy approaches - For states that are engaged in implementation and policy development efforts, approaches vary. No one state applies all possible existing policy mechanisms.
- ◆ Science-informed sea-level rise values - States generally take a bottom-up probabilistic or a top-down scenario-based approach to creating planning frameworks to embody sea-level rise science. Most states are considering how to address recent science regarding sea-level rise contributions from Antarctic ice-sheet melt. More states are choosing to incorporate probabilistic approaches for sea-level rise into their guidance.
- ◆ Planning for uncertainty - The rapidly evolving scientific understanding of sea-level rise science, and changing circumstances such as those associated with ice sheets covering Antarctica and Greenland, drive different approaches for incorporating sea-level rise information. Most states build in requirements to update state sea-level rise values as science emerges. Additionally, some states are implementing management approaches to plan for uncertainties.
- ◆ Support for implementation of policy - As states’ efforts to integrate sea-level rise science into policy matures, more states are developing specific strategies, such as decision-support tools, detailed guidance, and stepwise instructions to support implementation on the part of state agencies, local government and private sector entities, rather than setting sea-level rise values with the expectation that state and local agencies and private entities can interpret them.
- ◆ Effectiveness - Many of the states’ policies are new and, for that reason, it is difficult to measure effectiveness. The Rutgers Team found an extensive amount of new activity within the fifteen states’ programs in 2018 alone including updated science-informed sea-level rise values, adoption of new policies, development of new guidance and decision-support tools, and issuance of new comprehensive strategic plans.
- ◆ Vulnerability assessments - Assessing vulnerability is a key step in managing risk. Many states follow a risk management approach whereby linkages are drawn between climate science, vulnerability assessment, policy development, and implementation. These approaches involve applying science to understand vulnerability and risk to inform the necessary response measures to prevent and minimize future impacts to people, natural assets and built infrastructure.
- ◆ Limitations - Despite significant efforts on the part of the states to advance the integration of science-informed sea-level rise policies, there are some limitations with regard to the breadth of current state programs for consideration, such as consideration of socially vulnerable populations, how to effectively address private lands, and strategies to ensure adequate funding for programs.
- ◆ Interagency coordination and stakeholder engagement - Interagency collaboration at the state level serves several purposes: it ensures consistent application of sea-level rise science in programs and policies of multiple agencies; it identifies mechanisms that may not be available

to a Coastal Management Program to advance science-informed sea-level rise; and it allows multiple state agencies to offer consistent guidance and direction to local governments.

◆ **Community-based Resilience Planning** - In many of the states, there is a strong recognition of the value of engaging communities in sea-level rise and climate change resilience planning. Community-based resilience planning approaches, such as guidance developed in California, recognize that impacts from changing climate conditions, including sea-level rise, have broad multi-sector impacts that will affect the whole fabric of a community. This approach also recognizes that certain populations are especially vulnerable to changing climate conditions given social conditions and that planning processes need to address the needs of those populations.

◆ **Partnerships with academic institutions** - Academic collaboration on climate resiliency occurs in most of the states reviewed for this project either through a direct requirement that tasks universities with developing the climate science, guidance or tools, or through participation on various working groups.

**Lessons Learned and Relevance for the Coastal Resilience Framework:**

- Experiences of the states included in this study point to overarching leadership at the senior levels of government as an essential element of advancing comprehensive science-informed climate adaptation efforts, including sea-level rise.

**Background:** In October, 2022, the Government of Prince Edward Island released its first Climate Adaptation Plan. *Building Resilience: Climate Adaptation Plan* provides a concrete roadmap for the province to better prepare for the future while improving equity and resilience through lessening climate change's impacts on Islanders. The new resiliency plan builds on PEI's Climate Change Action Plan (2018-2023) and a 2021 comprehensive provincial Climate Risk Assessment. It also incorporates new and more ambitious climate change objectives through the 2040 Net Zero Framework. The Department of Environment, Energy and Climate Action is completing Critical Infrastructure Vulnerability Assessments (CIVAs) for coastal public infrastructure. Progress and accountability on the Climate Adaptation Plan will be reported annually through the *Minister's Report on Climate Change Risks and Progress Towards Targets*.

[https://www.princeedwardisland.ca/sites/default/files/publications/building\\_resistance\\_climate\\_adaptation\\_plan\\_oct\\_2022.pdf](https://www.princeedwardisland.ca/sites/default/files/publications/building_resistance_climate_adaptation_plan_oct_2022.pdf)

### Details of the Integrated Coastal Management and/or Coastal Resilience Framework

- The actions outlined in this plan - supporting vulnerable populations, primary industries, and natural habitat – offer PEI a solid roadmap for becoming a more resilient province.
- Twenty-eight adaptation actions are distributed across six themes:
  - (1) *Disaster Resilience & Response* (e.g., develop a Coastal Flood Warning System);
    - (2) *Resilient Communities* (e.g., create a Provincial Land Use Plan; there is no current provincial land use plan or policies to guide future development or changes regarding land use);
  - (3) *Climate-Ready Industries* (e.g., partner with industry to respond to climate risks of farm, fishing and tourism sectors);
  - (4) *Natural Habitat & Biodiversity* (e.g., adopting nature-based solutions to coastal hazards to assist with water management and for public infrastructure and areas);
  - (5) *Knowledge & Capacity* (e.g., public awareness of climate impacts and personal adaptation actions; municipalities identified capacity building and knowledge as essential to strengthening communities, as well as a willingness to use innovative tools to drive this work); and
  - (6) *Mental Health & Well-being* (e.g., support for mental health in our new climate reality).
- The plan also makes a commitment to five guiding principles: 1) achieve equitable outcomes, 2) leverage ways of knowing, 3) advance reconciliation, 4) work together, and 5) be ambitious.
- Accordingly, the Province will:
  - Introduce new province-wide policies and regulations to limit activities and future development in coastal areas to reduce the vulnerability of homeowners and businesses while protecting coastal habitat and storing carbon;

- Develop an awareness campaign on how many insurance plans do not cover coastal flooding and erosion, and the accompanying financial risks;
- Provide support for businesses and homes to relocate outside of the coastal area if impacted by a weather event; and
- Work with the real estate and construction industry to provide clearer information on coastal hazards before purchasing or developing a property.

**Benefits of Integration, Collaboration, and Resilience Planning:**

- Property owners are looking for lasting and affordable ways to minimize risks. Unfortunately, in many places, installing traditional hard armouring on coasts has resulted in the degradation of coastal habitat, the loss of public sandy beaches, and accelerated erosion of adjacent properties.
- In recent years, alternatives to conventional armouring have been receiving attention as nature-based solutions are more sustainable and affordable options for existing properties at risk.
- A land use plan can prevent development in places that may experience hazards such as erosion and flooding. Land use planning can also help protect natural areas that remove carbon or function as nature-based solutions to erosion or flooding.
- In securing our landscapes and services, nature-based solutions are the first consideration. Nature can help conserve landscapes and infrastructure, as well as assist with mental health and well-being.
- Municipalities play an essential role in building stronger communities and reducing the impacts of climate change. Municipalities have partnered with the Province to complete critical infrastructure assessments, emergency management plans, and climate change strategies.
- Limiting development in hazardous coastal areas protects ecosystems and avoids property damage.

**Lessons Learned and Relevance for the Coastal Resilience Framework:**

- Building resilience requires that we better plan for disasters and response, build more resilient communities, shift our industries, support our health and mental well-being in this new climate reality, protect and enhance our natural systems, and expand our knowledge and capacity to tackle what lies ahead.
- Building resilience cannot be accomplished without coordination between residents, communities, and all levels of government.
- PEI’s Climate Adaptation Plan was created in collaboration with all provincial departments, as well as with community partners, industry, and Island residents.
- The Climate Adaptation Plan is a whole-of-government strategy. Government is increasingly incorporating climate adaptation into planning and program delivery.
- Climate change will impact natural systems, but harnessing natural systems can also improve our resilience to climate change. Our relationship with nature needs to shift, and we must take bold steps to preserve biodiversity and ecosystem functions.

- In Canada, national codes (i.e., National Building Code, Canadian Electric Code, and National Fire Code) have traditionally been based on historical climate data. Over the past five years, work has been done to update these codes to consider climate hazards.
- More robust systems, infrastructure, emergency response capacity, and ecosystems can help us become more resilient.

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## **APPENDIX C – LEGISLATION AND POLICY REVIEW**

<b>TOOL</b>	<b>COUNT</b> N=86
<u>Legislation</u>	<u>28</u>
Policy	9
<u>Program</u>	<u>19</u>
Strategy	7
Agreement	7
Priority	7
Other	9

**Types of “tool” identified in scan**

<b>SCALE (JURISDICTION)</b>	<b>COUNT</b> N=86
International	1
Binational	15
First Nation	0
<u>Federal</u>	26
<u>Provincial</u>	25
Conservation Authority	7
Regional	0
Municipal	3
Site	0
Other	9

**Scale (jurisdiction, scope) of tools**

# Great Lakes- Integrated Coastal Planning and Management

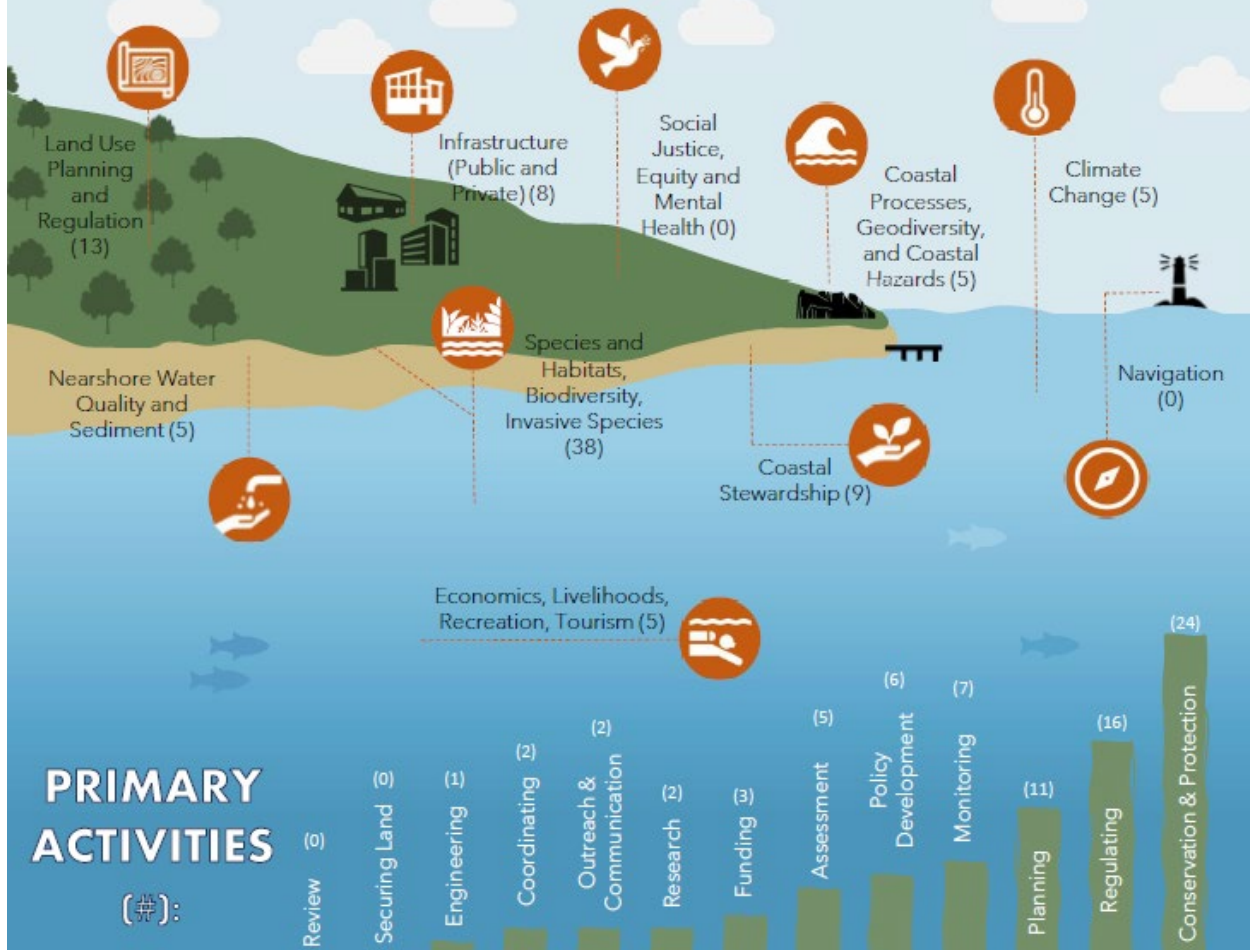
A POLICY, PROGRAM, AND LEGISLATION SCAN

A SUMMARY OF **88** INPUTS FROM 9 AGENCIES IDENTIFYING KEY TOOLS AND ACTIVITIES TO ADDRESS INTEGRATED COASTAL ZONE PLANNING AND MANAGEMENT. RESULTS ARE REFLECTIVE OF THOSE WHO RESPONDED TO SURVEY.

## TOOL TYPE:



## KEY COMPONENTS:



Info Graphic on Tools and Primary Activities