NOVA SCOTIA | UPLAND

A GUIDE FOR MUNICIPALITIES

COASTAL PROTECTION AND MUNICIPAL LAND USE BY-LAWS



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This guide and the example Municipal Planning Strategy and Land Use By-law text were prepared by UPLAND Planning + Design for the Province of Nova Scotia.

"UPLAND is an award-winning land use planning, engagement, and design services firm that works with rural and urban municipalities and other public sector clients across Atlantic Canada.

UPLAND is committed to delivering tangible planning and design solutions that are rooted in a sense of place and are built on a foundation of local expertise and support, a collaborative working approach, and in the creative application of innovative planning and design principles.

In all our years of working with communities around the province—from small to large, rural to urban —one of the most consistent themes we hear is the importance of the coast to the collective identity and culture of Nova Scotians. The coast both binds us together, and shapes each community in unique ways. It is a pleasure to support municipalities with tools to inform coastal municipal land use planning. Thank you to all of the staff and elected officials who helped make this work possible through your generous contributions of time, ideas, and experiences."

Ian Watson, Partner and Senior Planner, UPLAND Planning + Design

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MINISTER'S MESSAGE

Nova Scotians are coastal people. The ocean has shaped our communities, economy, livelihoods, culture, food, and who we are as a people. As coastal people, we know that our beaches, dunes and shoreline are ever-changing....shaped by the ebb and flow of tides, storms, wind and the earth's changing climate.

Global climate change is impacting all parts of our planet — wildfires, stronger storms, rising sea levels, drought and more. For many, that means rethinking how, and where, they live. Thankfully, there are ways to make communities, homes and infrastructure resilient to climate change. Here in Nova Scotia, that means taking steps to know the potential impacts to your property and then mitigating those impacts. For example, knowing your geology is key as areas with hard rock, like granite, are less subject to erosion compared to areas with soft rock, like shale, clay or sand. Building higher and further back from the coast is safer than building at sea level close to the water. Leaving a buffer of trees, shrubs and other vegetation between the ocean and the built environment is a relatively inexpensive — not to mention beautiful — way to protect homes and communities.

The Government of Nova Scotia has developed a number of tools and resources to help coastal communities and property owners make informed decisions. In February 2024, we released *The Future of Nova Scotia's Coastline: The plan to protect people, homes and nature from climate change along our coast*, which has 15 actions for property owners, municipalities and the Province to take to safeguard our coastal homes, communities and natural areas. Action 8 in this plan is a commitment to support municipalities with example land-use by-law content that they can use to regulate coastal protection in their communities. We are pleased to now share this example by-law text with municipalities.

One of the most effective ways to protect coastal homes and communities is through climate-informed zoning and land-use planning. The Province recognizes municipal jurisdiction for zoning and land-use planning. We also know it can be a big job especially as Nova Scotia continues to grow, so we will continue to support municipal leadership every step of the way in creating climate-resilient communities.

This example by-law content was developed by Upland Planning and Design Studio, a Nova Scotia company and recognized leader in innovative planning and design strategies. As part of their work to make these example by-laws responsive to the needs of municipalities and Nova Scotians, Upland did extensive consultation with municipalities. The end result is a comprehensive and practical tool that municipalities can use to regulate development so that communities are resilient, sustainable and still allow for a high-quality, coastal way-of-life for the people of our province.

Nova Scotia is changing. Our population is growing and becoming more diverse. Our climate is changing. We are advancing new opportunities to grow our economy. We are transforming how we produce and use energy, and much more. Our coastline will continue to change too. However, we have the data, tools and resources to design and build communities that are climate-resilient; and together we can navigate the impacts of climate change and create a sustainable province and maintain our coastal way of life.

The Honourable Timothy Halman
Minister, Nova Scotia Environment and Climate Change



1. INTRODUCTION

BACKGROUND

In February of 2024, the Province of Nova Scotia released *The Future of Nova Scotia's Coastline* (the "Coastal Protection Action Plan"), which contains 15 actions to protect people, homes, and nature from climate change and to help municipalities and property owners make informed decisions about coastal development.

Action 8 of the Coastal Protection Action Plan is to:

> *"Support municipalities with example land use by-law content they could use to regulate coastal protection in their communities. By providing example land use by-law text, we can offer municipalities the flexibility to take the best approach to coastal protection for their communities, with measures that reflect the concerns of their residents."*

WHAT IS THIS GUIDE?

This guide provides supporting information and a decision-making framework to help municipalities navigate the process of determining which approaches to coastal protection are suitable for their context. It includes links to example municipal planning strategy and land use by-law content that your municipality can use to incorporate coastal protection into your planning documents.

MUNICIPAL PLANNING STRATEGY

A municipal planning strategy is the overarching "blueprint" for municipal land use planning. It contains the background information, context, and high-level policies that a municipal council has established for land use planning in their municipality.

LAND USE BY-LAW

A land use by-law is one of the key implementing tools for the policies set out in the municipal planning strategy. The land use by-law contains zoning and regulations that shape how land is used and where buildings are located.

WHO IS THIS GUIDE FOR?

The primary audience for this guide is municipal staff, including planners and sustainability coordinators, who will be responsible for doing the legwork of researching and developing coastal land use policies and land use by-law regulations to present to the public and their council. However, this guide is designed to be accessible to a wider audience, which includes the public and members of municipal councils. This guide can be used in whole or in part to inform staff reports and public engagement activities regarding municipal coastal land use planning.



HOW TO USE THIS GUIDE & EXAMPLE TEXT MODULES

This guide and the linked example municipal planning strategy and land use by-law text are intended to be a flexible resource to help municipalities in Nova Scotia establish coastal land use planning that is tailored to their context. The guide and example text have, therefore, been structured to be modular.

> **SECTION 2** of this guide includes a discussion of context and a link to example introductory text you can use in your municipal planning strategy to describe your municipality's broad approach to coastal planning. It also includes discussion about priority-setting in your municipality. It is designed to help you address questions such as which coastal issues are important to residents and your council, and which are not applicable or are not a priority.
>
> **SECTION 3** of this guide covers some of the administrative aspects that are necessary to consider for effective coastal land use planning. How you approach administration will likely depend on the internal resources in your organization and the external resources (e.g. professional services) available in your community or region.

The remaining sections are topic specific. Each section covers an introduction to the coastal issue under discussion and potential approaches to land use policy and regulation.

The appendices include detailed information about useful data sources and about some of the science of climate change, modelling, and coastal flooding.

Each section of this guide includes reference links to "example text modules". These contain preamble, municipal planning strategy policies, and land use by-law provisions that you can use or adapt to implement your municipality's preferred approach to coastal land use planning. These are meant to be flexible; while they provide a functional policy and regulatory framework, you should also feel free to modify and adapt them as necessary. In many cases the example text modules include "fill-in-the-blank" portions that must be completed to tailor the content to your community and chosen approach. This might include places to write about the specific context of your community, or places to list the specific numerical values (e.g. vertical elevation) your council adopts. The 'fill-in-the-blank' portions of the example text are identified with the following formatting: [fill in this text].

Finally, many of the text modules have "options" that can be used depending on your municipality's preferred approach. The overarching policy or regulation module is identified by single digit (e.g. L1), with different sub-options that can be "plugged in" identified by a second digit and possibly a letter (e.g. L1.1 or L1.1A).

LEGAL REVIEW

As with any municipal regulation, municipal planning documents must be consistent with legislation and defensible from a legal perspective. You are encouraged to work with your municipal solicitor during the drafting and adoption of municipal planning strategy policies and land use by-law regulations related to coastal development.

INCORPORATING CLIMATE CHANGE

A challenge when talking about coastal issues is that many coastal hazards are expected to become worse in the future due to climate change. However, no one can perfectly predict the future, so determining how much worse, when, and where depends on projections. Scientists use their best understanding of climate physics, past climate trends, and assumptions about how humans will respond to the threat of climate change to build models and make predictions about sea level rise and other climate impacts.

Due to the complexity of the world, models can never be truly perfect; there will always be some uncertainty in any model. However, they are still extremely useful in thinking about what will likely happen in the future. There is also the issue that there is not one single model, but many. This is because our understanding of the science and data is evolving, and because models must make assumptions about the future, which vary from model to model. A more detailed discussion of modelling and uncertainty can be found in Appendix A.

The result is that there is no one “right” approach, and specific standards (e.g. minimum vertical elevation) can vary from community to community based on local risk tolerance, council priorities, and assumptions about climate change. Nova Scotia’s various segments of coastline also have many differences among them that can affect how coastal dynamics play out. Things like exposure (or lack thereof) to wave action or the local range of tides will mean the specifics of land use by-law regulations can differ, for example, between the Bay of Fundy and the Strait of Canso.

A difference in approach to coastal development among communities is, therefore, okay. The important thing is to communicate through your municipal planning strategy your municipality’s risk tolerances, assumptions, and priorities so that the reason for differences among municipalities are clear instead of appearing arbitrary.



2. CONTEXT AND PRIORITIES

COMMUNICATING CONTEXT

A municipality's municipal planning strategy lays out, through preamble and policy, the intent and context for the regulatory approach that municipal council has implemented in their land use by-law. At a minimum, it must explain the *"what"* of the regulatory approach. If there is ever an unclear situation with the land use by-law or a land use by-law regulation is disputed, this clear explanation helps the Development Officer and the boards and courts who review planning appeals understand what the intent of the regulation was. Ideally, a municipal planning strategy should also include the *"why"*, to help affected property owners and future municipal councils and staff understand the need for the regulation. Finally, when it comes to coastal topics, it is extremely helpful to include *"how"* the land use by-law regulations were developed – the assumptions, projections, and risk tolerances that went into establishing the specifics of the land use by-law regulations. This helps provide transparency and confidence in the land use by-law regulations, helps users understand the difference in approaches taken by neighbouring municipalities, and will allow future municipal councils and planners to more easily update the land use by-law regulations based on new data or shifting understanding of climate impacts.

Example text module M1 includes basic introductory text that sets the stage for the remaining policy.

IDENTIFYING PRIORITIES

Fundamentally, regulation is about managing risk and balancing it with potential benefits. In the case of coastal development, risks include risks to human health and safety, economic loss, and environmental damage (see below). On the other side of the equation, many people experience joy from being close to the ocean, and many economic activities and culturally significant activities in Nova Scotia depend on access to the coast. Decisions about the types of activities and development that are permitted in coastal areas should consider this balance.

KEY RISKS TO CONSIDER

Health and Safety:

- Injury or loss of life from falls, collapsing infrastructure, or floodwaters.
- Isolation caused by damaged transportation infrastructure.
- Harm to emergency services personnel.
- Saltwater intrusion into potable water sources.
- Exposure to sewage and other environmental hazards from damaged infrastructure.
- Navigation hazards from debris.

Economic:

- Replacement or repair costs for damaged or destroyed buildings and infrastructure. As the nature and value of coastal development changes (e.g. a shift from small cottages to large, year-round homes) this risk increases.
- Lost time due to damaged transportation infrastructure.
- Loss of economic drivers, such as fishing infrastructure, beaches, trails, and tourist infrastructure.

Environmental:

- Release of contaminants from damaged buildings or infrastructure, such as oil tanks and septic tanks.
- Damage to natural habitats due to construction of defensive infrastructure.
- Disruption of natural processes, such as beach sand replenishment.

The early stages of creating a local coastal development framework should include discussions with your residents and your council about which risks are a priority to address, and which benefits need to be considered or preserved. The results of these discussions will inform the types of land use by-law regulations that are appropriate for your municipality, and how strict or relaxed those land use by-law regulations should be.

Example text module M1 includes sections where you can describe the broad issues that your residents and council considered and prioritized for coastal land use planning.



3. ADMINISTRATIVE CONSIDERATIONS

VERTICAL DATUMS

To accurately and easily compare vertical measurements, such as elevation, they must all be measured using the same vertical datum. An explainer on vertical datums can be found in Appendix 'A'.

Unless otherwise noted, this guide uses the Canadian Geodetic Vertical Datum of 2013 (CGVD2013). This has been the standard in Canada since 2015 and is recommended for use in your planning documents. However, CGVD1928 is also still widely in use, and may be used instead. Regardless of the datum used, your planning documents **must** communicate the applicable datum for any vertical elevations to have meaning. This can be done with example text module L3.

DEFINING THE COAST

One of the challenges of coastal regulation is defining where the "coast" ends. From a regulatory perspective, when does a river or estuary become the coast? Coastal dynamics are complicated and depending on local factors can sometimes reach far inland. For example, the Shubenacadie River is tidal as far as 30 kilometres inland from its mouth. On Cape Breton Island, the Bras d'Or Lake is both tidally influenced and large enough to be meaningfully affected by storm surge and wave action. Natural landscapes such as salt marshes and barrachois ponds may be located landward of what would typically be considered the "coastline", but also play an important role in buffering against wave action and coastal flooding.

The answer to where the coastal boundary is defined may also change depending on what specific coastal hazard or issue is being discussed. While tidal (and thus sea level rise) influence can reach far inland, exposure to wave action and its effects on erosion are typically most impactful at the ocean's edge.

Like many aspects of coastal land use planning, there is no single "right" answer to defining your coast. However, it is important that your planning documents clearly indicate where the cutoff has been made to avoid any potential confusion about whether land use by-law regulations for coastal development apply to a particular piece of land or not. This could be labelled specifically on maps or described in the text of your land use by-law.

SOME KEY FACTORS TO CONSIDER WHEN DEFINING YOUR COAST:

- Any physical features, such as waterfalls or weirs, that put a hard boundary on coastal influence
- Any areas where existing inland flood mapping creates regulatory limitations similar to, or stricter than, potential land use by-law regulations for coastal development
- Any easily identifiable features, such as bridges, that provide a clear point of reference to separate areas considered to be coast from areas that are excluded from the definition of coast
- The boundaries of natural coastal buffers, such as coastal wetlands, salt marshes, and barrachois ponds
- The municipality's overall approach to risk when it comes to coastal regulation

In situations where there is no clear dividing line you may wish to establish a standardized approach, such as establishing cutoffs a specific distance upriver or when rivers narrow to a specific width.

Example text modules M2 and L4 provide preamble, policy, and land use by-law regulations for defining your municipality's coastal planning area.

APPROACHES TO IDENTIFYING AFFECTED LANDS

Implementation of coastal land use planning depends on identifying the lands to which any land use by-law regulations apply. This helps landowners and the Development Officer easily interpret when land use by-law regulations need to be considered or when they can be ignored as not relevant to a specific proposal. This can be done in a few different ways, each with benefits and challenges as explained below. Your municipality may also use more than one approach, with different approaches used for different coastal hazards (e.g. coastal flooding versus coastal erosion).

OVERLAYS

This approach creates a separate set of maps, or "overlays", to spatially identify applicable lands. The overlay applies on top of any regulations imposed by the underlying zoning.

PROS:

- Overlays are created for a specific purpose (e.g. defining coastal areas) so can be applied without needing to consider the suitability of different land uses, lot sizes, etc. for different segments of the coast.
- Overlays can be selectively applied based on known characteristics of different segments of the coast or different community priorities for each segment of the coast.
- Depending on how land use by-law regulations for coastal areas are structured, overlays may eliminate the need to involve qualified professionals (e.g. surveyors) to determine where land use by-law regulations apply.

CONS:

- Since overlays are separate from zoning, it can be easier for landowners to miss them.
- If the overlay boundary is based on underlying data (e.g. vertical elevation or distance from the coast) the accuracy of the boundary depends on the precision of the data source used to define that boundary.
- The overlay boundaries may need to be updated over time to reflect changes in the physical coastline (e.g. as a result of erosion).

If this approach is used, please see example text modules M2.2B and L4.1A.



ZONING

This approach applies land use by-law regulations for coastal development via a specific land use zone or zones on the zoning map of your land use by-law. Much like zoning for "residential" or "industrial", your land use by-law could include a "coastal" zone.

PROS:

- It is harder for landowners to miss the land use by-law regulations that apply to their land. If people are reviewing land use and development regulations for their land, typically the first thing they will check is the zoning.
- Zoning can be selectively applied based on known characteristics of different segments of coast and/or different community priorities for different segments of coast.
- Depending on how land use by-law regulations for coastal areas are structured, zoning may eliminate the need to involve qualified professional (e.g. surveyors) to determine where land use by-law regulations apply.

CONS:

- Zoning also controls things like permitted uses, minimum lot sizes, and maximum building sizes. What is appropriate in terms of things like permitted uses may vary along different segments of the coast. For example, one segment of coast may be mostly residential in nature, while another may be industrial; a single "coastal" zone might not be flexible enough to accommodate both scenarios.
- If the zone boundary is based on underlying data (e.g. vertical elevation or distance from the coast) the accuracy of the boundary depends on the precision of the data source used to define that boundary.
- Zone boundaries may need to be updated over time to reflect changes in the physical coastline (e.g. as a result of erosion).

If this approach is used, please see example text module M2.2A and L4.1B.

TEXT PROVISIONS

In this approach the coastal area is described textually, such as 'all areas below a specific elevation' or 'all areas within a certain horizontal distance of the coast'.

PROS:

- This approach does not require GIS mapping capacity.
- The text description clearly communicates the physical thresholds (e.g. elevation or distance) that define coastal regulatory areas.
- Because the coastal area is defined in relation to physical features, it automatically adjusts as those coastal features change (e.g. as the coastline erodes or expands).

CONS:

- Landowners may not read all the text of the land use by-law, so the text can be easier for landowners to miss than zoning.
- Without further visual data or information, landowners may be unclear as to whether their property falls in this category or not. For example, they may not know the elevation of their land. If they do it is likely in relation to chart datum rather than the specific vertical datum used in the municipality's land use by-law and thus difficult for a lay person to compare.
- On-site verification by a qualified professional may be required in any situation where applicability is unclear or could be disputed, which requires time and cost for the applicant.

If this approach is used, please see example text modules M2.2C and L4.1C.



DEVELOPMENT AGREEMENTS & SITE PLAN APPROVAL

The *Municipal Government Act* includes development agreements and site plan approval as potential tools to regulate land use (see below). If these are to be used, they must be enabled in both your municipal planning strategy and land use by-law.

Development Agreement

A written legal agreement between a municipality and a property owner establishing specific lands uses and densities, building designs, and site layouts permitted on a property. This allows municipal council to have a finer-grained level of management over a proposed development, and to implement specific measures to mitigate potential impacts. Once approved, the agreement is a legally binding contract that is registered on the property and carries with the land (i.e. binds future owners). It is in effect until discharged by the municipality.

Site Plan Approval

This tool falls between standard "as-of-right" development approvals and development agreements. Under this tool, a specific site plan forms part of the approval, tying the development to the proposed design. Unlike development agreements, site plan approval is administered by the Development Officer, without the involvement of the municipality's council or the public. However, an approved site plan is appealable by property owners within a specified distance of the site.

Most things that can be regulated by development agreements can be regulated directly by the land use by-law. However, development agreements can have some advantages when:

- public engagement in a development proposal is desired;
- there is a need to consider the site-specific context of a proposed development regarding things like traffic generation, servicing, and environmental risks; or
- a development is very large and complex

The downside of this tool is the time and administrative burden for the applicant, the municipality, and the community to create and adopt a development agreement. When changing your planning documents, the process involves public engagement to develop new requirements as per your Municipality's Public Participation Policy. Having clear and consistent regulations in the land use by-law can mean additional engagement and regulation through a development agreement is not necessary.

Site plan approval can have advantages when there is a need to identify a specific layout for the proposed development, there is a need to have a clear record of on-site conditions (e.g. the location of vegetation or other natural features) at the time of development, or there is a desire to provide a mechanism for flexibility based on the qualitative aspects of the development.

This guide and the example text modules are based on regulating directly in the land use by-law. However, there may be some situations where your municipality's approach to exemptions or flexibilities for development on the coast could justify using a development agreement or site plan approval approach. An example might be flexibilities in downtown waterfront areas, subject to detailed flood proofing standards. In such a situation your municipality may wish to have a mechanism to review and approve a specific building design or site layout, and to hold the landowner to that specific design.

VARIANCES

Section 235 of the *Municipal Government Act* enables the Development Officer to grant variances (i.e. flexibility) of certain requirements in the land use by-law in some situations. This includes variances to "size or other requirements relating to yards". If your municipal planning strategy and land use by-law say so, the Development Officer can also grant variances to the "ground area […] of a structure".

Importantly, the Development Officer may not grant a variance that violates the intent of your municipal planning strategy. Land use by-law regulations related to horizontal distances and the floor area of a structure in coastal areas should, therefore, be specific about whether your council intends for them to be eligible for a variance or not.

SUBDIVISION

The creation of new lots is addressed by a municipality's subdivision by-law. Municipal subdivision by-laws are required to be consistent with, or more stringent than, the Nova Scotia *Provincial Subdivision Regulations*. The result is that most municipalities have either adopted the Regulations directly or have created a modified version of them. As part of your municipality's subdivision procedures, you may wish to include an advisory stamp on approved plans of subdivision in coastal areas warning subdividers that the land use by-law may contain applicable coastal development regulations.

QUALIFIED PROFESSIONALS

The example municipal planning strategy and land use by-law text modules include instances where a "qualified professional" may need to be involved. This includes confirmation that as-built development complies with the land use by-law regulations, and situations where flexibilities in the land use by-law regulations can be considered (such as "floodproofed" development). Depending on the applicable coastal topic and on the local availability of professionals, this might include surveyors, landscape architects, and/or engineers practicing in specific disciplines. You may want to work with your municipal solicitor to specifically identify within your land use by-law the professions your municipality considers as "qualified" to prepare specific studies or designs.



4. COASTAL FLOODING

CONTEXT

Nova Scotians are well acquainted with the power of the ocean and the coastal flooding that can occur during a large storm. The ultimate extent of coastal flooding depends on several factors:

- storm surge
- wave run up
- coastal subsidence
- sea level rise

Background information about each of these factors can be found in Appendix B.

The *Municipal Government Act* contains the Statement of Provincial Interest ("SPI") Regarding Flood Risk Areas (https://novascotia.ca/just/regulations/regs/mgstmt.htm). This Statement requires municipal planning documents to consider "locally known floodplains" and to implement specific restrictions on development within those floodplains. Such locally known floodplains include coastlines and estuaries mapped under Nova Scotia's Municipal Flood Line Mapping Program. More specifics on the Municipal Flood Line Mapping Program can be provided by reaching out to the Nova Scotia Department of Municipal Affairs.

DEVELOPING LAND USE BY-LAW REGULATIONS TO REDUCE RISKS FROM COASTAL FLOODING

ESTABLISHING AFFECTED AREAS

A primary source of data for municipal coastal flood areas is the Municipal Flood Line Mapping Program. Using this mapping will help your planning documents be consistent with the Statement of Provincial Interest Regarding Flood Risk Areas.

Municipal Flood Line Mapping Program mapping is considered "known floodplains" (current scenario 1 in 20 and 1 in 100 flooding). Therefore, planning documents should be, at a minimum, reasonably consistent with the Floodway Fringe provisions of the SPI for these mapped areas. Municipalities can decide to use the 2050 or 2100 maps if so desired to reduce flood exposure over a longer timeframe.

For areas that have Municipal Flood Line Mapping Program mapping, please refer to example text modules M3.1A and L5.1A.

However, there are coastal areas that are not yet mapped under the Municipal Flood Line Mapping Program. In these areas your municipality may wish to establish a minimum vertical elevation below which certain regulations within your land use by-law will apply. Your municipality may also wish to be more stringent than the Municipal Flood Line Mapping Program mapping, and similarly may wish to establish a minimum vertical elevation based on locally made decisions about risk tolerance and climate change projections.

Custom Development

Fundamentally, vertical elevations for potential coastal flooding can be determined with the following equation:

(minimum vertical elevation) = (HHWLT*) + (storm surge) + (expected relative sea level rise)

***Higher High Water Large Tide (HHWLT)**

The 19-year average of the highest predicted tide for each year.

Wave run-up could also be included; however, the very site-specific nature of wave run-up makes determining a value for municipality-wide regulatory purposes extremely challenging.



HHWLT: Obtained from tidal gauge records in your area.

Storm surge: Storm surges are caused by meteorological effects on sea level, such as wind set-up and low atmospheric pressure, and can be defined as the difference between the observed water level during a storm and the predicted astronomical tide. In creating custom data, a return period needs to be selected (e.g. 1 in 20, 1 in 100, or 1 in 200).

The storm surge level can be derived from long-term tidal gauge measurements for your area, and/or modeling.

Expected relative sea level rise: Most recent projections of sea level rise are based on the emissions scenarios developed by the Intergovernmental Panel on Climate Change's Fifth Assessment Report ("AR5", released in 2013) or the Sixth Assessment Report ("AR6", released in 2021). A straight-forward source for IPCC sea level rise projections, corrected for local subsidence, can be found within the CAN-EWLAT tool described in Appendix 'D'. While the tool does not include all possible versions of the IPCC's emissions scenarios, it does include three scenarios based on AR5 and three scenarios based on AR6 – providing a range of scenarios from less conservative to more conservative, which your council and community members can explore. Typically, sea level rise projections for the year 2100 are currently used for coastal land use regulation since this provides a decent balance between model uncertainty (which gets larger the further out in time you project) and ensuring development remains lower risk over a reasonable lifespan (75 years).

If your municipality develops a customized vertical elevation, please refer to example text modules M3.1B and L5.1B.

LAND USE BY-LAW REGULATIONS WITHIN THE VERTICAL ELEVATION

Once your municipality has established coastal flood areas, it must establish the land use by-law regulations that will be applied within those areas. These land use by-law regulations can take a few different approaches, such as those described below. For known flood areas (including the areas mapped under the Municipal Flood Line Mapping Program), municipalities should, at a minimum, require developments to be flood proofed and not permit residential institutions and uses associated with the warehousing or production of hazardous materials. This is a provision under the Statement of Provincial Interest Regarding Flood Risk Areas.

Prohibition

This approach would prohibit all development, except any specifically noted exceptions. This approach reduces health and safety risks, environmental risks, and economic risks.

Example text modules M3 and L5.2A apply to this approach.

Targeted Prohibition

This approach would generally allow development, but place limitations on specific land uses that your municipality considers higher risk based on human health and safety or the environment. Potential land uses to restrict could include:

- institutional housing for vulnerable populations (e.g. nursing homes and residential care facilities), where evacuation during high-flooding periods would be challenging;
- "habitable" development, such as dwellings and tourist accommodations, where human health and safety could be put at risk in a flood situation; and/or
- industrial uses, any use associated with the warehousing or production of hazardous materials, or other similar uses that could cause environmental damage in the event of a flood

Example text modules M3 and L5.2B apply to this approach.

Floodproofing

This approach would require developments to be "floodproofed" up to the minimum elevation, either by elevating the building itself or by ensuring any openings to the building and high-risk infrastructure (e.g. electrical infrastructure) are above the minimum elevation. Regulating the latter approach through land use planning documents can be challenging though, especially any aspects of the development internal to the building (e.g. the location of electrical infrastructure).

Example text modules M3, L5.2C, and L6 apply to this approach.





5. COASTAL EROSION

CONTEXT

Nova Scotia's coastline is always changing. Wave action, storm surge, rivers, overland stormwater (e.g. rain runoff), and human activities all combine to reshape our shores on a regular basis. Sometimes this happens as a slow, continuous process. Other times it can happen in one big event with multiple metres of shoreline lost in a single storm.

Coastal erosion is a natural and important process, providing the sediment that builds beaches and new coastlines and feeds coastal marshes and other habitats. However, it also can conflict with human development, which is typically fixed in place.

The rate that coastal erosion happens varies widely along each coast depending on the underlying geology, exposure to wave action, the amount and type of vegetation, the extent and thickness of winter sea ice, and the scope of any human-made infrastructure or land disturbance. In Nova Scotia, average erosion rates can vary from essentially zero to more than a metre per year.

ESTABLISHING A REGULATORY APPROACH TO COASTAL EROSION

Fundamentally, regulation relating to coastal erosion is intended to allow the coast to naturally erode without threatening the use of whatever development occurs along the coast. Therefore, development should be set back far enough from the top of the bank to allow a reasonable lifespan of use based on local erosion rates. There are two main approaches your municipality can take to coastal erosion regulation: develop local erosion data or establish a precautionary horizontal buffer.

Develop Local Erosion Data

Coastal and geomatics professionals can determine coastal erosion rates through a variety of methods. A relatively simple method that is commonly employed is to digitally trace the coastline over a series of historic air photos and then use the measured change in the coast between photos to calculate the average yearly erosion rate. This does have some downsides because there is no guarantee the geology of the current exposed coastline is the same as previous coastlines that have already eroded, so the erosion rate may change. However, on the scale of municipal regulation this can be an appropriate approach.

More complex methods can use understandings of the local geology to model expected erosion.

Your municipality could engage a professional to develop projections for the expected amount of erosion over a specific time period (the length of which would depend on your municipality's chosen approach to risk) along different segments of coast and then use that to limit development within areas that are expected to erode.

If you use this approach, please see example text modules M4.1A and L7.



Precautionary Horizontal Buffer

Absent specific erosion data, another potential approach is to establish a precautionary horizontal buffer from the top of bank. This approach is based on choosing a single horizontal buffer distance that meets your municipality's and residents' tolerance for risk. In choosing a buffer distance there is a balance to be made between reducing risk and the impact it has on the reasonable developability of land. For example, a large horizontal buffer reduces risk, even on highly erodible properties, but may be overly stringent on coastlines that barely erode at all. A small horizontal buffer allows for reasonable development of coastlines that only erode slowly but may not provide sufficient protection to properties that are eroding quickly. To illustrate: a 10-metre buffer provides 100 years of protection for a property that erodes at a rate of 0.1 metre per year, but only 10 years of protection for a property that erodes at a rate of 1 metre a year.

One way to mitigate the effects of being overly stringent on slowly erodible properties is to establish a higher precautionary buffer but enable that buffer to be reduced based on on-site study. This provides flexibility, but requires an extra cost and effort for the property owner.

If you use this approach, please see example text modules M4.1B, L7, and L8.





6. EXEMPTIONS

CONTEXT

The goal of land use by-law regulations in coastal areas is to reduce human health and safety risks, environmental risks, and/or economic risks. However, there are some types of development where, by their nature, these risks are lower. There may also be situations where the desire to reduce risk needs to be balanced against other municipal and community goals and values. In those situations, your planning documents may need to include flexibilities.

POTENTIAL EXEMPTIONS

Marine-dependent uses

Many types of development depend specifically on access to the coast and may need to be exempted from vertical elevation controls and/or horizontal buffers to meet their purpose. This could include uses such as marine industry (shipyards, fish sheds, etc.), marinas, boathouses, and marine scientific research structures.

Low-cost development

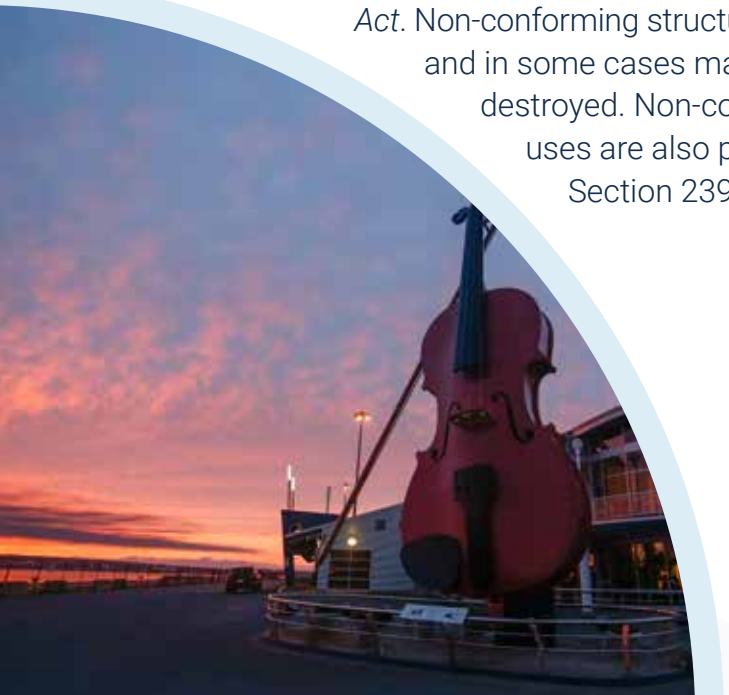
Some development is relatively cheap to replace and can be closed at times when there is a risk to health and safety (e.g. during large storms). In these situations, balancing the expected frequency of damage and the cost to rebuild versus the potential benefit of the development may favour allowing the development. Examples in this category could include developments such as trails and boardwalks, parking lots, small sheds or other small accessory structures, or small tourism-focused structures such as kiosks.

Elevated development or protected development

Other types of development are of high enough value and meet other community goals that it can be worth investing in development approaches that provide protection from the risks of coastal flooding, rather than avoiding the at-risk areas. One example would be development on downtown waterfronts, where such investment may support a community's intensification or revitalization goals, or where investment to support tourism is important. In these cases, approaches such as elevating or flood proofing the development may be a reasonable approach.

Existing development

Many coastal areas in Nova Scotia are already developed. Legally existing buildings and uses that would be impacted by any land use by-law are protected as "non-conforming structures" or "non-conforming uses" under Section 238 of the *Municipal Government Act*. Non-conforming structures and uses are permitted to continue to exist, and in some cases may be reconstructed if they are damaged or destroyed. Non-conforming structures primarily used for residential uses are also permitted to expand in certain circumstance under Section 239 of the *Municipal Government Act*.



Section 242 of the *Municipal Government Act* permits municipalities to further relax these restrictions. Your municipality may wish to do this to ease the burden on existing landowners or to meet other municipal goals, such as encouraging investment in historic districts. Some potential approaches to relaxations include:

- Allowing expansions of existing building if the expansion does not reduce the coastal buffer or does not reduce the building elevation
- Allowing buildings to be moved if they do not end up at a lower elevation or reduce the coastal buffer
- Allowing expansions of a certain sized building footprint or floor area
- Allowing expansions that are "floodproofed"
- Allowing non-residential buildings to be reconstructed if they are destroyed, provided they are "floodproofed"

Undevelopable lots

In some cases, implementing a minimum elevation or a coastal buffer will make existing lots undevelopable. Your municipality may wish to allow some flexibility to allow lower-risk development on existing lots that are otherwise undevelopable due to land use by-law regulations for coastal areas. This could include:

- allowing a reduction of other land use by-law standards that impact developability;
- allowing a small structure; or
- allowing a limited range of uses

Example text modules M5, L9, L10, and L11 address potential exemptions.





7. REFERENCES

1. Natural Resources Canada (2020). *Height Reference System Modernization*. Retrieved on January 10, 2025 from https://natural-resources.canada.ca/sites/nrcan/files/files/pdf/Height_reference_system_modernization_(EN).pdf

2. Richards, W. and Daigle, R. (2011). *Scenarios and Guidance for Adaptation to Climate Change and Sea-Level Rise – NS and PEI Municipalities*. Prepared for Nova Scotia Department of Environment and Atlantic Canada Adaptation Solutions Association

3. National Aeronautics and Space Administration (n/d). *Sea Level*. Retrieved on January 10, 2025 from https://climate.nasa.gov/vital-signs/sea-level/?intent=121



8. APPENDICES

APPENDIX A – A PRIMER ON VERTICAL DATUMS

Distance measurements require a beginning and end point. The place you measure from (i.e the beginning, or "0") is formally known as the "datum line". Traditionally, coastal vertical elevations mattered most for ensuring that ships did not hit the bottom, so the datum line on navigation charts ("Chart Datum" or "CD") was typically set at the elevation of the lowest tide. However, tides can shift over time, and coastal elevation measurements began to be used for things other than navigation charts, such as infrastructure projects; it thus became necessary to establish more complex standards.

In 2015 the Government of Canada adopted the Canadian Geodetic Vertical Datum of 2013 (CGVD2013). This datum uses a gravity-based digital model (a "geoid") to approximate the average surface of the Earth, reducing errors and simplifying the maintenance of the datum.[1]

Many sources for coastal data in Nova Scotia still use a previous datum, the Canadian Geodetic Vertical Datum of 1928 (CGVD1928). The conversion between the CGVD1928 and CGVD2013 depends on location, so Natural Resources Canada has developed a tool for conversion that can be found at: https://webapp.csrs-scrs.nrcan-rncan.gc.ca/geod/tools-outils/gpsh.php?

APPENDIX B – CLIMATE CHANGE AND UNCERTAINTY

Scientists use their best understanding of climate physics, past climate trends, and assumptions about how humans will respond to the threat of climate change to build models and make predictions about sea level rise and other climate impacts. Due to the complexity of the world, models can never be truly perfect; there will always be some uncertainty in any model. However, they are still extremely useful in thinking about what will likely happen in the future. A good model will communicate the range of uncertainty in its outputs.

The various different assumptions about how humans will respond to the threat of climate change are known as "scenarios". The table below describes some of the scenarios modeled under the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (AR5) and Sixth Assessment Report (AR6).

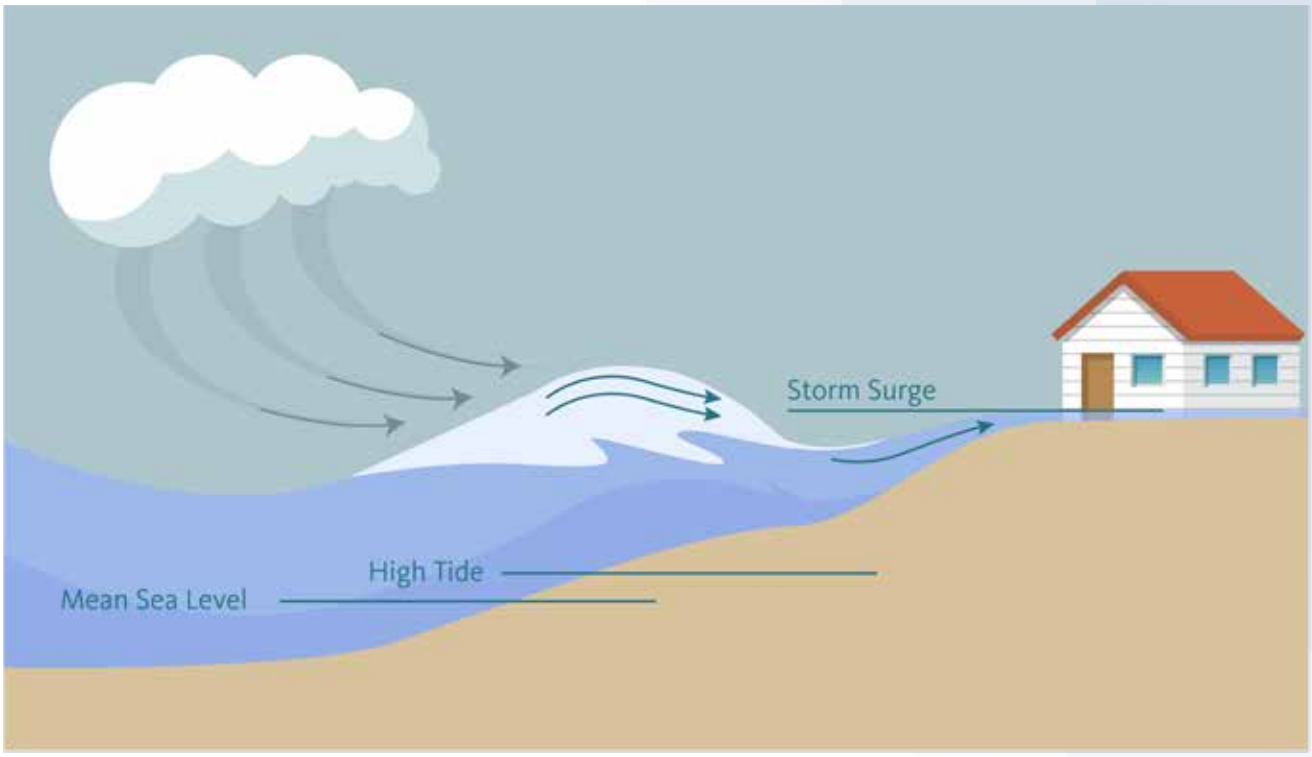
When multiple climate models generate results for the same scenario, percentiles are used to show where the bulk of model results fall and which results are outliers. The 50th percentile indicates the median (middle) of the various model outputs while, for example, the 5th and 95th percentiles indicate the results from lower range or higher range outliers, respectively.

AR5 RCP2.6	"Very stringent" scenario where greenhouse gas emissions begin to decline by 2020 and reach zero by 2100.
AR5 RCP4.5	"Intermediate" scenario where greenhouse gas emissions peak around 2040 and then decline.
AR5 RCP8.5	"High emissions" scenario where greenhouse gas emissions continue to rise throughout the 21st century.
AR6 SSP1-2.6	Emissions decline throughout the 21st century, reaching net-zero by 2075. Global average temperatures are likely to be 1.8 degrees warmer in 2100 than in 1900.
AR6 SSP2-4.5	Emissions continue to increase until mid-century and then decline to almost net-zero by 2100. Global average temperatures are likely to be 2.7 degrees warmer in 2100 than in 1900.
AR6 SSP5-8.5	Emissions continue to increase before peaking near the end of the century. Global average temperatures are likely to be 4.4 degrees warmer in 2100 than in 1900.

APPENDIX C – FACTORS THAT AFFECT COASTAL FLOODING

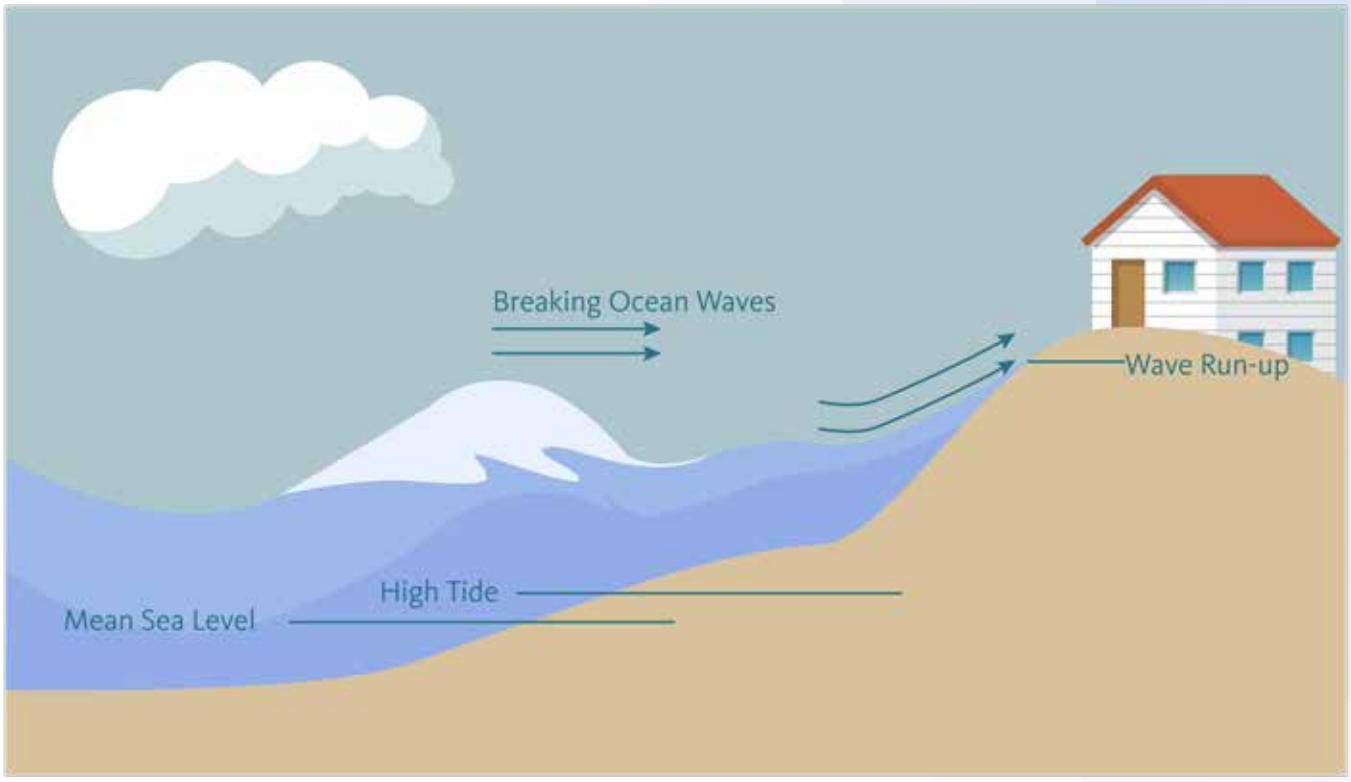
STORM SURGE

A storm surge is an abnormally high water level, and can be defined as the difference between the observed water level during a storm and the predicted astronomical tide. Storm surges are caused by a combination of high wind speeds and low atmospheric pressure, essentially pushing water up onto the land.



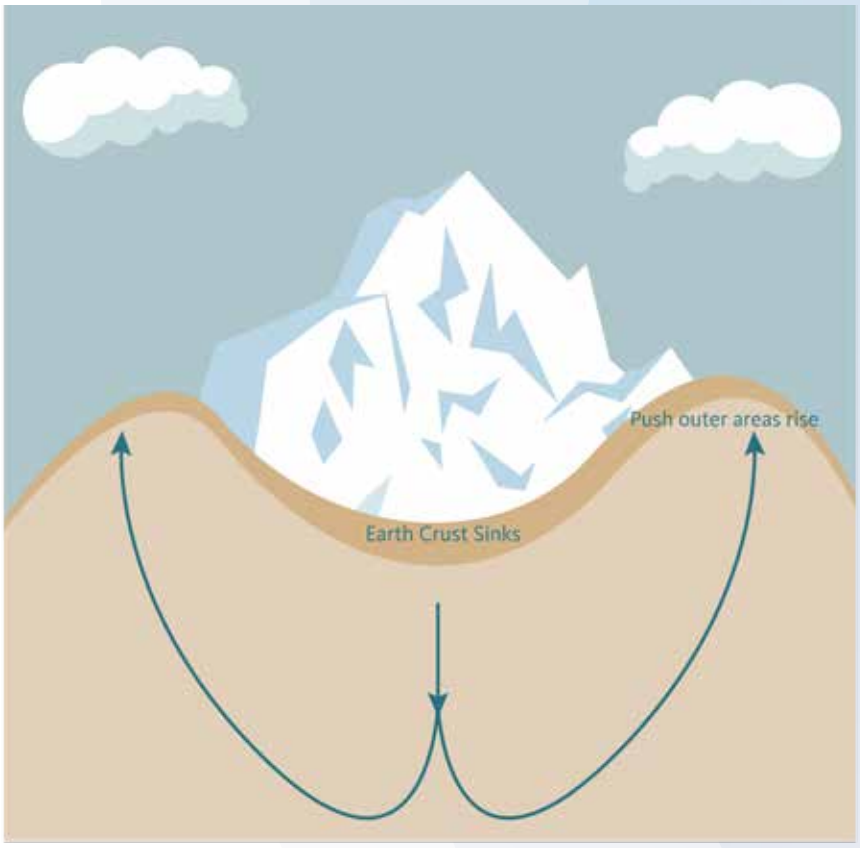
WAVE RUN-UP

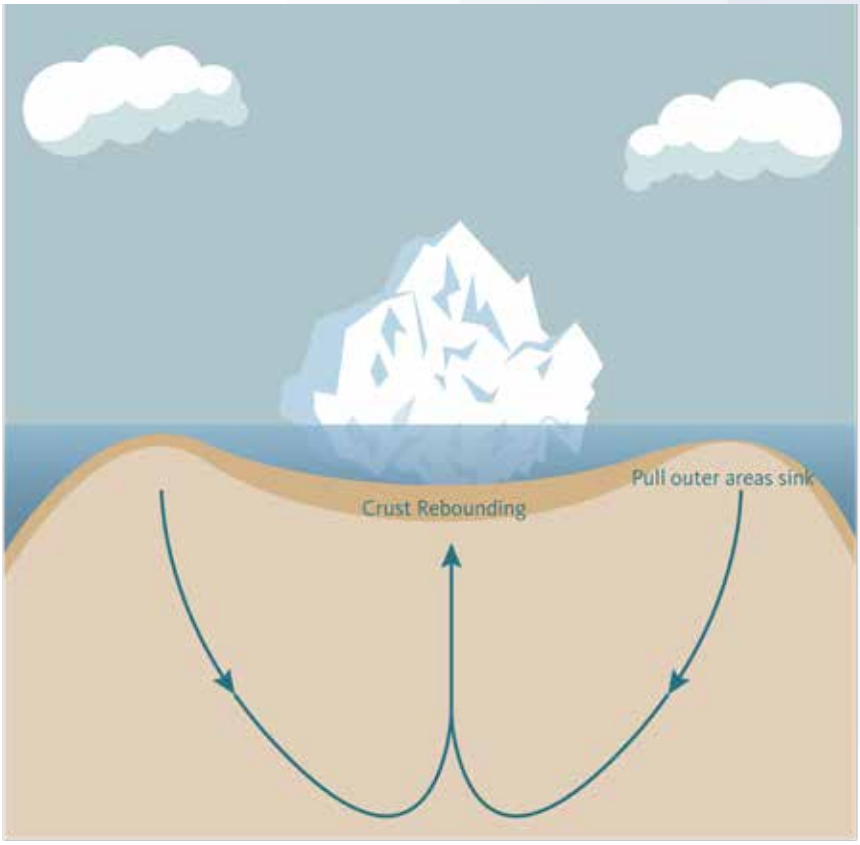
Wave run-up is the maximum level that water reaches on the shore, above the levels caused by the regular tide and by storm surge. The physics of wave run-up are complicated and depend heavily on the specific physical characteristics of each section of coastline, on the precise wind direction relative to the coast, and on the interaction of the waves with the tide and storm surge. As a result, wave run-up can vary drastically over time and along different sections of coast.



COASTAL SUBSIDENCE

Nova Scotia's coastline is slowly subsiding (sinking). This is the result of a process called "post-glacial rebound". In short, the weight of the glaciers during the last ice age pressed down on the centre of the continent, causing the edges (such as Nova Scotia) to rise, much like someone sitting in the middle of a firm couch cushion. When the glaciers melted the continent began to rebound back into its original shape – the central areas are rising, and the edges sink back down.





SEA LEVEL RISE

Earth's climate is, on average, warming and this has increased average sea levels for two main reasons:

1. when water warms up it expands and takes up more space; and
2. the warming temperatures are melting glaciers and polar ice caps, and this melted water ends up in the ocean.

High-precision satellite data shows that the global average sea level has increased by 9.95 centimetres (+/- 0.4 cm) since 1993, and historical tidal gauge data suggests that levels have risen over 20 centimetres since 1900[2]. This trend is expected to continue, and likely accelerate, as Earth continues to warm.

APPENDIX D – USEFUL DATA SOURCES

Nova Scotia Municipal Floodline Mapping Program

The Province of Nova Scotia is partnering with municipalities to develop detailed flood hazard mapping of major watercourses. This includes coastal flood hazards. The work is currently ongoing. As this data gets released, municipal planning documents will, at a minimum, need to include development restrictions within the identified areas.

Government of Canada Tidal Gauges

The Government of Canada maintains tidal data, including HHWLT, measured at tidal gauges around Nova Scotia. This data can be found at www.tides.gc.ca. To use this data, find the tidal gauge that is most applicable to your coastline and click the "heights" tab to get the data you need. **NOTE:** this data is in Chart Datum and must be converted to the datum you are using for your land use by-law. The "datums" tab for many (but not all) of the tidal gauges includes a conversion factor for converting to other datums.

Richards and Daigle

In 2011, a report on sea level rise scenarios and climate change data for Nova Scotia and Prince Edward Island was prepared by Williams Richards Climate Consulting and R.J. Daigle Enviro for the Atlantic Climate Adaptation Solutions Association, often known as the Richards and Daigle[3] report. The report provided a comprehensive review of, and guidance on, sea level rise scenarios and climate change data for Nova Scotia and Prince Edward Island. The Richards and Daigle report based its projections on the Intergovernmental Panel on Climate Change's Fourth Assessment Report (AR4). Many of the municipalities in Nova Scotia that have existing land use by-law regulations for coastal areas were based at least in part on this report.

Province of Nova Scotia Coastal Hazard Map

The Coastal Hazard Map (https://nsgi.novascotia.ca/chm) is a tool provided by the Nova Scotia Department of Environment and Climate Change that can be used to make informed decisions and support action. Using this tool you can see what sea level rise and storm surge could look like on properties at high tide. The online mapping tool provides information on how Nova Scotia's coastline is changing, coastal hazards, and more to help make informed decisions.

Climatedata.ca

Climatedata.ca is an online data portal that "enables Canadians to access, visualize, and analyze climate data, and provides related information and tools to support adaptation planning and decision-making." It includes data and mapping for various aspects of climate, such as average temperatures and the number of frost free days, across Canada under different climate change scenarios. Importantly, this resource includes data for relative sea level rise for various scenarios, uncertainty ranges, and time periods, corrected for coastal subsidence.

Canadian Extreme Water Level Adaptation Tool (CAN-EWLAT)

The Canadian Extreme Water Level Adaptation Tool (https://www.dfo-mpo.gc.ca/science/oceanography-oceanographie/accasp-psaccma/can-ewlat-ocanee/index-eng.html) is primarily a tool for infrastructure planning. It provides vertical allowances accounting for storm surge and sea level rise at tide gauges and small craft harbours around the province (and country). CAN-EWLAT centralizes relative sea level rise projections for scenarios under both the IPCC Fifth Assessment Report and the Sixth Assessment Report. CAN-EWLAT includes projected relative sea level rise each decade using the median value (50th percentile) for the six different climate scenarios.




NOVA SCOTIA