



SEA LEVEL RISE PRIMER PART IV

SEA LEVEL RISE DRAFT
RECOMMENDED STRATEGIES AND
ACTION PLAN

CAMPBELL RIVER
RISING SEAS

STRUCTURE OF THE SEA LEVEL RISE ENGAGEMENT SUPPORT PROCESS

THE SEA LEVEL RISE ENGAGEMENT SUPPORT PROCESS IS PRESENTED IN FOUR PARTS:

- I. Introduction to Sea Level Rise, Risks and Adaptation Methods** – a summary of why sea level rise adaptation is required, introduction to terms and local risks.
- II. Sea Level Rise Adaptation Best Practices** – a guide to common tools to address sea level rise adaptation in Campbell River, highlighting their strengths and challenges.
- III. Local Adaptation Options and Evaluation Process** – a summary of the evaluation process and proposed options to address sea level rise.
- IV. Sea Level Rise Draft Recommended Strategies and Action Plan** – reporting on preferred options and how sea level rise adaptation may be strategically integrated into ongoing City planning and other processes and redevelopment.



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1.0 INTRODUCTION

As a coastal community, Campbell River has a history of flooding in low-lying areas, associated property damage, and coastal erosion from winter storms. Climate change and sea level rise will increase the need for mitigation of flooding risks along the ocean coast and river.

The City is examining the community's entire coastline, including the estuary, to determine the best course of action that will adapt existing buildings and infrastructure at the time of new development or reconstruction.

The risks and potential solutions are summarized in a series of printed primers and on the Rising Seas webpage at <http://www.campbellriver.ca/planning-building-development/sea-level-rise>.

Sea Level Rise Primer Part I is a broad introduction to the sea level rise assessment project and addresses the following:

- ▶ defining coastal flood and sea level rise management concepts and terms
- ▶ recognizing the differences between coastal and inland flood management areas
- ▶ outlining typical adaptation approaches and best practices
- ▶ mapping what's at risk if no action is taken in four Campbell River focus areas

Sea Level Rise Primer Part II provides more detail on typical best management practices to adapt to sea level rise and flood risk:

- ▶ at a neighbourhood scale ranging from beach nourishment and living shorelines through various types of foreshore and shoreline protection, as well as techniques to drain inland flood waters.
- ▶ at a building/lot scale, including elevating buildings and building systems above floodwaters.

Sea Level Rise Primer Part III summarizes options under consideration:

- ▶ setting minimum elevations for new buildings- termed flood construction levels (FCLs)- to establish minimum levels for the base of wood structures or slabs for living spaces to be above the risk of flooding.
- ▶ introducing options that evaluate a variety of sea level rise best practices in four focus areas in Campbell River. A technical comparison of options is tabled as a background to public input on the values and criteria that should guide a recommended sea level rise adaptation strategy.

Sea Level Rise Primer Part IV (this document) makes draft recommendations for Council, based on:

- ▶ a summary of technical and public engagement evaluation of options.
- ▶ shoreline adaptation best practices that appear the most suitable for Campbell River neighbourhoods.
- ▶ recommendations for an implementation action plan to integrate sea level rise considerations into new development or on-going infrastructure renewal.

SUMMARY OF PUBLIC AND STAKEHOLDER PROCESS

Community engagement is an important component in fine-tuning sea level rise adaptation strategy for Campbell River. Opportunities for input have included:

- ▶ Introduction to Sea Level Rise (November 2018)
- ▶ Evaluation Options for Sea Level Rise (March 2019) - results are available at <http://www.campbellriver.ca/planning-building-development/sea-level-rise>
- ▶ Draft Recommended Strategies for Sea Level Rise (May 2019)



Public Open House Workshop. November 2018

The draft recommendations draw from both technical and community evaluation of options. The directions proposed are strategic in nature. The intent is not to commit immediately to significant capital expenditures but rather to integrate sea level rise adaptations into capital or development projects that are undertaken for reasons other than sea level rise, such as redevelopment or infrastructure renewal. As a long-term strategy, it is recognized that new information and innovations are likely to come forward, including improvements in technical and public capacity to adapt. On-going climate change monitoring, community consultation, regulation adjustments and technical training is warranted during implementation stages.

OPTIONS CONSIDERED

Three different options have been considered for each of the four study areas outlined in Primer I. These options explore a range of approaches to sea level rise adaptation and are defined below:

- Option A: Parcel-Scale Adaptation, Minimum Community Intervention
- Option B: Neighbourhood Scale Adaptation, Extensive Community Intervention
- Option C: Balanced Adaptation with Limited Community Intervention

Additional information concerning the various sea level rise adaptation options can be found in Primer III and the Technical Background Report

SEA LEVEL RISE AND ADAPTATION TERMS.

The below definitions describe common terms used in the science of coastal management and adaptation.

Higher High Water Large Tide (HHWLT) is an existing high water level that often occurs during winter spring tides. These tides happen several times a month and are associated with the occurrence of a full moon or a new moon, approximately every two weeks.

Storm Surge occurs during a coastal storm due to strong winds and low air pressure, which can bring the water above tide levels.

The Design Flood Level (DFL) is the anticipated still water level that considers both HHWLT and Storm Surge.

Flood Construction Level (FCL) is the required minimum elevation for the base of a floor structure for habitable floors or for the storage of valuable goods. FCL includes the Design Flood Level, plus Wave Effects, and a Freeboard allowance.

Freeboard is a vertical distance between the anticipated Wave Effects and the Flood Construction Level. It allows for unknowns including a more rapid sea level rise than anticipated, specific details of an individual land parcel and particulars of the waters immediately offshore of a property.

Wave Effects considers the actions and effects of waves along the shoreline that causes water to rise above the design flood level. These effects vary considerably depending on the shoreline exposure, its character and the presence of coastal structures including seawalls or steep shorelines. These effects drive the spray and debris that may affect a building located close to the shoreline.

Natural Boundary (NB) defines the seaward boundary of a property where the prolonged presence of water creates a change in vegetation and the character of the land itself (see Land Title Act). The seaward side of the Natural Boundary is Provincial and Crown property.

The Future Estimated Natural Boundary (FENB) is the predicted location of the future Natural Boundary as the result of sea level rise. Setbacks for future new buildings should move inland with the Future Estimated Natural Boundary to preserve the protection that exists at the shoreline. Provincial guidelines suggest that calculation of the Future Estimated Natural Boundary can be based on the Flood Construction Level minus the Freeboard allowance.

Setback is the required minimum horizontal distance between the Natural Boundary (or Future Estimated Natural Boundary) and any flood construction level related structures that would be susceptible to wave impact or erosion.

2.0 DRAFT RECOMMENDED STRATEGIES (PREFERRED OPTIONS)

CONCEPTUAL FRAMEWORK

Conceptual options to address coastal flooding risks and damaging, seasonal storm waves for our coastal areas were developed and presented to the public. Public feedback on the proposed options was analyzed during the evaluation process. The following draft recommended strategies are the results of that evaluation process. In general, the recommendations pursue City intervention and investment in community projects where there is a clear benefit for the broader community. Where significant community benefits are not realized, the City would strive to facilitate private adaptation for private property, in some cases by supporting a neighbourhood local improvement if approved by property owners.



PAINTER BARCLAY

The Concept: Balanced Adaptation, Limited Community Intervention

- City could provide design and contract administration assistance, arrange senior government approvals, apply for senior government grants, and facilitate private-funded neighbourhood improvement projects for constructed combinations of groynes and beach nourishment.
- Beach improvements including additional groynes and beach nourishment may improve public access along the beach on a sand/cobble intertidal shoreline, but a hard surface ‘Seawalk’ is not anticipated.

PAINTER BARCLAY PREFERRED OPTION BREAKDOWN

Costs	PUBLIC: \$\$ PRIVATE: \$\$\$
Phasing Logistics	<ul style="list-style-type: none"> • Foreshore environmental and property approvals may be challenging. • Upland owner riparian rights or access would require negotiation.
Key Benefits	<ul style="list-style-type: none"> • Toe of bank stabilized against erosion. • Risk of steep slope failure reduced (but not eliminated). • Public access along the foreshore maintained/enhanced but not formalized in a seawalk. • Shoreline vegetation protected, ecology potentially enhanced. • City service to design/gain approvals/arrange financing and supervise construction has economy of scale over owners acting independently.
Remaining Risks	<ul style="list-style-type: none"> • Proper engineering of the groynes and beach nourishment will be critical to minimize rate of foreshore erosion. • Expect some foreshore erosion and material movement – top-up of beach materials may be required periodically. • Financing is likely to rely on a local improvement approach, which requires neighbourhood approval.



Groyne, Germany. (Credit: Sanctuary Studios)

DETAILED ADAPTATION STRATEGY

PB C1: Local Improvement Funded Groyne/Beach at Bluff Waterfronts



Existing pocket beaches will be protected and supplemented by improved groynes. Limited supplementary beach materials may be installed to reduce wave effects and erosion at the toe of the existing bluffs and to improve walking access along the shoreline.

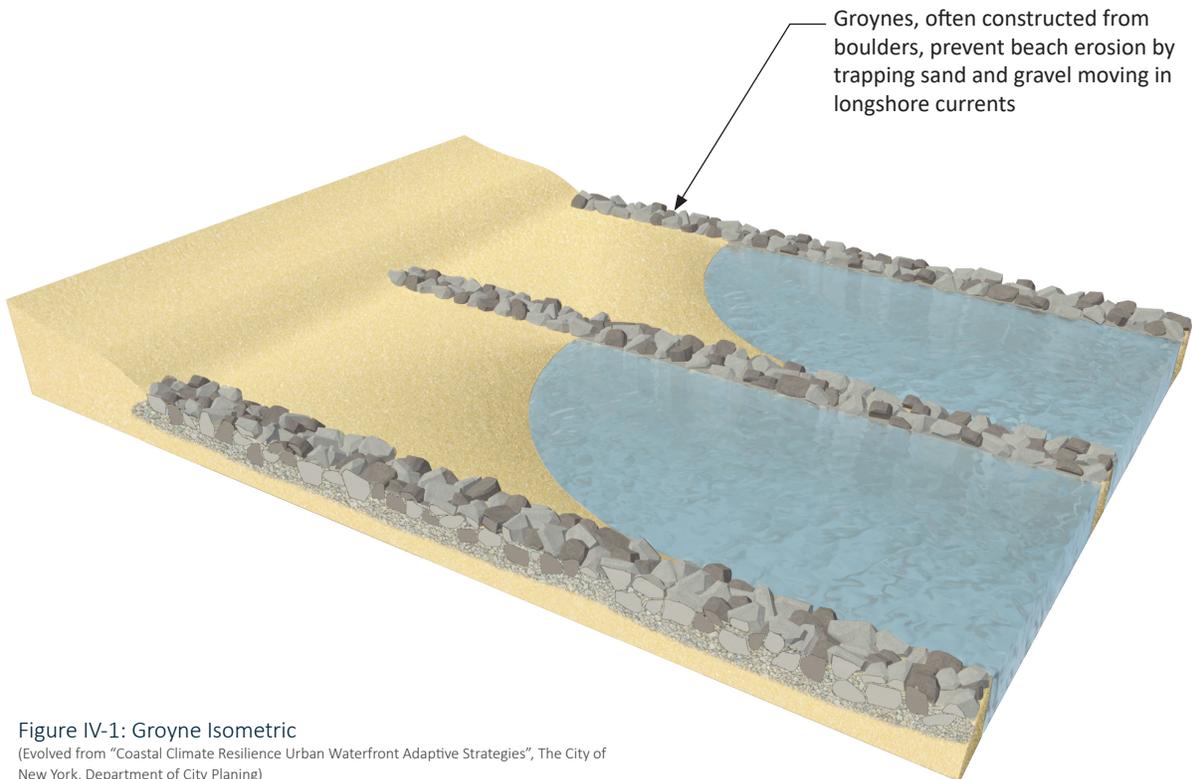
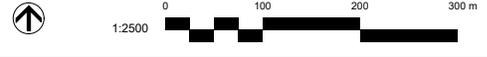


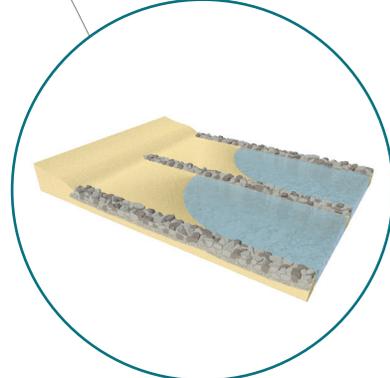
Figure IV-1: Groyne Isometric

(Evolved from "Coastal Climate Resilience Urban Waterfront Adaptive Strategies", The City of New York, Department of City Planning)

Figure IV-2: Draft Recommended Painter Barclay Adaptation Strategy



PB C1



DOWNTOWN

The Concept: Balanced Adaptation, Limited Community Intervention

- Coastal Flood Management Area: Breakwater extensions would be considered at BC Ferries and the Small Craft Harbour. A moderate height raised seaside walkway and waterfront streets on public land would provide a line of defense along Robert Ostler Park, Hwy 19A, and eventually extending around downtown.
- Inland Flood Management Area Buildings: At time of reconstruction, downtown buildings would be raised in one lift based on a Design Flood Level (DFL) of 3.7 m elevation.* Lower risk uses could be below the DFL at landowner risk (e.g. micro retail, parking and select non-habitable flood-adapted designs). Residential and higher risk uses must be above the DFL.
- Inland Flood Management Area Streets: At time of reconstruction, downtown streets and utilities would be raised in one lift to provide emergency access and gravity drainage based on a Design Flood Level (DFL) of 3.7 m elevation.* Installation of flood-relief pump stations would be planned, but their construction delayed as long as practical.



Figure IV-3: Draft Recommended Downtown Sea Level Rise Adaptation



Raise major streets / utilities above DFL in one lift



Raise waterfront trail to established FCLs as sea levels rise.



Install underground stormwater tanks and pump stations at Ostler Park and Nunns Creek (as needed)



Raise minor streets / utilities above DFL in one lift

Additional adaptation measures
 -Extend breakwaters at BC Ferries and small craft harbour
 -Install temporary flood barriers at BC Ferries

*Elevation is above geodetic datum, which bases vertical elevation on '0' being mean sea level.

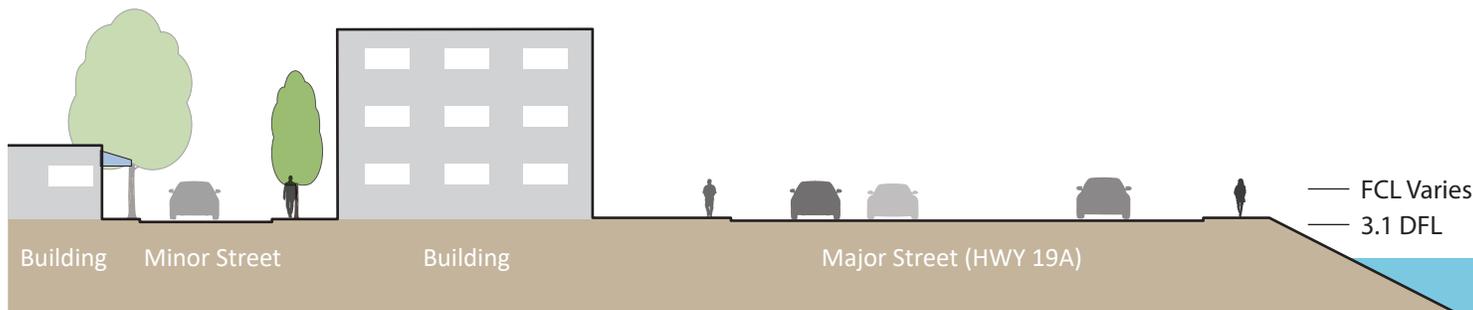


Figure IV-4: Existing Downtown Conditions

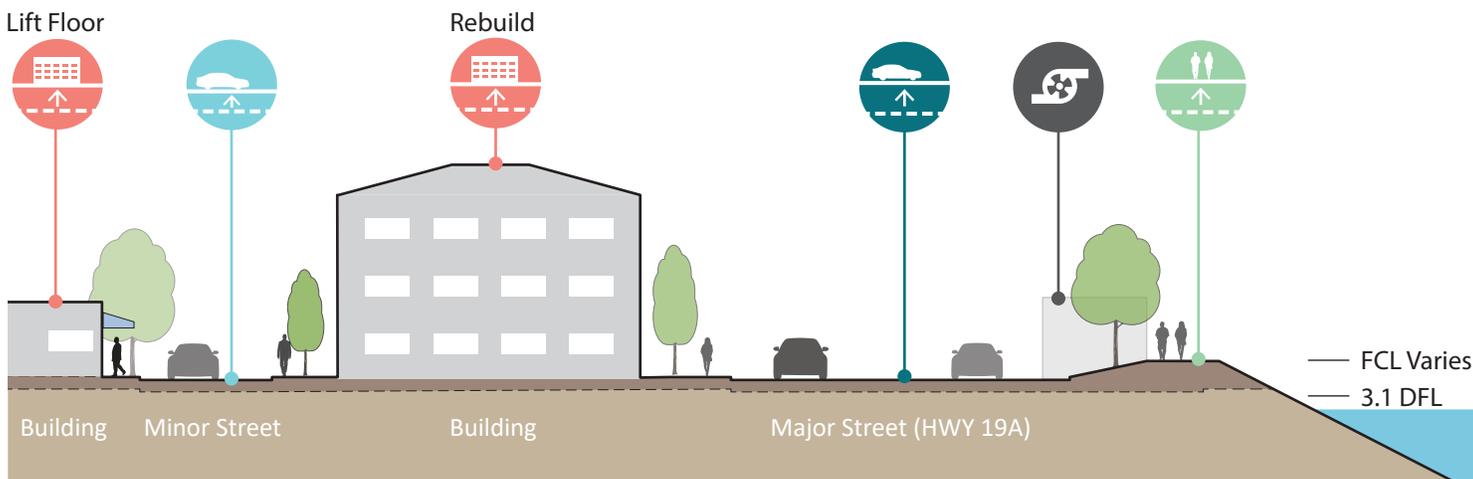


Figure IV-5: Proposed Downtown Sea Level Rise Adaptation Measures



Raise major streets / utilities above DFL in one lift



Raise habitable parts of existing buildings to FCL or rebuild buildings. Non-habitable, flood-adapted designs are allowable below FCL, but above DFL



Raise waterfront trail to established FCLs as sea levels rise.



Raise minor streets / utilities above DFL in one lift



Install underground stormwater tanks and pump stations at Ostler Park and Nunns Creek (as needed)

Additional adaptation measures
 -Extend breakwaters at BC Ferries and small craft harbour
 -Install temporary flood barriers at BC Ferries

DOWNTOWN PREFERRED OPTION BREAKDOWN

Costs	PUBLIC: \$\$\$ PRIVATE: \$\$\$
Phasing Logistics	<ul style="list-style-type: none"> Downtown shoreline defense could be phased with ferry, harbour, parks and street renewal projects. Pump stations would be delayed as long as possible. Reconfiguration of downtown stormwater pipes to flow to pump station locations could occur during infrastructure upgrades. A single lift of downtown streets and buildings would be necessary.
Key Benefits	<ul style="list-style-type: none"> Extension of offshore breakwaters reduces required height of shoreline defense and maintains ground level views of Discovery Passage. Delays single lift of downtown streets. Ideally most buildings would redevelop concurrent with or prior to street raising. Delayed pump station investment provides time to investigate/apply for funding options such as senior government partnering or development cost charge funding. Combination of shoreline defense and one lift of streets reduces risks compared to other options. Shoreline defenses have room to be raised in response to ongoing sea level rise.
Remaining Risks	<ul style="list-style-type: none"> Remaining risk is reasonable compared to other options. Ongoing adaptation to sea level rise would be required after 2100.

DETAILED ADAPTATION STRATEGY

DT C1a: Offshore Breakwater Allowance (BC Ferries, 100 m extension)

The existing breakwater from the BC Ferries terminal is extended seaward by approximately 100m. This reduces wave effects inland of Hwy 19A and the City waterfront.

DT C1b: Offshore Breakwater Allowance (Small Craft Harbour, 100 m extension)

The existing breakwater at the Small Craft Harbour is extended seaward by approximately 100 m. This reduces wave effects inland of Ostler Park.

DT C2: Ostler Park Barrier/Trail Ph 1 (lift 0.7)



An elevated trail and berm provide flood resistance parallel to the waterfront in Ostler Park and running diagonally behind the existing First Nations longhouse to join an extended line of defense beside Hwy 19A. This Phase 1 lift is limited to a berm height of 3.9 to allow continued views to the sea retaining the option of a second lift as sea level rise progresses.

DT C3: Hwy 19A Lift if 100m Breakwater (0.4 lift)



A single phase lift of Hwy 19A to elevation 3.7 is associated with its planned reconstruction. The highway remains lower in relation to existing private property grades, while also having view to sea over future barrier grades on the waterfront that are lower due to the breakwater extension.

DT C4: BC Ferries Barrier/Trail if 100m Breakwater (0.9 lift)



As an extension of the Ostler Park Barrier/Trail, a single phase elevated walkway and barrier runs between the reconstructed Hwy 19A and BC Ferries. A retaining wall on the BC Ferries side keeps space efficiency while allowing for future raising of the BC Ferries parking area.

DT C5: BC Ferries Temporary Barrier if 100m Breakwater (0.5 m lift)

Two driveways need to cross the line of defense for ingress and egress from BC Ferries terminal and access to the Coast Marina parking area. Temporary Barriers (manual or automated) would allow flood protection of the driveways when they are closed during rare coastal design storm events. The gates could be designed to full FCL height of 4.1.

DT C6: Barrier/Trail at Hwy 19A if 100m Breakwater (1.1 lift)



A raised public walkway on a paved trail and extended revetment to 4.3 is about 0.6 above raised Hwy 19A. Views to the water would be maintained.

DT C7a: Underground Stormwater Tank Ostler Park



Flood boxes will need to be installed to reduce backflow, which will also allow water to accumulate in the storm system. If the flood box remains closed for too long during concurrent heavy rainfall and coastal defense overtopping, flooding would occur in the downtown low areas. As a first step, increased storage underground in the storm system would be gained by tank installation under Ostler Park.

DT C7b: Pump Station Ostler Park



A proposed pump station would remove water from the low point storage tank in the storm drainage system and pump it over the line of defense during extreme storm surges or storm events. Gravity drainage, rather than pumped drainage, would remain in use at lower coastal water levels and tides. The proposed single lift of the low parts of downtown would allow increased storage and higher ground elevations to improve the effectiveness of gravity drainage, potentially delaying the timing of pump station installation.

DT C7c: Underground Stormwater Tank Nunns Creek



Parts of the downtown storm drainage system flow towards Nunns Creek. This project is a similar underground storage tank outfalling to Nunns Creek.

DT C7d: Pump Station Nunns Creek



This second pump station project would be associated with the flood storage and outfalls near Nunns Creek Again, if single lift of low roads and uses draining to this location were accomplished, the timing of pump station installation may be delayed.

DT C8: Barrier Trail City Waterfront Property if 100m Breakwater (0.6 lift)



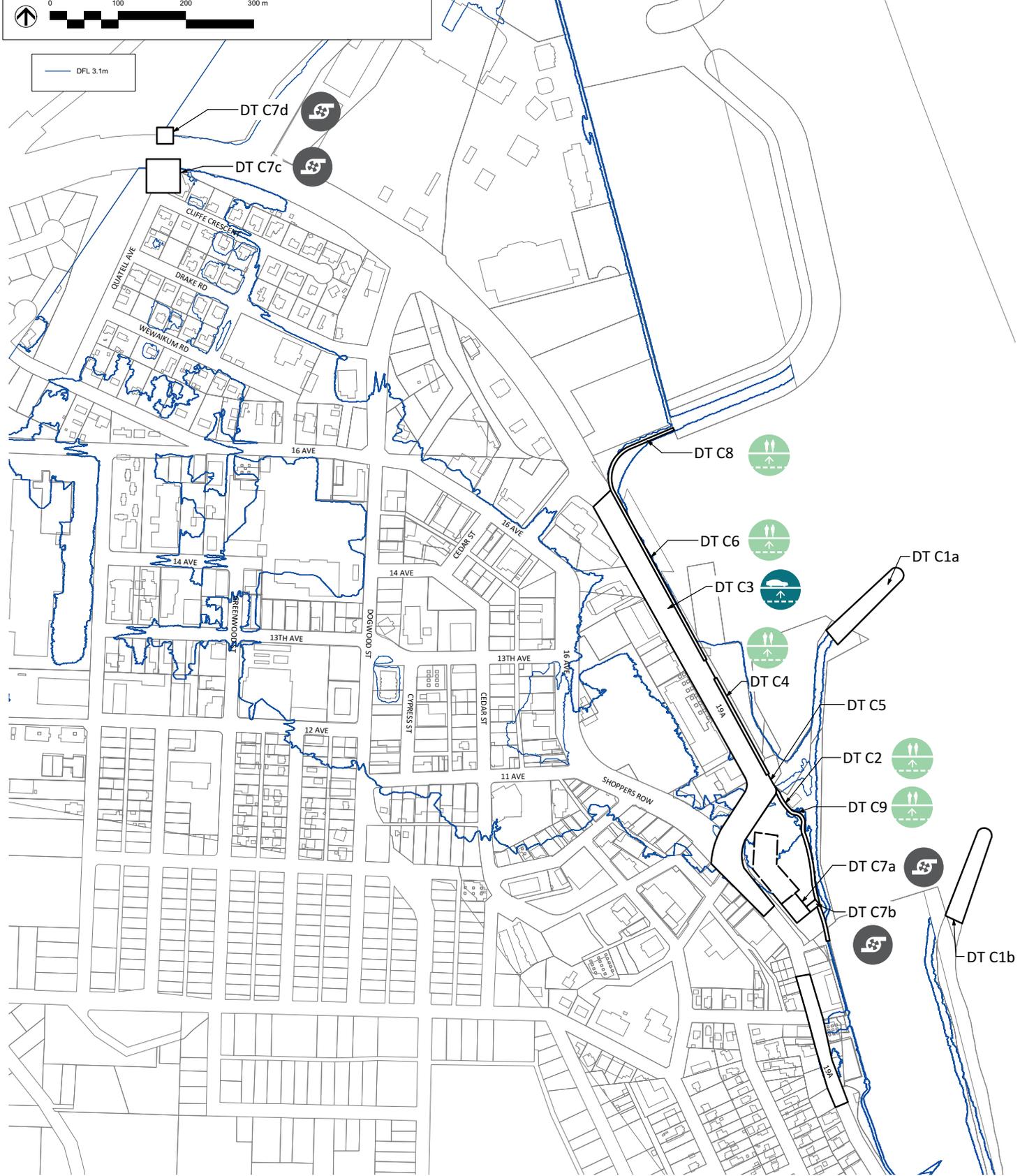
A raised public walkway and extended revetment, created in a single lift up to FCL 4.4, is envisioned fronting the City waterfront property.

DT C9: Ostler Park Barrier/Trail if 100m Breakwater Ph 2 (lift 0.5)



As sea levels rise, the flood construction levels at the line of defense will need to raise accordingly. This project is a second lift to FCL of 4.6 for the Ostler Park Barrier/Trail. It is possible that areas inland of Ostler Park could be raised at the same time, perhaps associated with the enhancement options below including underground parking. Raising the park interior would provide views from there to the sea over the waterfront trail/barrier.

Figure IV-6: Draft Recommended Downtown Adaptation Strategy



SEQUOIA PARK (MHC TO EVERGREEN)

The Concept: Balanced Adaptation, Limited Community Intervention

- On the foreshore at public lands and where riparian rights are granted fronting private land, the City may construct raised pocket beaches that would be protected by offshore rock headlands. Beach improvements would facilitate better public access along the beach on a sand/cobble intertidal shoreline. A formalized 'Seawalk' is not anticipated, at least until riparian rights are gained along this entire section of waterfront.
- Where riparian rights are not gained, the existing foreshore would remain as is and upland owners would manage their flood risk inland of the natural boundary, which may include maintaining existing rock armouring.

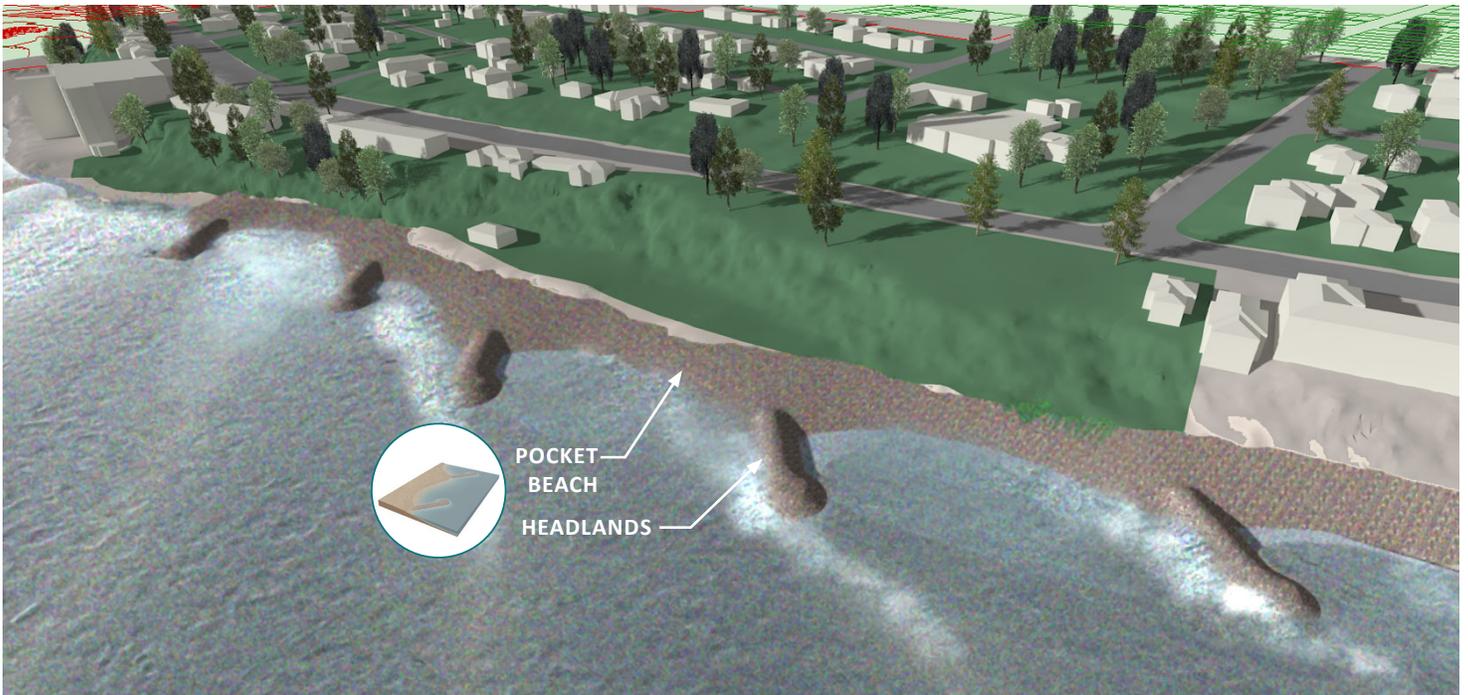
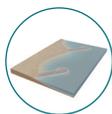


Figure IV-7: Draft Recommended Sequoia Park Sea Level Rise Adaptation



Pocket beaches / headlands extended along the foreshore

SEQUOIA PARK PREFERRED OPTION BREAKDOWN

Costs	PUBLIC: \$\$\$ PRIVATE: \$\$
Phasing Logistics	<ul style="list-style-type: none"> • Foreshore environmental and property approvals may be challenging. • Upland owner riparian rights or access would require negotiation. • Where riparian rights are not granted, existing or eroding beach would remain, restricting public access along the shoreline. In these locations, waterfront land owners would be responsible for shoreline protection.
Key Benefits	<ul style="list-style-type: none"> • Where rights are gained, public access along the foreshore is enhanced. • Public pocket beaches created for recreational use. • Opportunities for enhanced shoreline revegetation. • Foreshore ecology potentially enhanced for forage fish and intertidal habitat. • Toe of bank stabilized against erosion. • Risk of steep slope failure reduced (but not eliminated). • City service to design/gain approvals/arrange financing and supervise construction has economy of scale over owners acting independently.
Remaining Risks	<ul style="list-style-type: none"> • Proper engineering of the headlands and ongoing monitoring and beach nourishment would be critical to minimize rate of foreshore erosion. • Expect some foreshore erosion and material movement – top-up of beach materials may be required periodically. • Shared financing likely to rely on a local improvement approach, which requires neighbourhood approval. • High cost to public finances. • Potential delay until continuous raised public access along shoreline.



Offshore headlands, Qualicum Beach. (Credit: Sanctuary Studios)

DETAILED ADAPTATION STRATEGY

SP C1: City Frontage Headland/Beach

Pocket Beach/Headland demonstration projects are completed fronting Sequoia Park and the vacant lot south of Maritime Heritage Centre.

SP C2: Private Frontage Headland/Beach

To provide continuity of public access along the beach, as well as improved environments for forage fish like surf smelt and sand lance, Pocket Beach/Headland projects are extended along the private frontage to link Hidden Harbour and Maritime Heritage Centre. Foreshore tenure and riparian rights would need to be gained.

Figure IV-8: Draft
Recommended Sequoia
Park Adaptation Strategy



WILLOW POINT

The Concept: Balanced Adaptation, Limited Community Intervention

- On the foreshore at relatively sheltered public lands like Frank James Park and Sybil Andrews Cottage the City may construct raised pocket beaches that would be protected by offshore rock breakwaters.
- In areas exposed to high waves, the City may refine the existing land acquisition policy to continue purchasing waterfront homes on a willing seller basis or innovative lease if pricing is favourable, to convert these areas to parkland.
- When sufficient length of public waterfront is available, the City could pursue funding to improve shoreline views and environmental performance through creating 'windows' in rock armouring and constructing sheltered inland beach/marsh environments accessible from the Seawalk.



Figure IV-9: Draft Recommended Sea Level Rise Adaptation at Frank James Park



Offshore breakwaters

WILLOW POINT PREFERRED OPTION BREAKDOWN

Costs	PUBLIC: \$\$\$\$ PRIVATE: \$\$\$
Phasing Logistics	<ul style="list-style-type: none"> Public parks with relatively low wave exposure and City riparian rights allow beach nourishment and headlands to proceed when funded and where feasible. Land acquisition is a long-term and unpredictable process in terms of what land may be assembled/available. Improvement of beach access/windows through rock armour at other public parks depends in part on adjacent land acquisition timing.
Key Benefits	<ul style="list-style-type: none"> Public pocket beaches created for recreational use. Opportunities for enhanced shoreline revegetation/environment at parks. Foreshore ecology at parks potentially enhanced for forage fish and intertidal habitat.
Remaining Risks	<ul style="list-style-type: none"> Proper engineering of the breakwaters and ongoing monitoring and beach nourishment would be critical to minimize rate of foreshore erosion. Expect some foreshore erosion and material movement – top-up of beach materials may be required periodically. Potential delay until park expansion and greater foreshore access. High land acquisition cost.



Offshore headlands, Qualicum Beach. (Credit: Sanctuary Studios)

DETAILED ADAPTATION STRATEGY

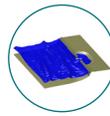
WP C1: Offshore Breakwaters/Nature Shore on City Lands

Fronting on Frank James Park and Adams Park, a demonstration of offshore breakwaters and beach nourishment would be provided in concert with upgrades to the Park. Consideration of raising the Sybil Andrews Cottage and associated grounds would be required in the latter part of the century.



WP C2: Extended Revetment Window/Inland Beach Environment at City Park

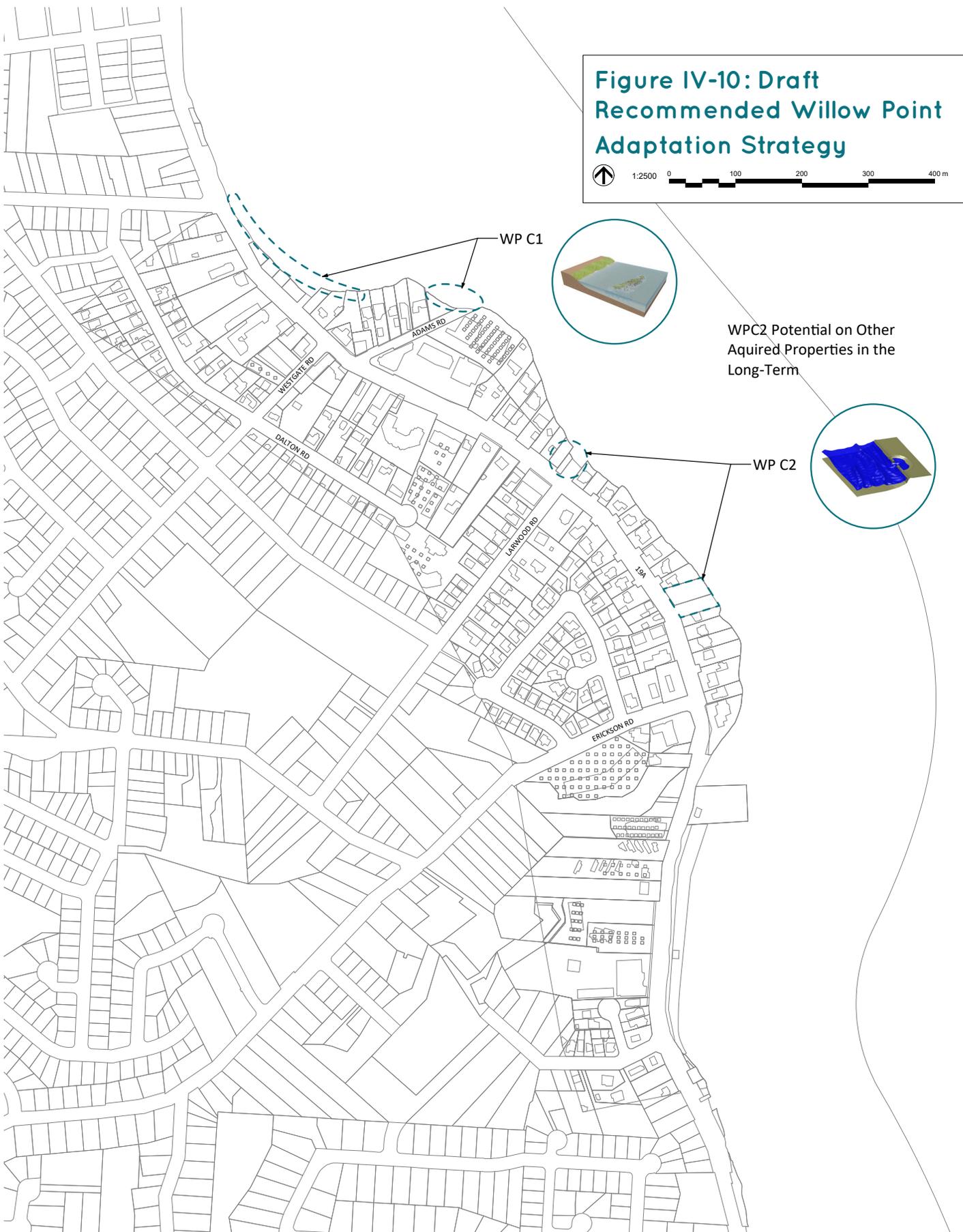
Fronting on Larwood Park and Jaycee Park and other City lands acquired on a willing-seller basis, park improvements that adapt existing shoreline revetment berms to include a narrow opening to the sea would be combined with inland beach nourishment and environmental/access improvements to the park. Consideration of eventual raising of pump stations and the Seawalk would be appropriate towards the end of the century, or when reconstruction occurs.



Enhancement: Willow Creek Flood Barriers

In rare circumstances when a coastal design storm with high tide coincides with an inland rainfall event causing severe flooding in local creeks, it is possible that flooding of land uses will occur at the creek interface with the sea (estuaries). To reduce this risk, flood barriers could be considered along the lower reaches of Simms or Willow Creek.

**Figure IV-10: Draft
Recommended Willow Point
Adaptation Strategy**



WPC2 Potential on Other
Aquired Properties in the
Long-Term

WP C2

3.0 DRAFT IMPLEMENTATION STRATEGY

SEA LEVEL RISE ADAPTATION IN THE PUBLIC SECTOR

Primers II and III introduce a range of building and neighbourhood scale options and evaluate them against community values, including a consideration of what roles the City (using public finances) might play.

Primer IV recommends different approaches in different neighbourhoods. These recommendations are based on wave and flood exposure technical analysis, the degree of significant community benefit that an intervention provides, and community values determined through public engagement. The recommendations are based on a few key principles, duplicated here from Primer III:

- I. Protecting property from coastal flooding and erosion risk has traditionally been the responsibility of the waterfront property owner. Broad community financial support to protect private waterfront property would be a change in practice.
- II. Unless Crown foreshore lease and environmental approvals are gained for works on the public foreshore, adaptation would be exclusively on the parcel above the natural waterfront boundary. This will move inland with sea level rise.
- III. Setbacks to new building construction must account for the inland migration of the sea and associated wave-driven spray, logs and debris for the serviceable time of the building, which may be 75 to 100 years into the future.
- IV. In the Campbell River context, fiscal responsibility would link public investment in waterfront improvements and protection to public benefits. Examples include protecting tax base or economic development and jobs, improved public waterfront access, and recreation and environmental protection. Community financial support could range from no public support, to fully public-funded support from senior governments as well as the City. Blending of public and private funding is also possible, in proportion to benefits received.
- V. The City of Campbell River has an established waterfront property acquisition program. To date, the program has acquired properties on a willing seller basis when the sale price is fair. Such properties have sometimes been rented for a period, and eventually converted to public open space and parkland, with provisions for public road and utilities as well as improvements to the Seawalk. If this program were to give priority to smaller properties that may not have space to effectively adapt to sea level rise, the City would assume coastal flood and environmental protection risks, adaptation costs, and would also be losing the associated tax base, and sale prices would need to reflect these considerations. Due to high costs, purchase of commercial or multi-family property is usually a lower priority.

It may not be desirable or affordable to have widespread community acquisition of private property. Where property acquisition by the community is a worthwhile priority, ideally it would involve contiguous parcels to allow neighbourhood scale solutions that include soft shores with beaches, sea walk and environmental improvements. In other cases where sea level rise adaptation might involve using fill to raise beaches on public foreshore, it may be desirable to arrange granting of riparian rights, which protect boat access to the shoreline, and also a right to fill a strip of private land so that the on-foreshore beach fill could extend up to meet grade on private property- often burying existing rock armouring.

LEVEL RISE ADAPTATION IN THE PRIVATE SECTOR

Existing private property impacted by sea level rise will also need to adapt. Ideally existing development will be serviceable for its remaining life. However, when new development or building replacement occurs, it will be necessary to anticipate Sea Level Rise or other flood risk to the end of the service time of the proposed new building, so that existing or future property owners are safe.

To provide guidance, the City will monitor the science of predicted Sea Level Rise, will share that insight in public information programs, and will update its land use and building regulations from time to time. Existing development permit components of the Official Community Plan will be updated to illustrate how both flood protection setbacks and shoreline designs could balance flood safety, environmental and property objectives. A Flood Management Bylaw will be created and amended periodically to provide area-specific minimum elevations (Flood Protection Levels) for habitable floors of new buildings.

Brought forward from Primer III, the concepts below illustrate approaches under consideration for adaptation of private waterfront sites and new buildings to setbacks and flood construction levels that might accommodate Sea Level Rise for the service life of a building constructed in the 2020 to 2025 period.

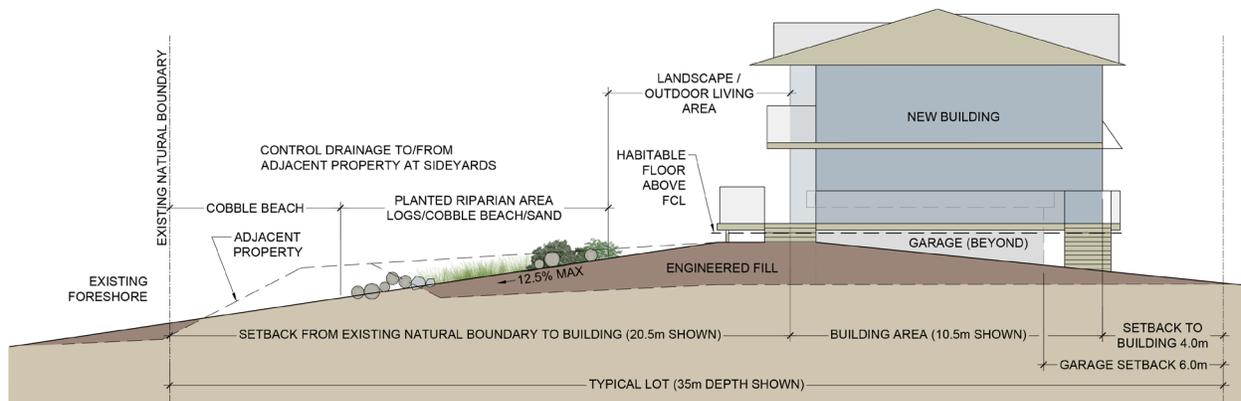


Figure IV-11: Waterfront Residential Development Concept A

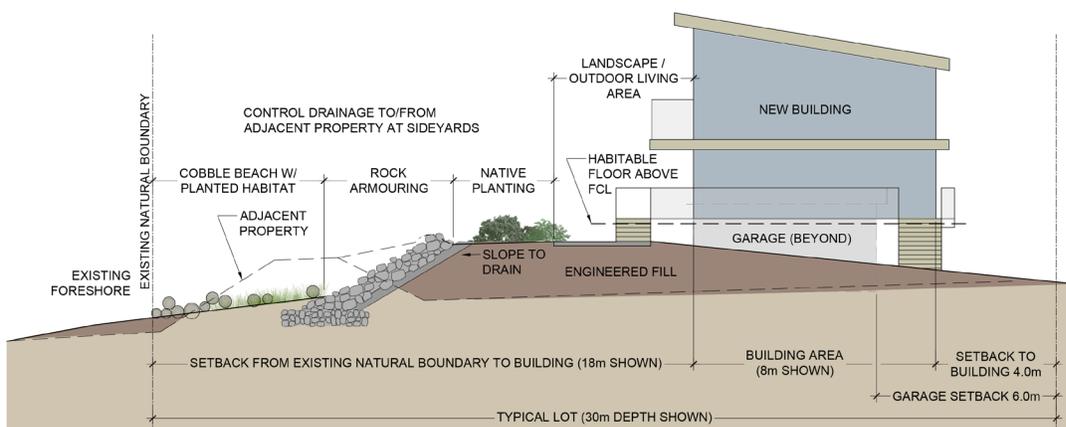


Figure IV-12: Waterfront Residential Development Concept B

DRAFT IMPLEMENTATION ACTION PLAN

The sea level rise draft adaptation recommendations are not intended to become their own program at the City of Campbell River. Rather, the recommendations identify actions that can be integrated into the ongoing business of the City and private sector in an efficient and effective manner.

The City's general role is proposed to include:

- I. Technical analysis and planning, ongoing monitoring of climate science and granting programs, building adaptation partnerships
- II. Public awareness and information, demonstration projects
- III. Capital works to adapt City-owned park, street and utility properties when reconstructed
- IV. Regulations that require private properties to adapt to anticipated sea level rise when reconstructed
- V. For private property protection, technical support only (not capital funding except where there is a significant community benefit) for local improvement projects that would allow neighbourhoods to pool funds for capital works on the foreshore (e.g. beach nourishment, headlands) or in inland flood management areas (e.g. downtown).

Many of the City's roles may involve partnerships with senior government granting or approval agencies, First Nations, agencies like Small Craft Harbours or BC Ferries, or with neighbourhoods and the private sector.

The Action Plan Summary Table on Page 23 suggests steps towards implementation. Priorities are based on 'just in time' actions as well as opportunities to incorporate adaptation with the lowest disruption and cost – often incidental to construction that is undertaken when buildings or infrastructure are at the end of their service period.

The gradual rate of sea level rise in the short term provides some time for capacity building and planning for funding. However, it is important that infrastructure and buildings constructed now anticipate ongoing sea level rise levels to the end of their service.

Each Action is assigned a Lead and Assist Agency within the City. The nature of sea level rise and other climate change adaptation is that it will often cut across department lines, requiring close cooperation.

The Year column will depend on the City's Five Year and Annual Budgeting Process, where these actions will be compared to other priorities. The timing of action may also be driven by opportunities to partner or successful grant applications to senior government agencies. A key priority will be building resilience against sea level rise and climate change into design and construction that is underway due to end of serviceability or new development.

The City must not allow the risks, consequences or cumulative costs of sea level rise to become worse due to inattention or inaction.

ACTION PLAN SUMMARY TABLE

	YEAR	LEAD	ASSIST
ONGOING			
SLR adaptation grant funding applications/administration		LRPS	F/LS
SLR adaptation partner nourishment (FN, utilities, NGOs, senior gov. agencies)		CW	LRPS
Integrate SLR into five year capital/operating budget administration and DCCs		F/LS	CPDS/CW
SLR research monitoring and long-term strategy updates		LRPS	ES
FIRST PRIORITY			
Implement coastal flood construction levels (floodplain bylaw, amend OCP, DP, zoning)		LRPS	CPDS
Public awareness and information program (web, guidebook, events)		LRPS	IT
First Nations adaptation partnering program		MO	LRPS
Adaptation partnering strategy for short-term projects (e.g. BC Ferries, senior gov. agencies)		LRPS	CW
SECOND PRIORITY			
Technical capacity building program (City staff, consultants, developers, builders)		RD	CPDS
Update CW and subdivision/development servicing bylaw to include SLR best management practices		RD	CPDS
Waterfront land acquisition program update		LRPS	F/LS
Seek to arrange coastal foreshore tenure(s) from senior government agencies		LS	LRPS
Update foreshore management MOU with DFO		LRPS	P
Asset management strategy update			
THIRD PRIORITY			
Downtown storm drainage and pump station(s) adaptation feasibility study		RD	CW
Raising Hwy 19A downtown partnership		RD	CW
Integrating raised streets into downtown refresh (in phases)		RD	CW
Raised downtown waterfront walk system		RD	P/CW
Responses to river/estuary flooding			
FOURTH PRIORITY			
City park / soft shore adaptation demonstration (Willow Point)		P	CW
Sequoia Park headland / pocket beach demo		P	CW
Painter Barclay shoreline adaptation demo		P	CW
Facilitate administration of local improvement SLR adaptation		P	F/LS

CPDS: Community Planning & Development Services

CW: Capital Works

ES: Emergency Services

F: Finance

IT: Information Technology

LS: Legislative Services

LRPS: Long Range Planning and Sustainability

MO: Mayors Office

P: Parks

RD: Roads Drainage

FOR MORE INFORMATION

CITY OF CAMPBELL RIVER WEBSITE LINKS

www.campbellriver.ca/rising-seas

BACKGROUND INFO FROM OTHER SOURCES

Engineers and Geoscientists BC

Legislated Flood Assessments in a Changing Climate in BC

<https://www.egbc.ca/getmedia/f5c2d7e9-26ad-4cb3-b528-940b3aaa9069/Legislated-Flood-Assessments-in-BC.pdf.aspx>

Flood Hazard Area Land Use Management Guidelines (2018)

https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/flood_hazard_area_land_use_guidelines_2017.pdf

Ausenco Sandwell

Climate Change Adaptation for Sea Dikes and Coastal Flood Hazard Land Use

http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/draft_policy_rev.pdf

Ministry of Forests, Lands and Natural Resource Operations

Coastal Floodplain Mapping – Guidelines and Specifications (June, 2011)

http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/coastal_floodplain_mapping-2011.pdf

BC Ministry of Environment and Climate Change

Sea Level Rise Adaptation Primer A Toolkit to Build Adaptive Capacity on Canada's South Coasts (January 2013)

<https://www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/resources/slr-primer.pdf>

BC Ministry of Environment and Climate Change

Professional Practices in Assessing Flood Protection Guidelines (June 30, 2014)

BC ADAPTS VIDEO SERIES

Includes a BC Climate Change Backgrounder, plus six video shorts on Coastal Flood Management

www.gov.bc.ca/gov/content/environment/climate-change/adaptation/bc-adapts

CONTACT US

Long Range Planning and Sustainability - Sea Level Rise

Email: policy@campbellriver.ca

Phone: 250-286-5725



City of
**Campbell
River**

nhc
northwest hydraulic consultants

LANARC