



# TECHNICAL BACKGROUND REPORT

CAMPBELL RIVER  
RISING SEAS

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# 1.0 PROJECT OVERVIEW

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## PURPOSE

Climate change and sea level rise are environmental phenomena occurring globally over the past century. Rising sea levels and more extreme storms create increasing hazards like flooding and erosion for seaside communities. The City of Campbell River is one of many coastal municipalities in British Columbia preparing to deal with the effect of rising seas now, and in the future, as we adapt to our changing environment.

As a seaside community, the City of Campbell River has a history of flooding in low-lying areas, property damage, and coastal erosion from winter storms. Given the importance of the foreshore to ongoing residential, commercial, recreational, environmental, and infrastructure development priorities, the City of Campbell River recognizes that a long-term foreshore strategy is required.

Planning includes: assessing the impacts of sea level rise in combination with extreme weather and tide events, and site considerations and constraints in terms of possible future development, erosion risk, infrastructure exposure, and environmental damage and habitat loss.

The City of Campbell River is examining the community's entire coastline to determine the best course of action that will adapt existing buildings and infrastructure, avoid placing buildings and infrastructure in harms way, and develop appropriate flood and storm surge mitigation measures. Examples in this primer focus specifically on the following four areas: Painter Barclay, Downtown, MHC-Evergreen, and Willow Point. Studies have been conducted for the Campbell River Estuary and a 3.5 acre site downtown and are detailed in separate documents. Sea level rise adaptation is also being considered in current designs for Highway 19A improvements.



Figure 1: Study areas

## 2.0 COASTAL AND RIVER FLOOD RISK TECHNICAL DOCUMENTS

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Four documents under separate cover summarize technical and engineering analysis of flood risk and flood construction levels for the City of Campbell River.

- City of Campbell River Sea Level Rise Study, Phase 1 – Downtown Waterfront Site
- City of Campbell River Sea Level Rise Study, Phase 2 – Estuary Assessment
- City of Campbell River Sea Level Rise Study, Phase 3 – Additional FCL Assessment.
- City of Campbell River Sea Level Rise Study Technical Study – 4 Sites

# 3.0 REQUIRED BUILDING AND SITE ADAPTATIONS

## ADAPTING TO NEW MINIMUM LEVELS AND SETBACKS AT TIME OF RECONSTRUCTION

All buildings and infrastructure eventually come to the end of their serviceable time and require reconstruction. Reconstruction is often the best time to incorporate sea level rise and flood risk adaptations.

To be safe from evolving sea level rise, it is necessary to estimate sea levels and conditions that may occur for the duration of the building or infrastructure serviceability, which might be 80 to 100 years into the future.

Figure 2 illustrates the concept that each generation of building would be designed to be safe for sea level rise at the end of asset serviceability – each generation adapted to different conditions than the one before.

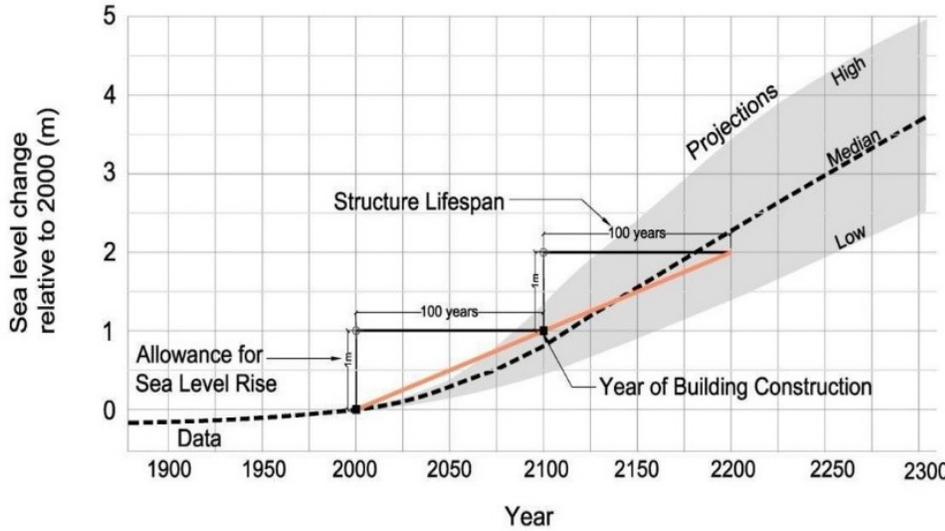


Figure 2: Adaptation needs to anticipate sea level rise at end of structure serviceability

## CONSIDERING PROVINCIAL GUIDELINES

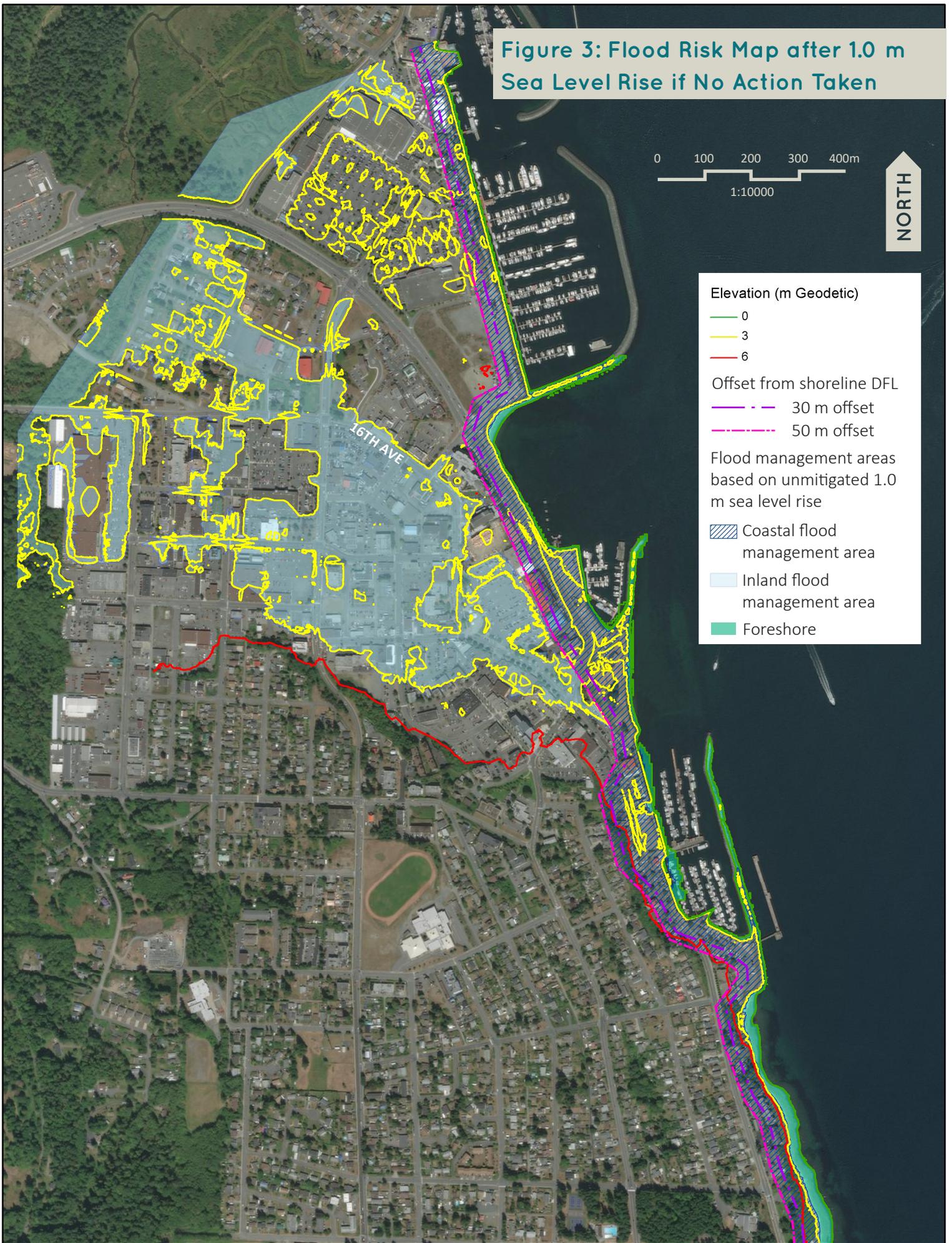
The Province of BC’s Flood Hazard Area Land Use Management Guidelines (amended January 1, 2018) encourage municipalities to introduce:

- ▶ requirements for buildings, subdivision, and zoning that account for 0.5 m of sea level rise by the year 2050, 1 m of sea level rise by the year 2100, and
- ▶ land use adaptation strategies in Official Community Plans and Regional Growth Strategies that account for 2 m of sea level rise by the year 2200 and beyond.

Municipalities are advised to require minimum floor elevations and define building setback requirements for new construction that take into account factors such as:

- ▶ sea level rise flood levels
- ▶ wind-blown waves
- ▶ wave-tossed debris
- ▶ shoreline erosion

Figure 3: Flood Risk Map after 1.0 m Sea Level Rise if No Action Taken



## **IMPLICATIONS ACROSS COASTAL AND INLAND FLOODPLAIN MANAGEMENT AREAS**

Primer I, Figure I—10, duplicated here as Figure 3, differentiates between coastal flood management areas and inland flood management areas.

The coast of Campbell River is exposed to wave effects and associated spray, logs and debris. All properties vulnerable to this risk are in Campbell River's coastal flood management area. Flood construction levels vary depending on wave exposure and shoreline shape but are generally higher than existing elevations.

Dynamic waves in design storm events may overtop coastal defenses, allowing floodwaters to flow into any low-lying inland areas. Parts of Campbell River's downtown area are low-lying – including Shoppers Row, parts of Pier Street and the Cedar Street area. Floodwaters from coastal overtopping and concurrent rainfall accumulation during a design storm will pool in these low-lying areas until tides drop. To manage this risk the properties affected are designated as part of an inland flood management area. The depth of floodwaters is not expected to be deep enough to have significant waves, and therefore the flood construction level in the inland areas is 3.7 m geodetic – considerably lower than flood construction levels in the coastal area.

Existing land uses and buildings in both the coastal and inland flood management areas will come to the end of their service time. At the time of their reconstruction, sea level rise adaptations can be incorporated that mitigate anticipated risks over the lifespan of the asset.

To guide this adaptation, the City of Campbell River should update the regulations that guide future building and site development.

## **FLOOD MANAGEMENT TOOLS IN THE LOCAL GOVERNMENT ACT**

Two regulatory tools from the Local Government Act are in common use by municipal governments to guide flood protection:

- Flood Hazard Mitigation (Floodplain) Bylaws
- Development Permits

These two tools should be organized to complement one another. Their combined use would provide reasonable public safety and property protection, while also allowing some flexibility to adjust to the neighbourhood context associated with a new development.

### **FLOOD HAZARD MITIGATION BYLAW**

The primary purpose of a Flood Hazard Mitigation Bylaw is to protect life from flood hazard. Flood construction levels for the bottom of wood structure or slab for habitable floors is established for different areas in the bylaw. A secondary purpose is to protect property including valuable goods, and flood construction levels may also designate minimum elevations for floors storing valuable inventory.

Flood Hazard Mitigation Bylaws may also specify setbacks from watercourses or the sea to new buildings. Provincial guidance is to provide a setback at a minimum of 15 m from future estimated natural boundary. The natural boundary is defined by the Land Act and is based on where regular and repeated inundation causes changes in shoreline vegetation and the land itself (see BC Land Act Chapter 245 definitions). With sea level rise, this natural boundary will move upward and inland, to create what is referred to as the future estimated natural boundary (FENB). The location of this FENB will vary over time as sea level rise progresses and with the terrain or slope of the land above the existing sea. Given these variables it is difficult to predict

the precise location of a future estimated natural boundary. Setbacks from this FENB are therefore also difficult to administer.

In a Flood Hazard Mitigation Bylaw, the flood construction levels and setbacks may not be varied by a local government, including Council or a Board of Variance. Only a technical report by a qualified professional engineer could be accepted by the Building Inspector to vary the bylaw requirements.

### **DEVELOPMENT PERMITS**

Development Permits, often located in an Official Community Plan, have wide powers under the Local Government Act to guide the form of new development.

For flood protection, regulations often use the Protection of Development from Hazardous Conditions form of Development Permit.

Development Permits may also be used for Protection of the Natural Environment, Its Ecosystems and Biological Diversity.

## **FLOOD MANAGEMENT EXISTING REGULATORY CONTEXT IN CAMPBELL RIVER**

The City of Campbell River has not yet implemented a Flood Mitigation Bylaw. Minimum elevations for new construction associated with watercourses and the sea are provided in its Zoning Bylaw Section 4.4, which stipulates:

- Where flood levels have not been determined, the City may permit building if the underside of the floor system is at least 1.5 vertical metres above the natural boundary of any lake, watercourse, stream, ocean or foreshore area.
- Storage tanks shall be located above the identified flood elevation level, or otherwise:
  - Buried and have a water-tight cap; and/or
  - Sufficiently anchored to withstand flood waters.
- Where landfill is required to raise a minimum floor area elevation above the identified floor level, the maximum building height permitted may be increased by the equivalent depth of the landfill or difference needed to raise the underside of the floor above the floor level.

The City has existing Development Permits (DPs) with guidelines relating to shorelines and habitat areas, including the following:

- General Environmental Development Permit Area
- Streamside Development Permit Area
- Campbell River Estuary Development Permit Area
- Foreshore Development Permit Area
- Hazard Conditions Development Permit Area

Issues of coastal flooding are partly addressed in the existing Foreshore and Hazard Conditions DPs. However, the guidelines require update to reflect the new information from the Sea Level Rise Assessment Study. Key existing content of DPs related to coastal flooding are summarized below. Refer to the Official Community Plan for full and current guidelines.

## **FORESHORE DEVELOPMENT PERMIT AREA**

All land alteration, shore line modification, subdivision or development shall be subject to approval for development permit within those areas designated as foreshore on Map 9 and extending 30 meters seaward and landward from the natural boundary at the sea.

## **FORESHORE DEVELOPMENT PERMIT AREA JUSTIFICATION**

- Filter pollutants including sediment
- House photosynthesis/primary productivity/carbon cycling in shallow productive zones;
- Support diverse marine shoreline ecologies, including:
  - Nursery rearing, migration, and food production (invertebrate and forage fish) for juvenile salmonids;
  - Shoreline aesthetic;
  - Forage fish spawning along sediment shorelines – forage fish are a critical food source for salmonids, marine mammals, and waterfowl; and
  - Eelgrass beds, salt marsh and kelp beds – these are important food production areas (primary producers) and critical habitats for a wide variety of marine species that include forage fish, salmonids and crabs).
- Dissipate wave energy, protecting property values and reducing risks from sea level rise.

In general, hardening the shoreline through the construction of seawalls and rip rap revetment is strongly discouraged because seawalls disrupt beach formation and reduce ecological and property values. Seawalls generate reflective or plunging waves that dramatically lower the beach cross section below the seawall over time, resulting in the destruction of critical habitat for forage fish spawning (particularly surf smelt and sand lance). Seawalls and rip rap revetments can also lead to increased rates of erosion for adjacent sections of shoreline.

Setbacks from the marine shore and higher construction elevations will become increasingly important as sea level rise escalates the risk of coastal flooding, erosion and associated impacts.

## **FORESHORE DEVELOPMENT PERMIT AREA GUIDELINES**

- Detailed description needed by QEP
- Shall not impede public access below natural boundary
- Min 30-meter setback from high waterline
- All occupied areas of buildings shall be constructed at an elevation at or greater than the construction level established by a QEP. Parking and loading may be located below.
- Upland structures to be located to avoid the need for shore protection
- Geotech analysis required
- New driveways and septic systems shall not be located in the DPA.
- If work is undertaken within the 30 meter setback area existing trees and shrubs are to be retained and clearly marked prior to development, and temporary fencing installed at the drip line
- Sensitive, rare or threatened species to be preserved
- Restoration required in any cleared areas
- Stormwater management plan and erosion and sediment control plan required

- Environmental Management Plan required
  - Site and project description
  - Roles and responsibilities for construction
  - Sequence of major construction activities
  - Scaled Site Map
  - Spill Management Protocol
  - Waste Management Protocol
  - Management Protocol for Hazardous Materials
- Geotech analysis for bluff shorelines
- Geotech to provide risk slope stabilization
- Routine maintenance to hardened foreshore (rip rap etc.) may not require a development permit provided that no new material (other than replacement material) is added to the structure and no new materials are taken away.

#### **FORESHORE DEVELOPMENT PERMIT AREA SHORELINE PROTECTION MEASURES**

- Avoid Groynes and breakwaters to prevent disruption of sediment movement
- Beach nourishment may be required.
- Limited to only what is necessary to prevent damage to existing structures or established uses.
- Use softest possible measure
- Should be appropriately sized to create natural beach slope and armour
- Use of sea walls / rip rap not acceptable except when there is no other alternative
- Measures that will cause erosion or other physical damage not supported
- New structural shore protection measures to protect existing structures may be considered with following criteria
  - Report by QEP
  - Erosion is not being caused by upland conditions (geo tech analysis needed)
  - Soft measures are not feasible
  - They do not result in net loss of shoreline
- Existing shore protection may be replaced if
  - It is the same size
  - It does not encroach on the natural boundary
  - Existing impacts marine habitats
- Structural protection measures should be installed as far inland as possible
- Materials should be inert, free of debris
- Shoreline protection measures should plan and accommodate for projected SLR through material choice and elevation

# POTENTIAL REGULATORY UPDATES FOR COASTAL FLOOD MANAGEMENT IN CAMPBELL RIVER

## ROLE OF FLOOD MITIGATION BYLAW AND DEVELOPMENT PERMITS

In the context of Campbell River’s existing coastal land use development and its Development Permit structure, a customized use of Flood Hazard Mitigation Bylaw and updated DP guidelines is proposed. In general terms, the role of each tool would be as below:

- Flood Hazard Mitigation Bylaw would establish Flood Construction Levels for various areas of the Coastal Flood Management Area and the Inland Flood Management Area.
- Foreshore Development Permit Updates would guide setbacks for property protection while integrating guidelines for foreshore protection of the natural environment, its ecosystems and biological diversity.
- Consequential amendments to other DPs and the Zoning Bylaw would be necessary.

## DRAFT APPROACHES TO FLOOD HAZARD MITIGATION BYLAW

It is proposed that a new Flood Hazard Mitigation Bylaw in Campbell River’s waterfront context would focus on setting floodplain areas and minimum Flood Construction Levels in accordance with Primer III, Figures 1- 4.

The District of North Saanich has recently been considering a Flood Hazard Mitigation Bylaw. It is a worthy precedent for review, available at their website. In considering a similar approach for Campbell River, the setback provisions would not be included, as they would be included in the Development Permits for Campbell River.

## DRAFT APPROACHES TO DEVELOPMENT PERMIT GUIDELINE UPDATES

The Foreshore Development Permit Area and its guidelines would be adapted to clarify setback and habitat provisions.

The Foreshore Development Permit Area Guideline clause c) would be replaced with more specific guidelines based on the principles and diagrams below.

Figures 4-6 show conceptual cross sections of approaches to site and building design at time of reconstruction to accommodate sea level rise on a typical waterfront residence. Application of the sections is in order of preference:

First preference (wherever feasible) is Figure 4:

- Habitable floors of the new home are established above the applicable flood construction level (FCL) and landward of a setback (20.5 m) from the existing (2020) natural boundary at the sea. Floor of non-habitable garage and storage areas would likely be below FCL and just above the adjacent street level, as well as above a design still water level of 3.7 m geodetic.
- From the seaside natural boundary, an engineered grade of cut and fill rising at about 1m vertical in 8 m horizontal (12.5%) would create a sloping cobble beach-like shoreline to absorb wave energy while improving or allowing views of the sea from the new residence.
- Driftwood log zones will initially be near the existing natural boundary, but will slowly work up the beach with sea level rise.
- A sea spray zone buffer of shoreline dune grass, beach pea, lupine is proposed at or just above the log zone, with a riparian area of woody shrubs such as snowberry, salal and native rose above the log zone. Tree planting is encouraged but optional.
- Seaward of the building, a minimum 3 m wide crest to minimize wave splash or overtopping is established at the flood construction level minus freeboard (minus 0.6 m from FCL). Balconies, terraces, and outdoor living areas are envisioned near the crest.
- Side yard areas need to be graded to control wave splash and drainage within the subject lot, with surface runoff flowing either to the sea or to the adjacent street drainage system. Sideyards also must be designed in context with existing or proposed grades on adjacent lots, so that waves or drainage do not flow into or out of the subject lot in an uncontrolled fashion.

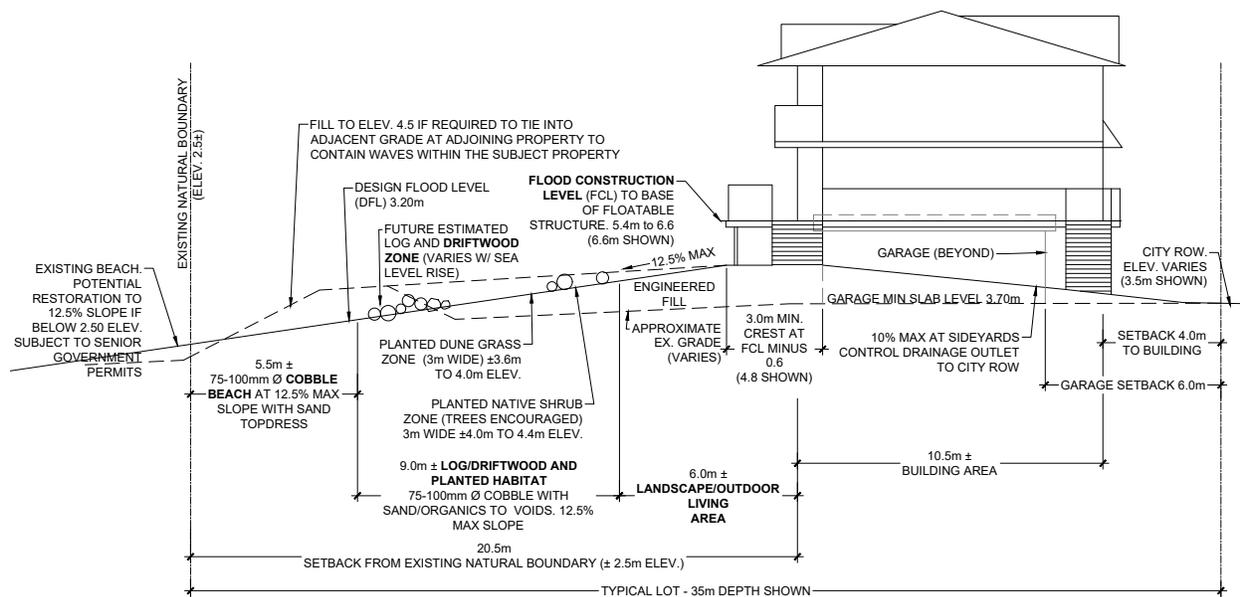


Figure 4: Waterfront Residential Development Concept A

Second preference (where Figure 4 is not feasible) is Figure 5:

- Similar to Figure 4, habitable floors of the new home are established above the applicable flood construction level (FCL). The setback from the existing (2020) natural boundary at the sea to the building is greater (23.0 m) resulting in less building space. Like Figure 4, floor of non-habitable garage and storage areas would likely be below FCL and just above the adjacent street level, as well as above a design still water level of 3.7 m geodetic.
- A rock armour revetment is shown set back from the seaside natural boundary. In the shoreline setback, an engineered grade of cut and fill rising at about 1 vertical in 8 m horizontal (12.5%) would create a sloping cobble beach-like shoreline similar too but narrower than Figure 4.
- Driftwood log zones will initially be near the existing natural boundary, but will slowly work up the beach with sea level rise.
- A sea spray zone buffer of shoreline dune grass, beach pea, and lupine is proposed at or just above the log zone, with a riparian area of woody shrubs such as snowberry, salal and native rose above the log zone. These areas will eventually be affected by sea level rise and extreme storm events, but will provide important habitat until that time.
- Between the top of the rock armour revetment and the building, a native shrub riparian zone and outdoor living areas will be subject to wave splash in severe storms and must be sloped back towards the sea to allow this splash to return seaward.
- Similar to Figure 4, near the building, a minimum 3 m wide crest to minimize overtopping is established at the flood construction level minus freeboard (minus 0.6 m from FCL). Balconies, terraces, and outdoor living area are envisioned near the crest. Side yard areas need to be graded to control wave splash and drainage within the subject lot, with surface runoff flowing either to the sea or to the adjacent street drainage system. Sideyards also must be designed in context with existing or proposed grades on adjacent lots, so that waves or drainage do not flow into or out of the subject lot in an uncontrolled fashion.

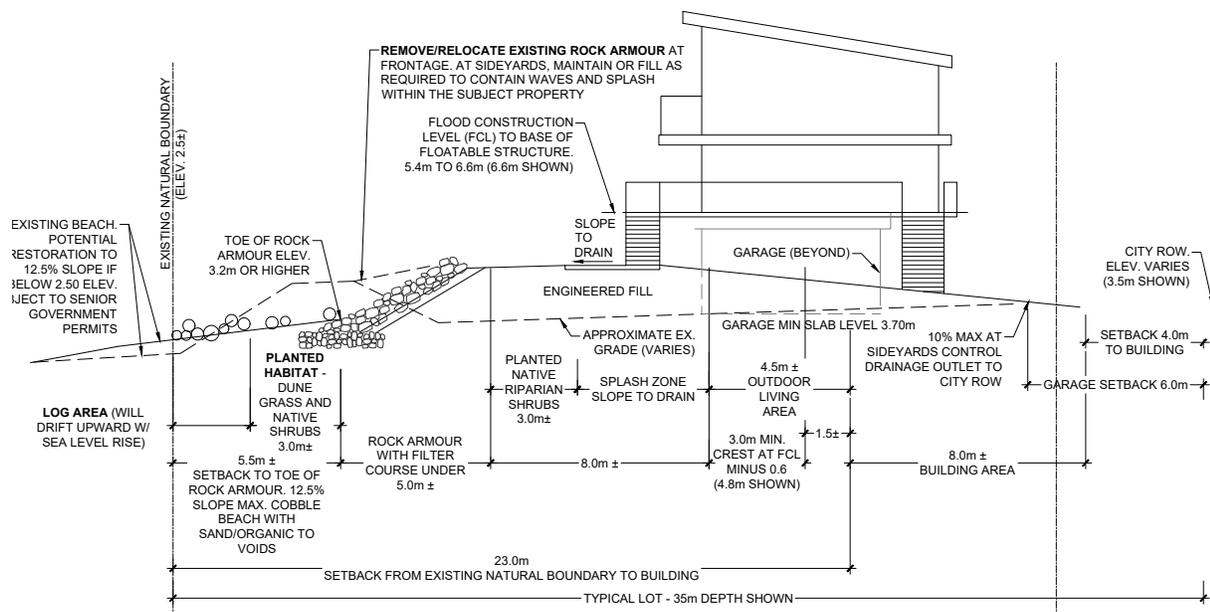


Figure 5: Waterfront Residential Development Concept B

Figure 6 is intended for those lots that have a stand of native vegetation or trees between the ocean shore and a proposed building. The intent of the design is to allow redevelopment while saving the existing foreshore trees:

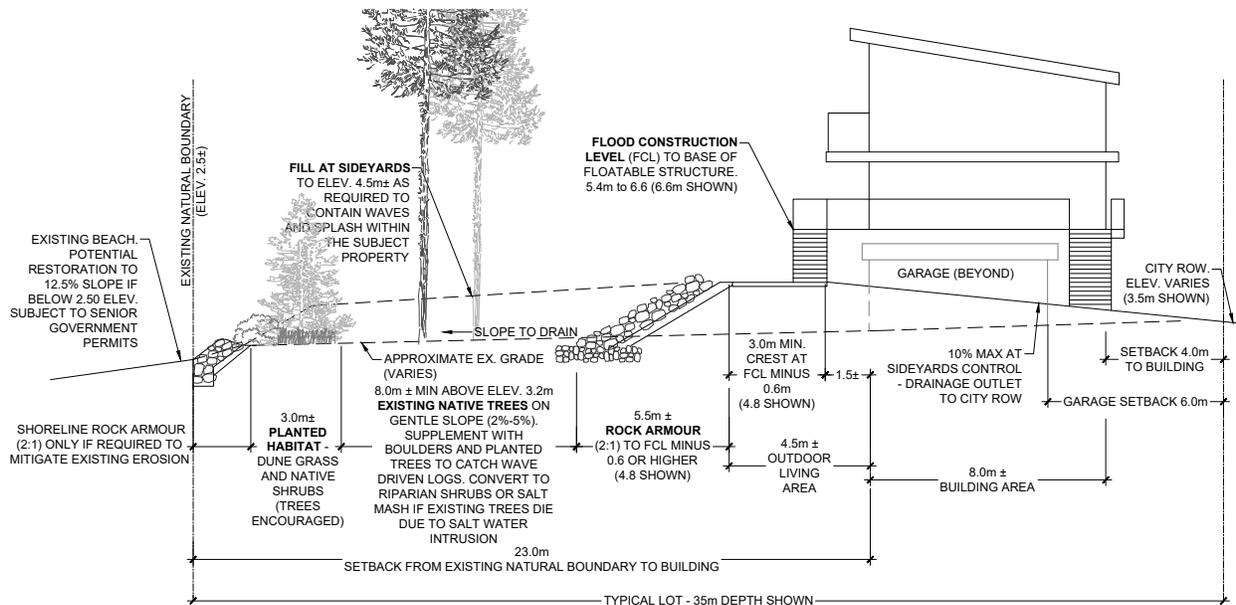


Figure 6: Waterfront Residential Development Concept C

- Like Figures 4 and 5, habitable floors of the new home are established above the applicable flood construction level (FCL) and landward of a setback (23.0 m) from the existing (2020) natural boundary at the sea. Floor of non-habitable garage and storage areas would likely be below FCL and just above the adjacent street level, as well as above a design still water level of 3.7 m geodetic.
- From the seaside natural boundary, minimum height of rock armour would be placed to protect the existing treed area from erosion. The height of this shoreline armour may need to be raised in conjunction with sea level rise from time to time, but the intent is to minimize the height and extent of the shoreline armouring.
- Depending on the height of the shoreline rock armour, driftwood log zones will initially be near the existing natural boundary, but will slowly work further into the treed zone with sea level rise.
- A sea spray zone buffer of shoreline dune grass, beach pea, and lupine is proposed at or just above the shoreline armour, with a riparian area of woody shrubs such as snowberry, salal and native rose mixed with the log zone. Tree planting is encouraged but optional.
- Seaward of the building, a rock armour revetment rises to a minimum 3 m wide crest to minimize wave splash or overtopping, established at the flood construction level minus freeboard (minus 0.6 m from FCL). Balconies, terraces, and outdoor living area are envisioned near the crest.
- Like Figures 4 and 5, side yard areas need to be graded to control wave splash and drainage within the subject lot, with surface runoff flowing either to the sea or to the adjacent street drainage system. Sideyards also must be designed in context with existing or proposed grades on adjacent lots, so that waves or drainage do not flow into or out of the subject lot in an uncontrolled fashion.

## NEIGHBOURHOOD-SCALE SLR ADAPTATION PLANNING IN THE COASTAL FLOOD MANAGEMENT AREA

In the Coastal Flood Management Area, the issue of how new buildings and site adaptation are coordinated among adjacent lots is important. Although the intent of the design guidelines is to allow each lot to redevelop independently, a coordinated approach among neighbours could reduce costs and complications in sideyard walls and drainage barrier treatments. This is of particular advantage in using Figure 6 approaches where many more trees could be saved if sideyard drainage control in the tree zone could be coordinated and minimized.

As the sea level rises, groundwater levels may also rise, and saline sea water may intrude further inland and higher. This could affect existing low-level tree root zones, leading to eventual death of shoreline trees. If this were to happen after applying Figure 6 approaches, neighbourhood owners would need to decide whether to allow the former treed area to naturalize as shoreline wetlands or salt resistant woody plants, or to reapply for a development permit to move more towards Figures 4 and 5 at that time.

## DOWNTOWN STREETS AND DEVELOPMENT ADAPTATION IN THE INLAND FLOOD MANAGEMENT AREA

The Inland Flood Management Area is concentrated in Shoppers Row, and the Pier Street and Cedar Street neighbourhoods. While this area is potentially sheltered from wave effects by shoreline defenses, it is at risk of stormwater back-up and rainfall accumulation during periods of coastal storms that block storm drainage outfalls.

The Inland Flood Management area is already designated floodplain in Campbell River. Flood Construction Levels (FCL) for new residential and commercial buildings are likely to be listed in the Flood Hazard Mitigation Bylaw. There may be different FCL for different land use types:

- For all residential uses, and where possible for commercial uses, FCLs for new construction are ideally above a single level of 3.7 geodetic to allow for a design flood level for still water of 3.1 plus a freeboard for safety and unknowns of 0.6 m.
- However, for pragmatic purposes, lower FCLs are permissible for retail storefront with a minimum floor elevation of 3.2 m geodetic for non-residential building floors in zero lot line (storefront) conditions provided that a covenant recognizing flood risk is placed on land title.

Existing site and building elevations are highly variable in the downtown, but the increase in floor elevation may be in the order of 1 m in some locations.

The streets and sidewalks in these areas also need to be increased in elevation at the time of their reconstruction to continue to provide public safety, emergency access and egress during a storm event. Streets vary in elevation to allow for gravity drainage and are designed to carry surface water at roadsides for short periods during extreme storm events. A guideline for future street elevations is to be between 3.1 and 3.7 m geodetic or higher, so that they are generally above design still water flood elevations but below building floor elevations. While existing street elevations vary, this rise in street level could range from 0.3 to 0.9 m.

Much of the downtown area has buildings that are setback from the street edge property line and can accommodate changes in street elevations by gradual slope transitions to buildings. Zero lot lines (no setback from street property line) exist at most buildings on Shoppers Row, parts of 11th Avenue and some other buildings. There are complications in adapting the building floors and street elevations one-building at a time during reconstruction.

Figures 7, 8, 9, and 10 show example cross sections for a staged adaptation to reduce flood risk of downtown commercial floors of buildings and streets at time of redevelopment. Strategies include:

1. While raising streets to be above 3.1 geodetic, in areas with existing zero lot line buildings strive for designs that are near this minimum.
2. Use flush curbs and gutters for drainage rather than upright curbs. The flush design reduces the cumulative increase in street edge at the property line while still allowing for drainage away from buildings.
3. Design raised streets with a street edge property line elevation that accommodates a maximum of three steps up to lowest residential floor level (3.7 m geodetic) and a maximum of three to four steps down to existing commercial floor levels before building redevelopment.

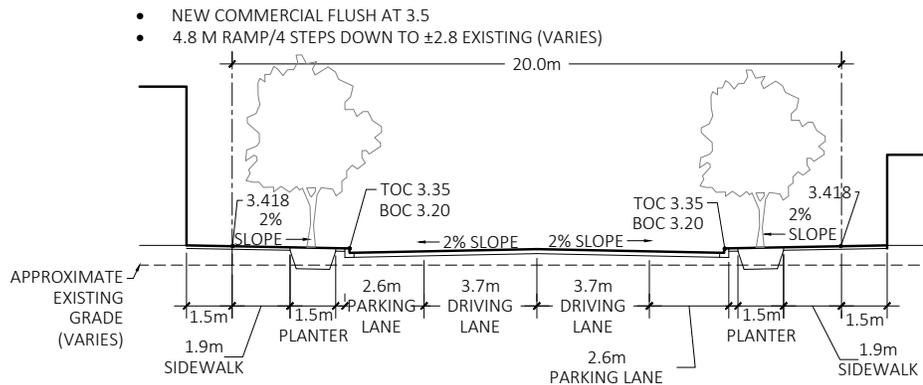


Figure 7: Example Cross Section of 11th Ave

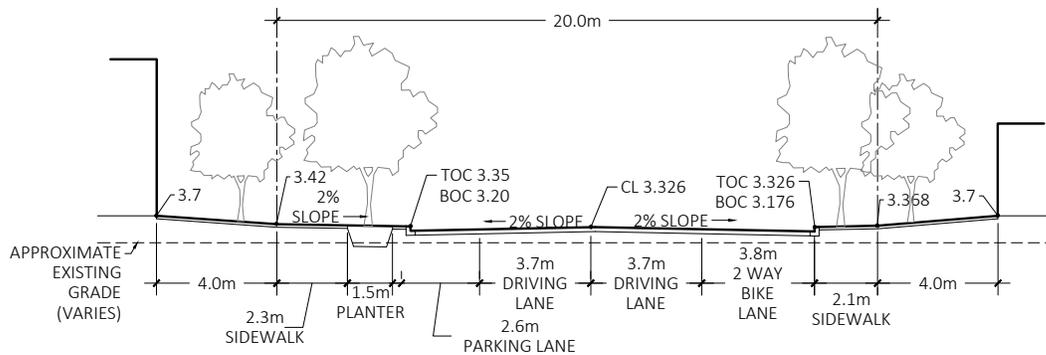


Figure 8: Example Cross Section of 16th Ave

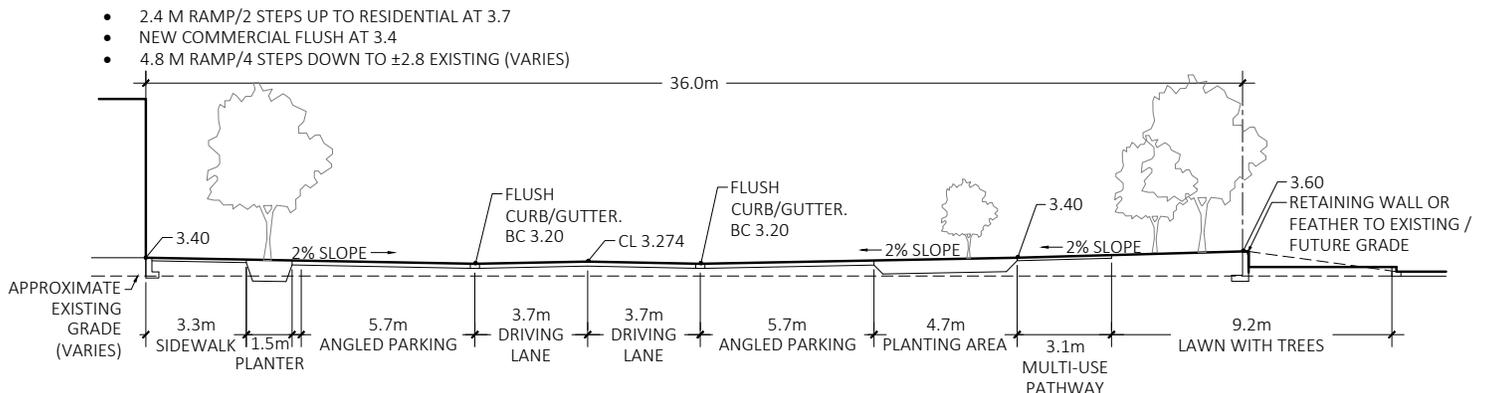


Figure 9: Example Cross Section of Shoppers Row - Upper

- 4.192 M RAMP/3 STEPS UP TO RESIDENTIAL AT 3.7
- NEW COMMERCIAL AT 3.2
- 3.2 M RAMP/3 STEPS DOWN TO ±2.8 EXISTING (VARIES)

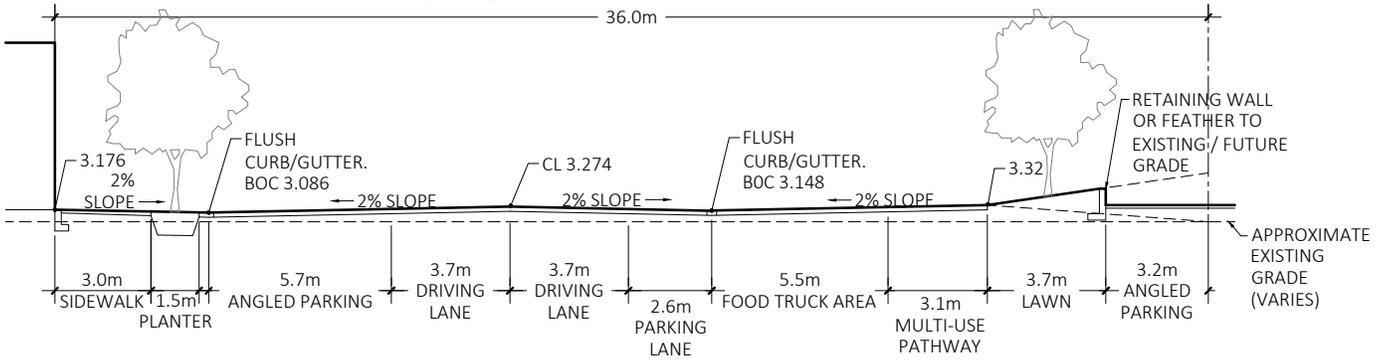


Figure 10: Example Cross Section of Shoppers Row - Lower

Guidelines to assist adjacent property owners to adjust to raised street levels could be in Form and Character Development Permits, including:

1. Encouraging raising floors of existing retail buildings to the new street level. Most commercial spaces have high ceilings, allowing for the floor elevation to be raised while still retaining a reasonable wall height to existing ceilings.
2. Where floors of existing buildings are not raised to match the street, work with property owners to design and install stairs and handicapped ramps that provide safe public access and egress while also maintaining an attractive commercial interface with the street. The change in grade could be at exterior alcoves or just inside entrance doors.
3. Split floor level combinations are also possible where parts of building floors raised to street level (e.g. front storefront areas) and other parts (e.g. rear storage areas) are left at lower levels while recognizing flood risks. Stairs and ramps to change grade would in these cases be interior to the building away from the storefronts.
4. When commercial buildings are reconstructed, if the proposal has retail space, the retail floor would be just above the level of the street edge, and in all cases above elevation 3.2 geodetic.
5. Mixed use commercial / residential buildings could have retail floor levels at street level (above 3.2 m geodetic) and residential areas above 3.7 m geodetic.
6. On larger sites, it may be desirable to have micro-retail facing the street above elevation 3.2 m geodetic, with parking behind the retail in the lot interior. A second level pedestrian-dominated concourse and courtyards above elevation 7.0 m geodetic may provide public access to multi-storey mixed commercial residential buildings.
7. Underground parking should be waterproofed and weighted (tank construction methods) to withstand flood waters, and have entrance drives designed to be floodproof – with driveway crests above 3.2 m geodetic.
8. Mechanical and electrical systems, including electric car chargers, should be floodproof or above the flood construction level of 3.7 m geodetic.

## INCIDENTAL CHANGES TO OTHER BYLAWS

### ZONING BYLAW

Zoning Bylaw Sections 4.3 and 4.4 regarding Locating Building Above the Natural Boundary of Lakes, Watercourses, Streams, the Ocean and Foreshore Areas should be reviewed to be consistent with the updated Foreshore Development Permit and Flood Hazard Mitigation Bylaw requirements.

The allowance for some uses to be below Flood Construction Level (e.g. parking, storage) could be reinforced in the zoning bylaw, with a table of specific uses allowed, while all other uses are excluded below FCL. A

situation to be avoided is where building space that is unallocated at time of building permit is subsequently converted to residential purposes below the FCL. It may be advisable to minimize such unallocated space, with preference for fill in areas that are not clearly garage space or limited storage space below FCL.

## **SUBDIVISION BYLAW AND ENGINEERING STANDARDS**

The existing Campbell River Subdivision and Development Servicing Bylaw includes design guidelines, standard drawings and specifications for a range of low impact development techniques. In a similar way, common sea level rise adaptation techniques (See Primer II) could be developed as standards in parallel with other best practices in the bylaw. This standardization would improve consistency of sea level rise best practice implementation and reduce time requirements for both approving officials and applicants and their consultants.

## **ROLE OF PUBLIC WORKS**

Beyond regulations that address private development, the City plays a major role in design and construction of streets, utilities, parks and other public works. Key actions that are advisable to facilitate sea level rise adaptation include:

- For areas like the downtown inland where streets will need to be raised, it is important for adjacent landowners to know well in advance of reconstruction or new development what the future elevation of the streetside will be at the lot line of their frontage. Street and sidewalk levels are often determined in concert with design of underground stormwater and other utilities, to provide for gravity drainage. Advance design is required that integrates stormwater system upgrades, street cross section and profile, and profile line at the lot line interface with private property.
- In the Coastal Flood Management Area, public parks, streets and flood protection works need advance planning to ensure that their design elevation meets or exceeds the flood protection requirements. Of particular importance is advance planning to be sure adequate space and land tenure is set aside to allow for future elevated works.
- Advance design is needed to avoid profile conflicts of storm system upgrades, sanitary sewer alignments, and other utilities with anticipation of location of future stormwater storage areas and pump stations.

## **SENIOR AGENCY REGULATORY ROLES**

Several senior government agencies have jurisdiction over the foreshore and waters beyond the natural boundary. Approvals for works on the foreshore are required from:

- Provincial Crown Lands
- BC Environment and Climate Change
- Fisheries and Oceans Canada
- Transport Canada (Navigable Waters)

These agencies may also offer to review or provide input to the Campbell River regulatory changes considered. City-wide or large area Memoranda of Understanding with agencies, or wide-area water lot leases, may provide efficiencies for both the City and approving agencies.

## 4.0 SEA LEVEL RISE COMMUNITY ADAPTATION OPTIONS CONSIDERED

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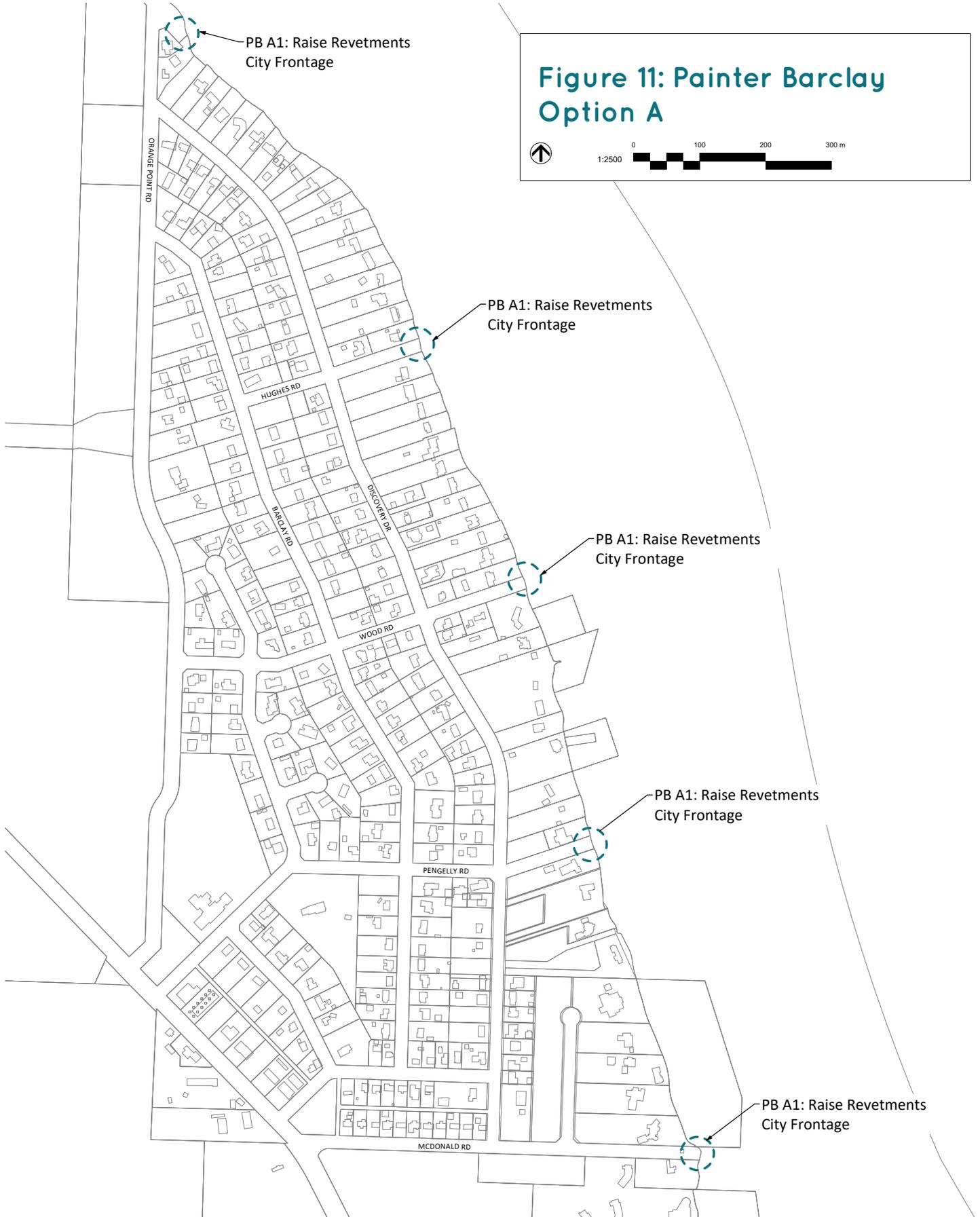
Primer III provides a summary of three options to adapt to sea level rise in Campbell River. Each option includes a set of projects for four focus areas – Painter Barclay, Downtown, Sequoia Park, and Willow Point and South.

The review of options is a planning method that allows comparison of different approaches, costs and benefits. Comparison of options allows for well-informed decisions on which option or mix of elements to pursue in an adaptation strategy.

The following pages provide additional project details for each option. Class D (order of magnitude) capital costs are provided for each project. Although these costs are calculated to the nearest dollar, they should be interpreted as broad guidelines (to the nearest \$10,000), and to a +/- 30% accuracy in 2018 dollars. Projects are intended to be implemented over a multi-decade timeline, and thus the effect of inflation as well as changes in market conditions will have a major impact on final costs and budgets. For these reasons, the capital costs shown should be used for relative comparison among options, as opposed to absolute figures for budgeting purposes.

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# Figure 11: Painter Barclay Option A



## PAINTER BARCLAY OPTION A

The Concept: Parcel-Scale Adaptation, Minimum Community Intervention

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No public intervention encroachment in crown foreshore. On private land, DP language is adjusted to define acceptable private treatment above natural boundary, which in most cases is likely to be installation or extension of revetment. Hazard DP adjusts building reconstruction setbacks to respect risk of on-going erosion of existing steep slopes. Flood Management Bylaw requires that all buildings are brought to above FCL and beyond setbacks at reconstruction.

### **PB A1: Raise Revetments City Frontage**

City street ends are existing City properties in this area. In all cases this option considers minimum shoreline revetment adjustments to adapt to rising seas.

- Removals
- Revetment Adjustments
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad

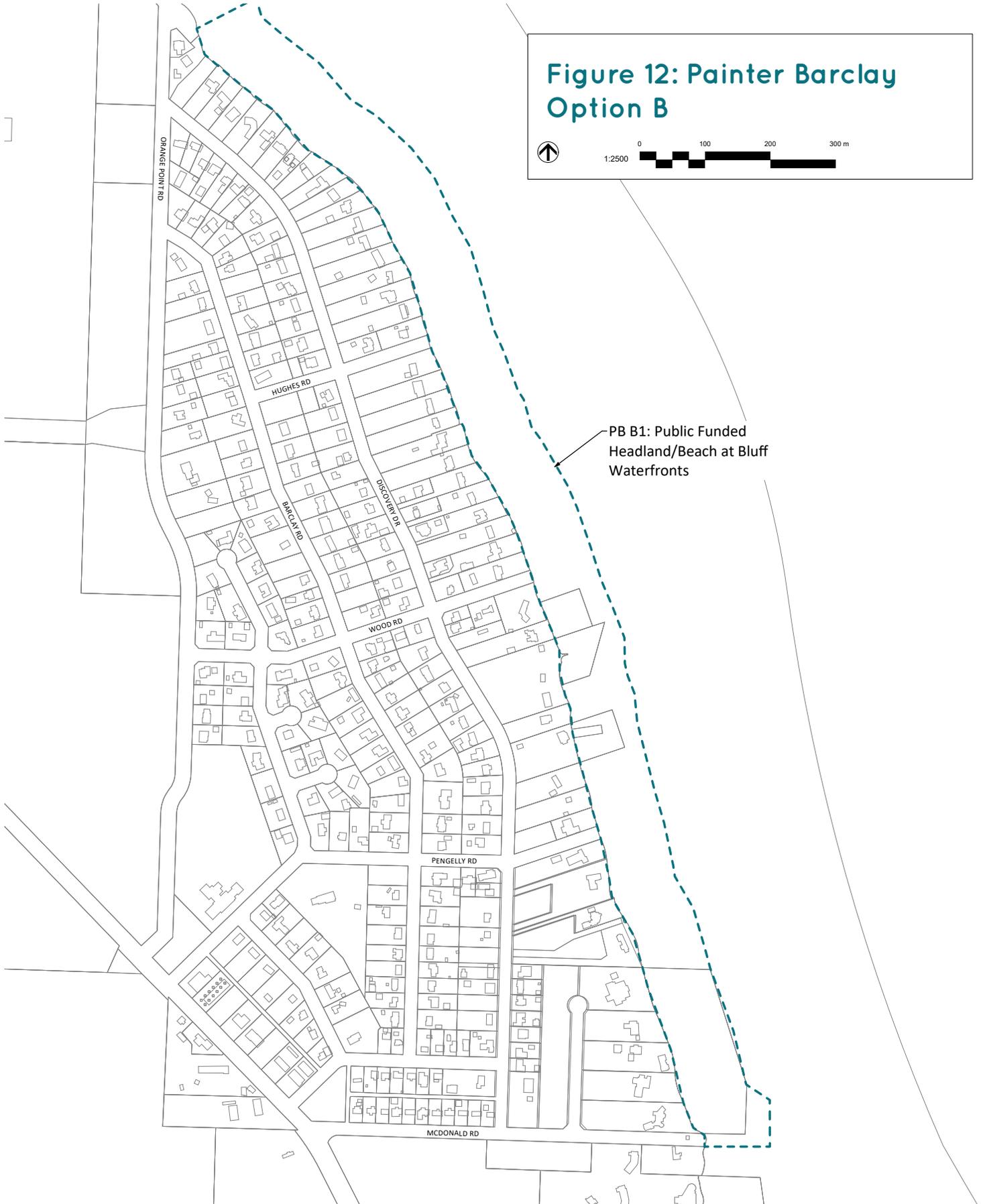
Calculated Budget: \$824,182

**Calculated Total Budget for Works Associated with Public Property: \$824,182**

**Figure 12: Painter Barclay  
Option B**



0 100 200 300 m  
1:2500



PB B1: Public Funded  
Headland/Beach at Bluff  
Waterfronts

## PAINTER BARCLAY OPTION B

The Concept: Neighbourhood Scale Adaptation, Extensive Community Intervention

The City will pursue funding to maintain and enhance foreshore 'pocket beaches' that are protected by improved groins and limited offshore headlands, with rights gained to extend the beach to meet grade on private land. Beach design will strive for continuous and more accessible surface for public access along the beach on crown foreshore or acquired property, other than when closed in a severe storm.

### **PB B1: Public Funded Headland/Beach at Bluff Waterfronts**

Existing pocket beaches will be protected and supplemented by improved groins and limited offshore headlands. Limited supplementary beach materials may be installed to improve walking access along the shoreline.

- Removals
- Rock Groin/Headland Installation
- Raised Beach Installation Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape

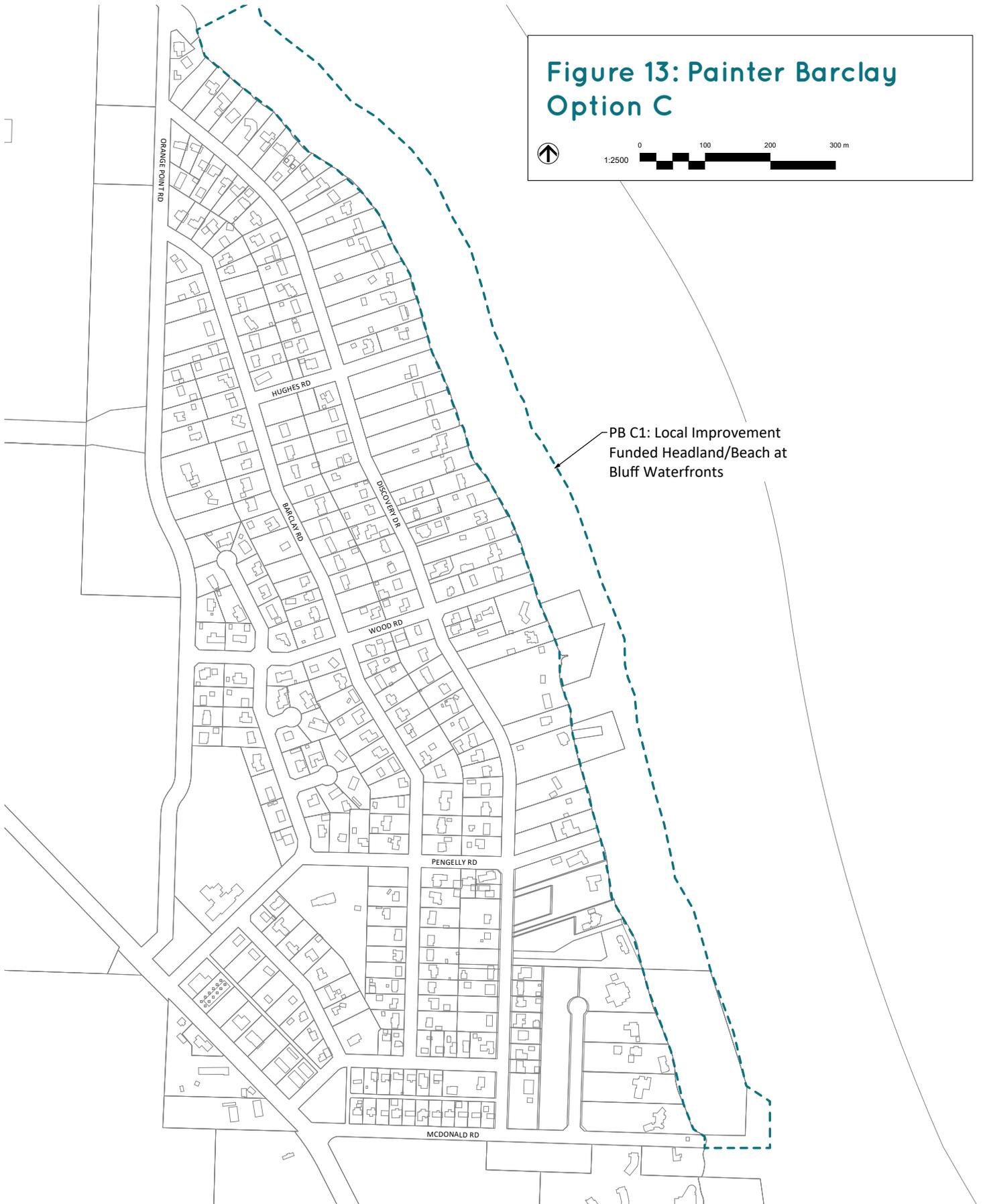
Calculated Budget: **\$14,456,480**

**Calculated Total Budget for Works Associated with Public Property: \$14,456,480**

# Figure 13: Painter Barclay Option C



0 100 200 300 m  
1:2500



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

## PAINTER BARCLAY OPTION C

The Concept: Balanced Intervention with Limited Neighbourhood Scale Priorities

The City will provide design and approval assistance and will facilitate/arrange financing for private-funded neighbourhood improvement projects for constructed combinations of groins, offshore headlands and beach nourishment. The beach design and implementation may improve public beach access, but continuity of public access is not assured.

### **PB C1: Local Improvement Funded Headland/Beach at Bluff Waterfronts**

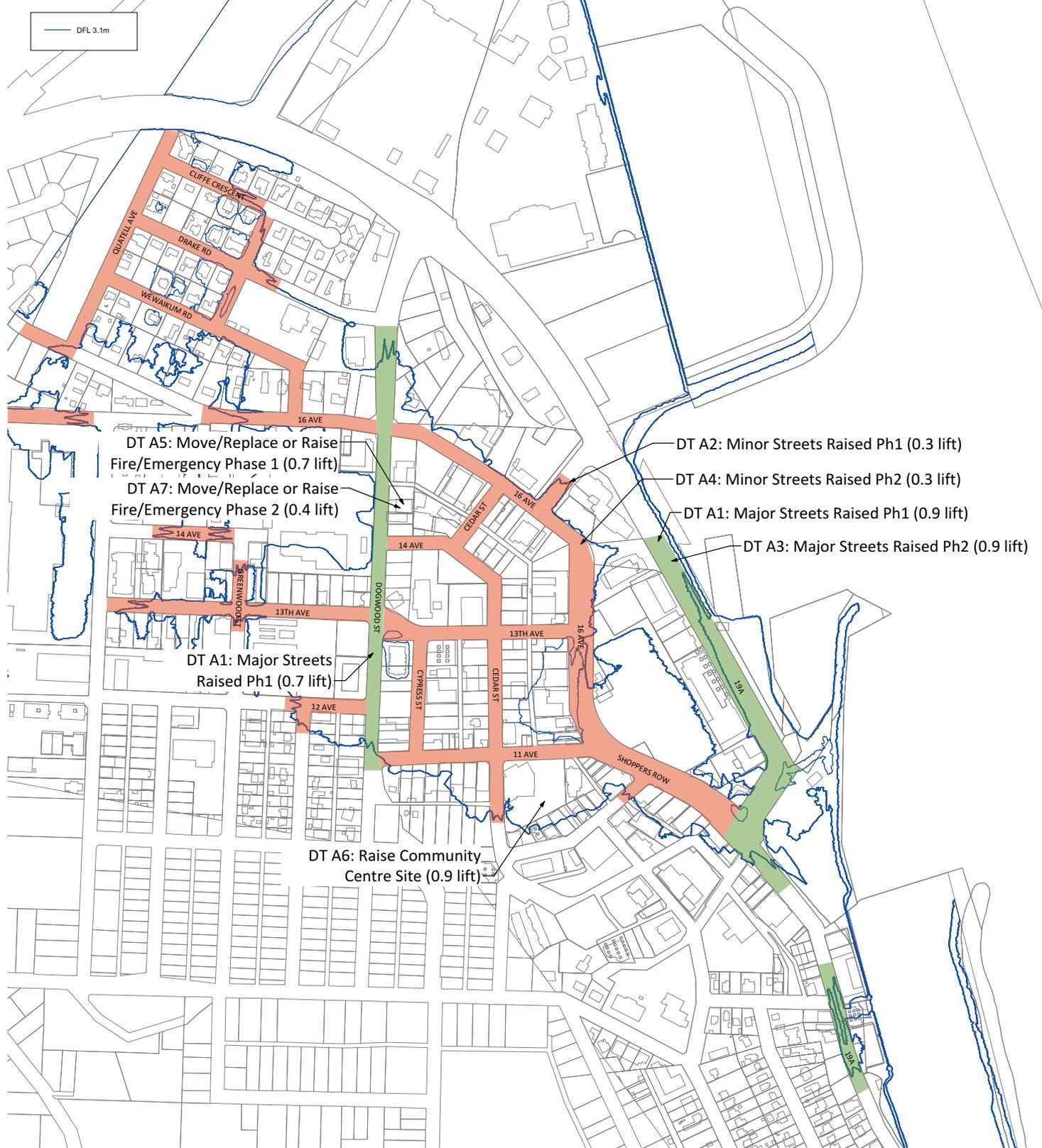
The physical improvements will be similar to Option B, but Option C relies on substantial funding by adjacent property owners through a local improvement program, which would be subject to landowner approval or alternate voter process.

- City contribution for planning / design / approvals / arrange financing. Capital works by Local Improvement
- Removals
- Rock Groin/Headland Installation
- Raised Beach Installation Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape

Calculated Budget: \$2,891,296

**Calculated Total Budget for Works Associated with Public Property: \$2,891,296**

**Figure 14: Downtown  
Option A**



## DOWNTOWN OPTION A

### The Concept: Parcel Scale Adaptation, Minimum Community Intervention

No pump station or public line of defense at the waterfront. Downtown buildings are raised to Coastal and Inland FCL in stages. Downtown streets/utilities are raised to have gravity drainage above DFL in a series of two lifts, each less than 1.0 m to allow access to adjacent properties. Major Streets are kept flood-proof and with base above DFL, while minor streets accept rare flooding into base courses.

#### DT A1: Major Streets Raised Ph 1 (0.9 lift)

Major evacuation and fire routes like Hwy 19A and Dogwood are raised to elevation 3.7 intended to have base courses above the DFL of 3.1.

- Removals
- Fill from 2.5 to 3.4 (0.9 m plus paving structure to 3.7)
- Retaining Wall at ROW both sides
- Ramp to Private Property Adjustments Allowance
- Storm drain and CB adjustment allowance
- Water Valve and Hydrant adjustment allowance
- Service Connection Water Meter, Gas, Communications Box Adjustments
- Highway Paving with Curbs, Lighting, Sidewalks
- Manicured Shrub/Tree Landscape (Medians and Roadside)

Calculated Budget: \$16,327,536

#### DT A2: Minor Streets Raised Ph 1 (0.3 lift)

Local Streets, including Shoppers Row, are raised to elevation 3.1. Lower street is intended to allow easier access into adjacent buildings until they are raised in the future to 3.7.

- Removals
- Fill from 2.5 to 2.8 (0.3 m plus paving structure to 3.1)
- Retaining Wall at ROW both sides
- Ramp to Private Property Adjustments Allowance
- Storm drain and CB adjustment allowance
- Water Valve and Hydrant adjustment allowance
- Service Connection Water Meter, Gas, Communications Box Adjustments
- Street Paving with Curbs, Lighting, Sidewalks
- Manicured Shrub/Tree Landscape (Medians and Roadside)

Calculated Budget: \$28,590,011

#### DT A3: Major Streets Raised Ph 2 (0.9 lift)

Second lift to 4.9 for major evacuation and fire routes within the Coastal Wave Area – in particular Hwy 19A that would provide partial absorption of rare wave effects in the design storm. Areas seaward of Hwy 19A would be flooded.

- Removals
- Fill from 3.7 to 4.6 (0.9 m plus paving structure to 4.9)
- Retaining Wall at ROW both sides
- Ramp to Private Property Adjustments Allowance
- Storm drain and CB adjustment allowance
- Water Valve and Hydrant adjustment allowance
- Service Connection Water Meter, Gas, Communications Box Adjustments
- Highway Paving with Curbs, Lighting, Sidewalks
- Manicured Shrub/Tree Landscape (Medians and Roadside)

Calculated Budget: \$16,327,536

#### DT A4: Minor Streets Raised Ph 2 (0.3 lift)

Second lift to up to inland FCL of 3.7 for minor streets in the Inland Flood Area to allow for improved gravity drainage. Late in the 21st century, adjacent new building FCL would also be raised for SLR in the century following.

- Removals
- Fill from 3.1 to 3.4 (0.3 m plus paving structure to 3.7)
- Retaining Wall at ROW both sides
- Ramp to Private Property Adjustments Allowance
- Storm drain and CB adjustment allowance
- Water Valve and Hydrant adjustment allowance
- Service Connection Water Meter, Gas, Communications Box Adjustments
- Street Paving with Curbs, Lighting, Sidewalks
- Manicured Shrub/Tree Landscape (Medians and Roadside)

Calculated Budget: \$29,767,106

**DT A5: Move/Replace or Raise Fire/Emergency Station Phase 1 (0.7 lift)**

The existing fire station appears to be lower than the DFL of 3.1. Although not costed, when replaced it would need to be raised to 3.7. However, if Dogwood is not yet raised full height the need to be accessible for fire trucks may restrict the building floor height.

- Removals
- Fill from 2.5 to 3.2 (0.7 m plus paving structure to 3.5)
- Fire Station Building & Mechanical Allowance
- SD Piping Allowance
- Manicured Grass/Tree Landscape
- Manicured Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad
- Urban Plaza (hard landscape area)

Calculated Budget: TBD

**DT A6: Raise Community Centre Site (0.9 lift)**

The Community Centre would likely act as an emergency refuge for Downtown. The building FFE would need to be checked that it is above the DFL of 3.1. However, it appears the parking area is below that level, and public assembly would be made more safe by raising the site (and building if necessary) to the inland FCL.

- Removals
- Fill from 2.5 to 3.4 (0.9 m plus paving structure to 3.7)
- CB and SD Piping Allowance
- Manicured Grass/Tree Landscape
- Manicured Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad
- Urban Plaza (hard landscape area)

Calculated Budget: TBD

**DT A7: Move/Replace or Raise Fire/Emergency Phase 2 (0.4 lift)**

Late in the century, and when Dogwood Phase II is lift completed, a second lift to up to 4.2 would keep the fire station accessible to the arterial road, and well above flood risk.

- Removals
- Fill from 3.5 to 3.9 (0.4 m plus paving structure to 4.2)
- Fire Station Building & Mechanical Allowance
- SD Piping Allowance
- Manicured Grass/Tree Landscape
- Manicured Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad
- Urban Plaza (hard landscape area)

Calculated Budget: TBD

**Calculated Total Budget for Works Associated with Public Property: \$91,012,198**

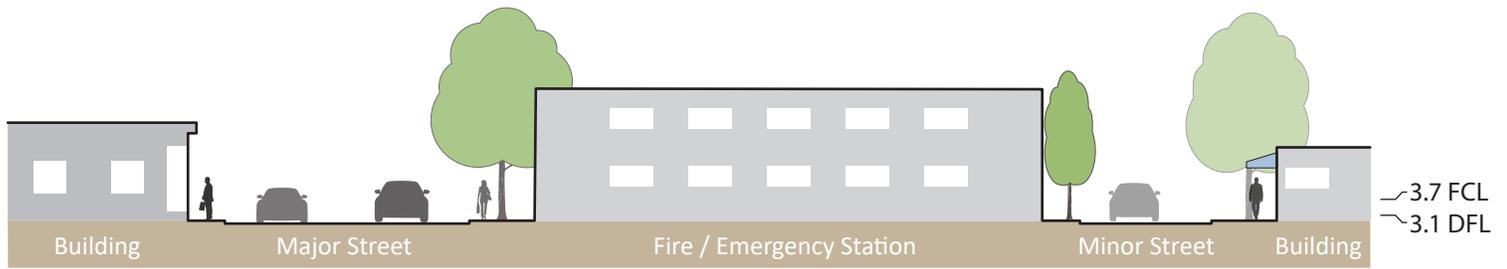


Figure 15: Existing Downtown Conditions

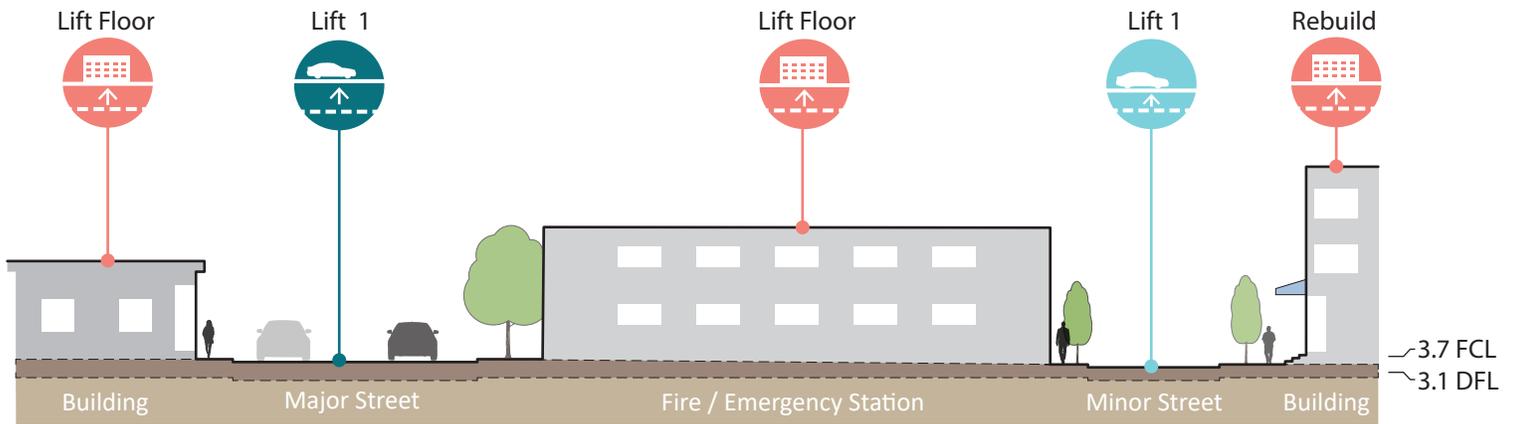


Figure 16: Phase A1

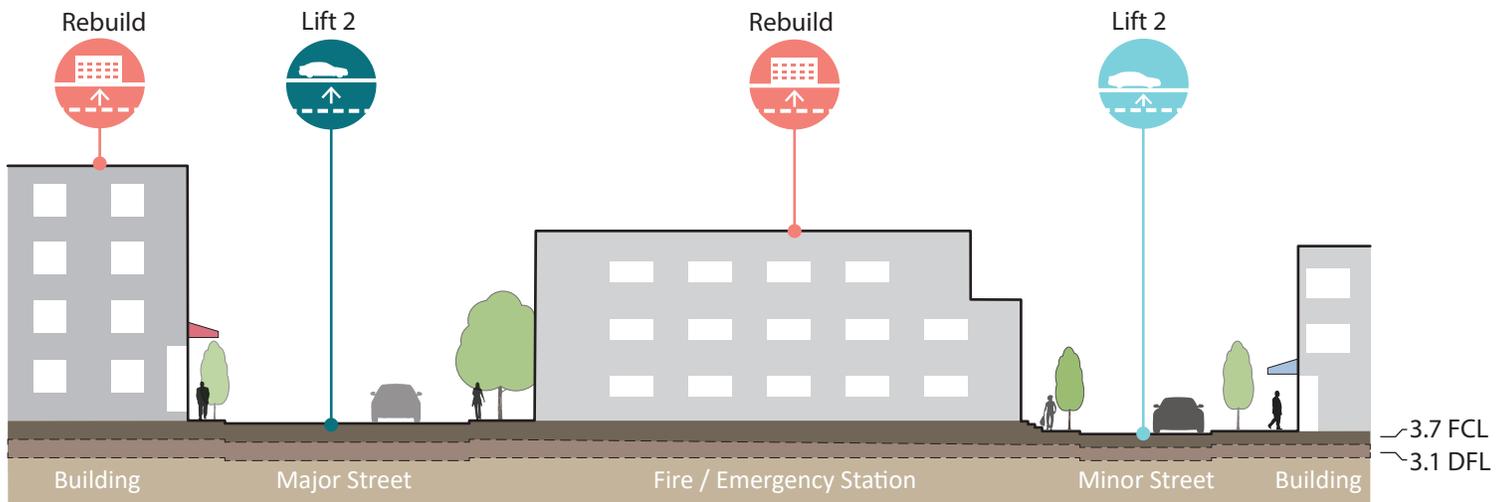


Figure 17: Phase A2



Raise major streets /  
utilities above DFL in  
0.9m lifts

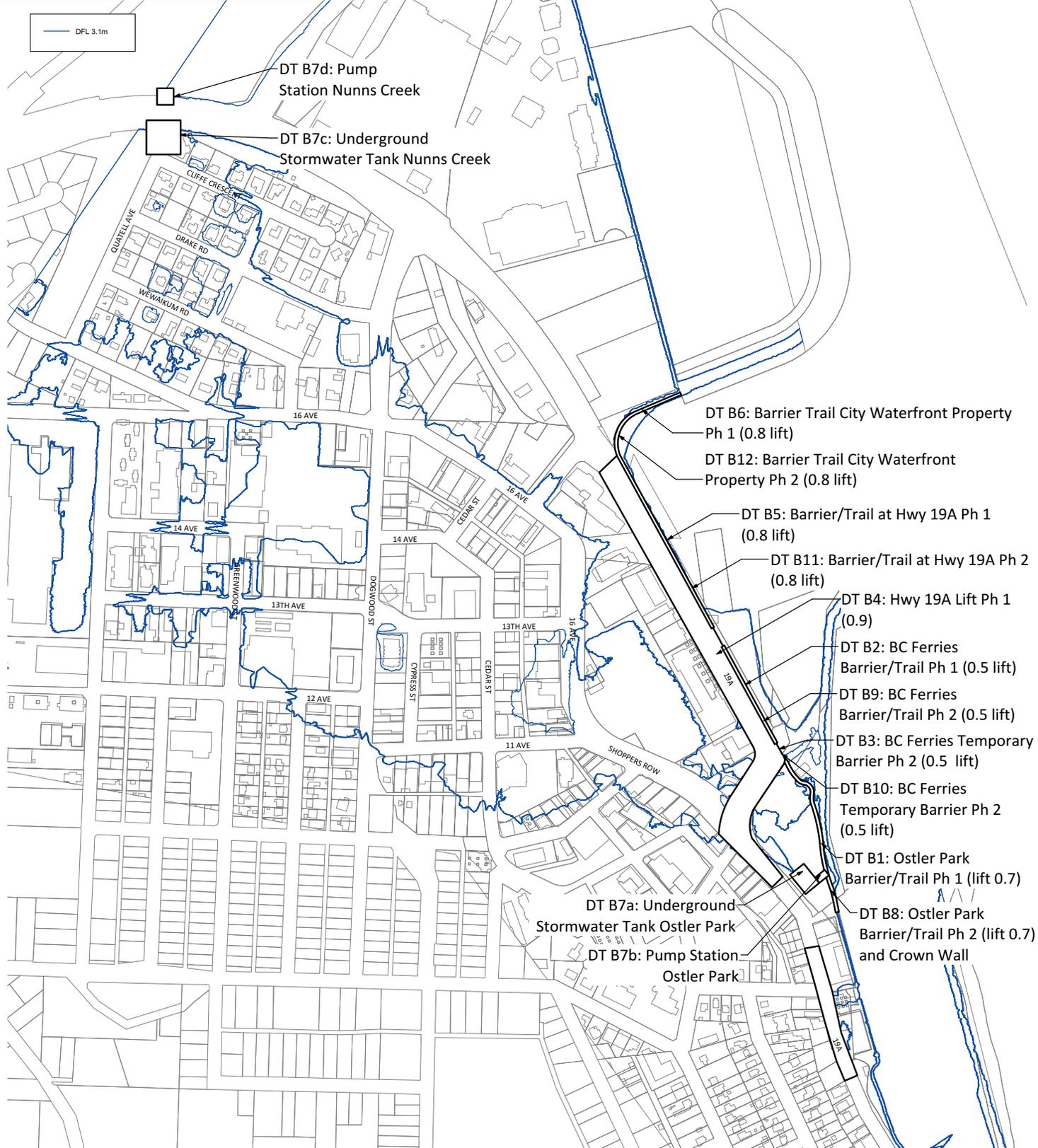


Raise minor streets /  
utilities above DFL in  
0.3m lifts



Raise existing building floors to  
FCL in stages or rebuild buildings

**Figure 18: Downtown  
Option B**



## DOWNTOWN OPTION B

### The Concept: Neighbourhood Scale Adaptation, Extensive Community Intervention

Line of Defense on public land (Ostler Park, Hwy 19A, eventually extending around downtown). Full pump station and storage system with no raising of downtown buildings or streets. High Continued risk of downtown flooding if line of defense or pump station fails, or from groundwater intrusion.

#### **DT B1: 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 diagonal behind the existing FN 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 until a second lift is required by SLR mid to late-century.

- Removals
- Fill from 3.0 to 3.7 (0.7 m plus 0.2 paving structure to 3.9)
- Water edge revetment 3 to 3.9
- Primary paved trail (4m asphalt)
- Manicured grass/tree landscape
- Bench, tables, bike rack on concrete pad

Calculated Budget: \$1,840,044

#### **DT B2: BC Ferries Barrier/Trail Ph 1 (0.5 lift)**

As an extension of the Ostler Park Barrier/Trail, an elevated Phase 1 walkway and barrier runs between a 'Refreshed' 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.

- Removals
- Retaining Wall Along Property Line
- Fill from 3.0 to 3.5 (0.5 m plus paving structure to 3.7)
- Primary paved trail (4m asphalt)
- Manicured Shrub/Tree landscape
- Litter container on concrete pad

Calculated Budget: \$1,108,102

#### **DT B3: BC Ferries Temporary Barrier Ph 1 (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. A 'hump' would be graded into the access driveway, but ramp grades restrict its elevation to about 3.7. Above this elevation, a Temporary Barrier (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 (one phase).

- Removals
- Fill from 3.0 to 3.5 (0.5 m plus 0.2 paving structure to 3.7)
- Storm drain and CB adjustment allowance
- Parking Area / Driveway with Curbs and Lighting

Calculated Budget: \$424,123

#### **DT B4: Hwy 19A Lift Ph 1 (0.9)**

A single phase lift of Hwy 19A to elevation 4.2 is incorporated into planned reconstruction. This elevation places the highway mid-elevation between existing private property grades and future barrier grades on the waterfront.

- Removals
- Fill from 3.0 to 3.9 (0.9 m plus 0.3 paving structure to 4.2)
- Ramp to Private Property Adjustments Allowance
- Storm drain and CB adjustment allowance
- Highway Paving with Curbs, Lighting, Sidewalks
- Manicured Shrub/Tree Landscape (Medians and Roadside)

Calculated Budget: \$9,245,654

#### **DT B5: Barrier/Trail at Hwy 19A Ph 1 (0.8 lift)**

A raised public walkway on a paved trail and extended revetment is the same grade as the raised Hwy 19A. Views to the water would be maintained in Phase I but would be obscured for low vehicles after Phase II raising of the waterfront barriers seaward of the highway.

- Removals
- Fill from 3.0 to 3.8 (0.8 m plus paving structure to 4.1)
- Revetment repair and extension to 4.1, associated fill
- Primary paved trail (4m asphalt)
- Handrail on water side
- Bench, Table or Bike Rack on Concrete Pad
- Litter container on concrete pad

Calculated Budget: \$2,136,303

#### **DT B6: Barrier Trail City Waterfront Property Ph 1 (0.8 lift)**

A similar raised public walkway on a paved trail and extended revetment is envisioned fronting the City waterfront property. It is possible that this extension could be elevated and constructed as one phase rather than two, depending on the design of the waterfront development.

- Removals
- Fill from 3.0 to 3.8 (0.8 m plus paving structure to 4.1)
- Revetment repair and extension to 4.1, associated fill
- Primary paved trail (4m asphalt)
- Retaining wall border on highway side
- Handrail on water side
- Bench, Table or Bike Rack on Concrete Pad
- Litter container on concrete pad

Calculated Budget: \$1,185,920

### **DT B7a: Underground Stormwater Tank Ostler Park**

As the sea rises, the amount of water is backflooding into the downtown storm drainage systems will increase. Flood boxes will need to be installed to reduce backflow, but this will also pond water in the storm system, and if the flood box remains closed for too long a period during concurrent heavy rainfall and coastal defense overtopping, ponding 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.

- Removals and Site Security
- Bulk Excavation
- U/G Storage Tank Foundation Allowance
- U/G Storage Tank Structure Allowance
- U/G Storage Tank Mechanical / Venting Allowance
- Surface backfill over Structure Allowance

Calculated Budget: \$1,666,162

### **DT B7b: Pump Station Ostler Park**

As the sea rises further, the underground storage capacity will also fill and flooding risk in low areas of downtown will increase. 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.

- Removals and Site Security
- Bulk Excavation and Backfill Allowance
- Pump Station Building Allowance
- Pump Station Mechanical Allowance
- SD Piping Allowance
- Low Level and High Level Floodbox / Outflow Allowance

Calculated Budget: \$4,927,568

### **DT B7c: Underground Stormwater Tank Nunns Creek**

Parts of the Downtown storm drainage system flows towards Nunns Creek. This project is a similar underground storage tank outfalling to Nunns Creek. Some First Nations lands are also at flood risk, and there is potential for a shared outfall system near Hwy 19A.

- Removals and Site Security
- Bulk Excavation
- U/G Storage Tank Foundation Allowance
- U/G Storage Tank Structure Allowance
- U/G Storage Tank Mechanical / Venting Allowance
- Surface backfill over Structure Allowance

Calculated Budget: \$1,114,128

### **DT B7d: Pump Station Nunns Creek**

This second pump station project would be associated with the flood storage and outfalls near Nunns Creek could be a part of a potential shared outfall and flood protection system with First Nations near Hwy 19A.

- Removals and Site Security
- Bulk Excavation and Backfill Allowance
- Pump Station Building Allowance
- Pump Station Mechanical Allowance
- SD Piping Allowance
- Low Level and High Level Floodbox / Outflow Allowance

Calculated Budget: \$4,932,189

### **DT B8: Ostler Park Barrier/Trail Ph 2 (lift 0.7)**

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 4.8 (FCL minus freeboard) for the Ostler Park Barrier/Trail.

- Removals
- Fill from 3.9 to 4.6 (0.7 m plus 0.2 paving structure to 4.8)
- Water edge revetment 3.9 to 4.8
- Primary paved trail (4m asphalt)
- Manicured grass/tree landscape
- Bench, tables, bike rack on concrete pad
- Crown wall to 5.4

Calculated Budget: \$1,349,868

### **DT B9: BC Ferries Barrier/Trail Ph 2 (0.5 lift)**

This project is a second lift for the barrier trail between Hwy 19A and BC Ferries, to FCL of 4.2.

- Removals
- Retaining Wall Along Property Line
- Fill from 3.5 to 4.0 (0.5 m plus paving structure to 4.2)
- Primary paved trail (4m asphalt)
- Manicured Shrub/Tree landscape
- Litter container on concrete pad

Calculated Budget: \$1,131,534

### **DT B10: BC Ferries Temporary Barrier Ph 2 (0.5 lift)**

BC Ferries may be raising its parking area at some point to adjust to SLR. This project allows for adjustments to its driveway entrances and associated temporary barrier gates.

- Removals
- Fill from 3.5 to 4.0 (0.5 m plus 0.2 paving structure to 4.2)
- Storm drain and CB adjustment allowance
- Parking Area / Driveway with Curbs and Lighting

Calculated Budget: \$339,984

**DT B11: Barrier/Trail at Hwy 19A Ph 2 (0.8 lift)**

The public trail and flood barrier parallel to Hwy 19A would be lifted to 4.9 (FCL minus freeboard) or higher in this phase. Due to limited right of way and space above existing revetment, it may be necessary to have this as an elevated walkway structure on retaining wall and piles, rather than at grade. Views of the sea from Hwy 19A would be impeded.

- Removals
- Fill from 3.8 to 4.6 (0.8 m plus paving structure to 4.9)
- Revetment repair and extension to 4.9, associated fill
- Boardwalk / Pedestrian Bridge (3m with metal handrail)
- Manicured Shrub/Tree landscape
- Bench, Table or Bike Rack on Concrete Pad
- Litter container on concrete pad
- Crown wall to 5.5

Calculated Budget: \$6,126,123

**DT B12: Barrier Trail City Waterfront Property Ph 2 (0.8)**

This project allows for a second lift to 4.9 (FCL minus freeboard), if the full height was not gained in Phase 1, of the paved waterfront trail/barrier on the City Waterfront property.

- Removals
- Fill from 3.8 to 4.6 (0.8 m plus paving structure to 4.9)
- Revetment repair and extension to 4.9, associated fill
- Primary paved trail (4m asphalt)
- Retaining wall border on highway side
- Handrail on water side
- Manicured Shrub/Tree landscape
- Bench, Table or Bike Rack on Concrete Pad
- Litter container on concrete pad
- Crown wall to 5.5

Calculated Budget: \$3,511,322

**Calculated Total Budget for Works Associated with Public Property: \$41,039,025**

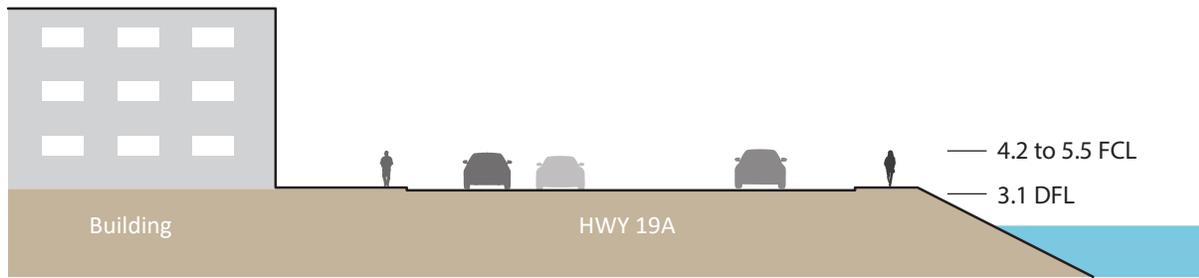


Figure 19: Existing Downtown Conditions

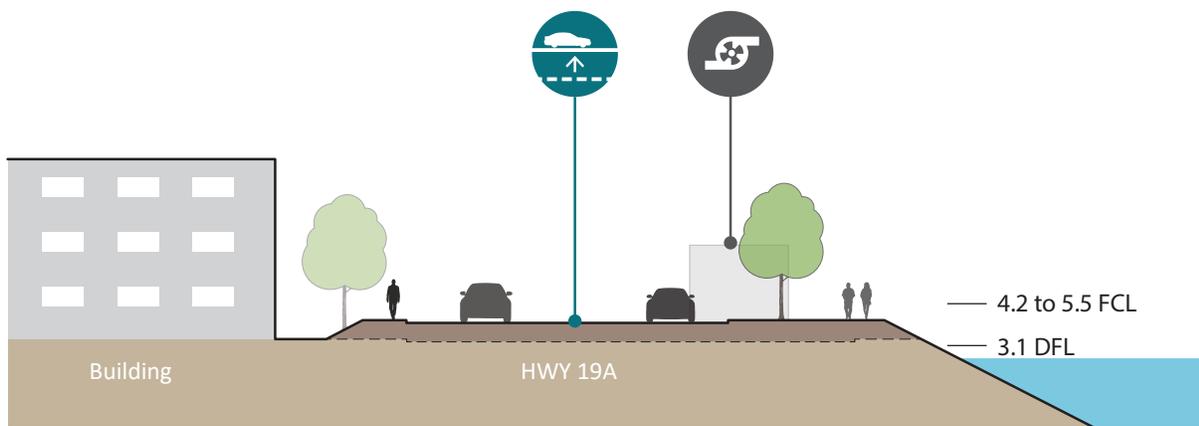


Figure 20: Phase B1

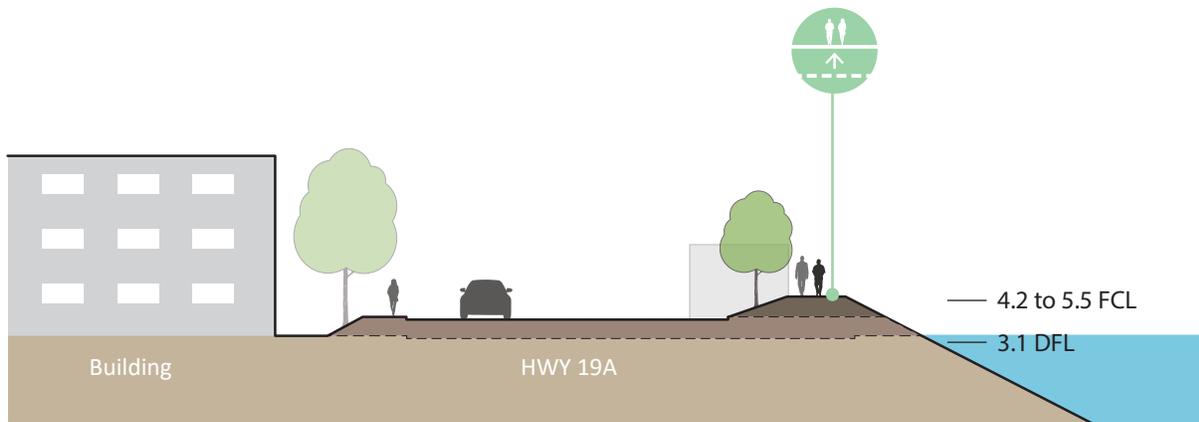
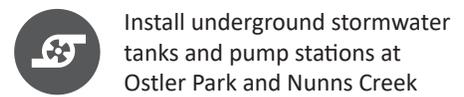
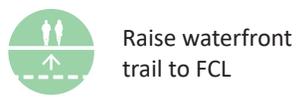
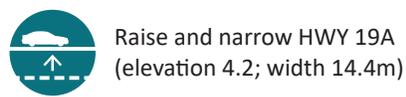
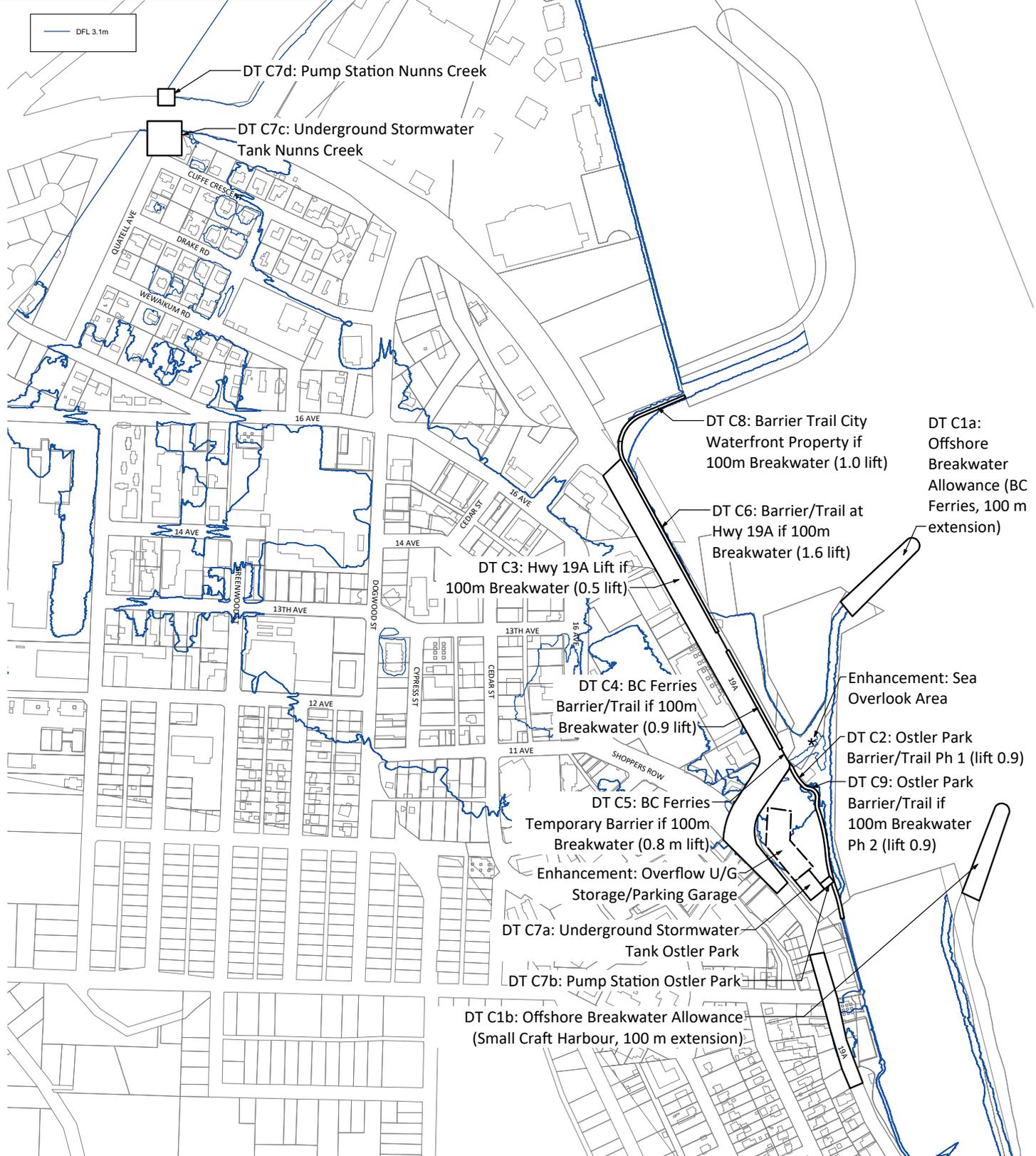


Figure 21: Phase B2



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**Figure 22: Downtown  
Option C**



## DOWNTOWN OPTION C

### The Concept: Balanced Intervention with Limited Neighbourhood Scale Priorities

Breakwater extensions considered at BC Ferries and Small Craft Harbour. Moderate height line of defense on public land (Ostler Park, Hwy 19A, eventually extending around downtown). Habitable parts of Downtown buildings, and major developments, are raised to above an Inland Flood Area FCL of 3.7. Micro retail, parking and select non-habitable flood-adapted designs accepted below FCL but above DFL, at landowner risk. Downtown streets/utilities are raised to have gravity drainage above DFL in one lift (not two). Pump station installation deferred as long as possible.

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

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

- Mobilization allowance
- Rock Class A
- Rock Class B
- Environmental Compensation

Calculated Budget: \$4,336,920

#### **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 at the Ostler Park.

- Mobilization allowance
- Rock Class A
- Rock Class B
- Environmental Compensation

Calculated Budget: \$4,336,920

#### **DT C2: Ostler Park Barrier/Trail Ph 1 (lift 0.9)**

An elevated trail and berm provide flood resistance parallel to the waterfront in Ostler Park, and running diagonal behind the existing FN longhouse to join an extended line of defense beside Hwy 19A. This Phase 1 lift is limited to a berm height of 4.1 to allow continued views to the sea until a second lift is required by SLR mid to late-century.

- Removals
- Fill from 3.0 to 3.9 (0.9 m plus 0.2 paving structure to 4.1)
- Water edge revetment 3 to 4.1
- Primary paved trail (4m asphalt)
- Manicured grass/tree landscape
- Bench, tables, bike rack on concrete pad

Calculated Budget: \$1,987,423

#### **DT C3: Hwy 19A Lift if 100m Breakwater (0.5 lift)**

A single phase lift of Hwy 19A to elevation 3.8 is incorporated into planned reconstruction. This elevation places the highway 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.

- Removals
- Fill from 3.0 to 3.5 (0.5 m plus 0.3 paving structure to 3.8)
- Ramp to Private Property Adjustments Allowance
- Storm drain and CB adjustment allowance
- Highway Paving with Curbs, Lighting, Sidewalks
- Manicured Shrub/Tree Landscape (Medians and Roadside)

Calculated Budget: \$8,020,080

#### **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 Phase 1 walkway and barrier runs between a 'Refreshed' Hwy 19A and BC Ferries. A retaining wall on the BC Ferries side keeps space efficiency while allowing for future raising of the BC Ferry Terminal.

- Removals
- Retaining Wall Along Property Line
- Fill from 3.0 to 3.9 (0.9 m plus 0.2 paving structure to 4.1)
- Primary paved trail (4m asphalt)
- Manicured Shrub/Tree landscape
- Litter container on concrete pad

Calculated Budget: \$1,223,646

#### **DT C5: BC Ferries Temporary Barrier if 100m Breakwater (0.8 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. A 'hump' would be graded into the access driveway, but ramp grades restrict its elevation to about 4.1. Above this elevation, a Temporary Barrier (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 height of 4.6 (FCL minus freeboard) in one phase.

- Removals
- Fill from 3.0 to 3.8 (0.8 m plus 0.3 paving structure to 4.1)

- Temporary Flood Barrier Posts and Components (to 4.6)
- Storm drain and CB adjustment allowance
- Parking Area / Driveway with Curbs and Lighting

Calculated Budget: \$335,208

**DT C6: Barrier/Trail at Hwy 19A if 100m Breakwater (1.6 lift)**

A raised public walkway on a paved trail and extended revetment to 4.8 is about 1.0 above raised Hwy 19A. Views to the water would be maintained.

- Removals
- Fill from 3.0 to 4.6 (1.6 m plus 0.2 paving structure to 4.8)
- Revetment repair and extension to 4.8, associated fill
- Primary paved trail (4m asphalt)
- Handrail on water side
- Bench, Table or Bike Rack on Concrete Pad
- Litter container on concrete pad

Calculated Budget: \$3,401,898

**DT C7a: Underground Stormwater Tank Ostler Park**

As the sea rises, the amount of water is backflooding into the downtown storm drainage systems will increase. Flood boxes will need to be installed to reduce backflow, but this will also pond water in the storm system, and if the flood box remains closed for too long a period during concurrent heavy rainfall and coastal defense overtopping, ponding 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.

- Removals and Site Security
- Bulk Excavation
- U/G Storage Tank Foundation Allowance
- U/G Storage Tank Structure Allowance
- U/G Storage Tank Mechanical / Venting Allowance
- Surface backfill over Structure Allowance

Calculated Budget: \$1,666,162

**DT C7b: Pump Station Ostler Park**

As the sea rises further, the underground storage capacity will also fill and flooding risk in low areas of downtown will increase. 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/head to increase the effectiveness of gravity drainage, potentially delaying the timing of pump station installation.

- Removals and Site Security

- Bulk Excavation and Backfill Allowance
- Pump Station Building Allowance
- Pump Station Mechanical Allowance
- SD Piping Allowance
- Low Level and High Level Floodbox / Outflow Allowance

Calculated Budget: \$4,927,568

**DT C7c: Underground Stormwater Tank Nunns Creek**

Parts of the Downtown storm drainage system flows towards Nunns Creek. This project is a similar underground storage tank outfalling to Nunns Creek. Some First Nations lands are also at flood risk, and there is potential for a shared outfall system near Hwy 19A.

- Removals and Site Security
- Bulk Excavation
- U/G Storage Tank Foundation Allowance
- U/G Storage Tank Structure Allowance
- U/G Storage Tank Mechanical / Venting Allowance
- Surface backfill over Structure Allowance

Calculated Budget: \$1,114,128

**DT C7d: Pump Station Nunns Creek**

This second pump station project would be associated with the flood storage and outfalls near Nunns Creek could be a part of a potential shared outfall and flood protection system with First Nations near Hwy 19A. Again, if single lift of low roads and uses draining to this location were accomplished, the timing of pump station installation may be delayed.

- Removals and Site Security
- Bulk Excavation and Backfill Allowance
- Pump Station Building Allowance
- Pump Station Mechanical Allowance
- SD Piping Allowance
- Low Level and High Level Floodbox / Outflow Allowance

Calculated Budget: \$4,932,189

**DT C8: Barrier Trail City Waterfront Property if 100m Breakwater (1.0 lift)**

A raised public walkway on a paved trail and extended revetment in a single lift up to FCL 4.8 is envisioned fronting the City waterfront property.

- Removals
- Fill from 3.6 to 4.6 (1.0 m plus 0.2 paving structure to 4.8)
- Revetment repair and extension to 4.8, associated fill
- Primary paved trail (4m asphalt)
- Retaining wall border on highway side
- Handrail on water side
- Bench, Table or Bike Rack on Concrete Pad
- Litter container on concrete pad

Calculated Budget: \$1,774,336

### **DT C9: Ostler Park Barrier/Trail if 100m Breakwater Ph 2 (lift 0.9)**

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 5.2 for the Ostler Park Barrier/Trail. It is possible that the 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.

- Removals
- Fill from 4.1 to 5.0 (0.9 m plus 0.2 paving structure to 5.2)
- Water edge revetment 4.1 to 5.2
- Primary paved trail (4m asphalt)
- Manicured grass/tree landscape
- Bench, tables, bike rack on concrete pad

Calculated Budget: \$1,272,300

### **DT C10: Major Streets Raised with Planned Reconstruction**

Major evacuation and fire routes are raised to elevation 3.5 intended to have base courses above the DFL of 3.1.

- Removals
- Fill from 2.5 to 3.2 (0.7 m plus paving structure to 3.5)
- Retaining Wall at ROW both sides
- Ramp to Private Property Adjustments Allowance
- Storm drain and CB adjustment allowance
- Water Valve and Hydrant adjustment allowance
- Service Connection Water Meter, Gas, Communications Box Adjustments
- Highway Paving with Curbs, Lighting, Sidewalks
- Manicured Shrub/Tree Landscape (Medians and Roadside)

Calculated Budget: \$5,134,189

### **DT C11: Minor Streets Raised with “Refresh”**

Local Streets, including Shoppers Row, are raised to elevation 3.3 with rare flooding of base courses from the DFL of 3.1. Lower street is intended to allow easier access into adjacent buildings until they are raised in the future to 3.7.

- Removals
- Fill from 2.5 to 3.0 (0.5 m plus paving structure to 3.3)
- Retaining Wall at ROW both sides
- Ramp to Private Property Adjustments Allowance
- Storm drain and CB adjustment allowance
- Water Valve and Hydrant adjustment allowance
- Service Connection Water Meter, Gas, Communications Box Adjustments
- Street Paving with Curbs, Lighting, Sidewalks
- Manicured Shrub/Tree Landscape (Medians and Roadside)

Calculated Budget: \$8,916,576

**Calculated Total Budget for Works Associated with Public Property: \$53,073,150**

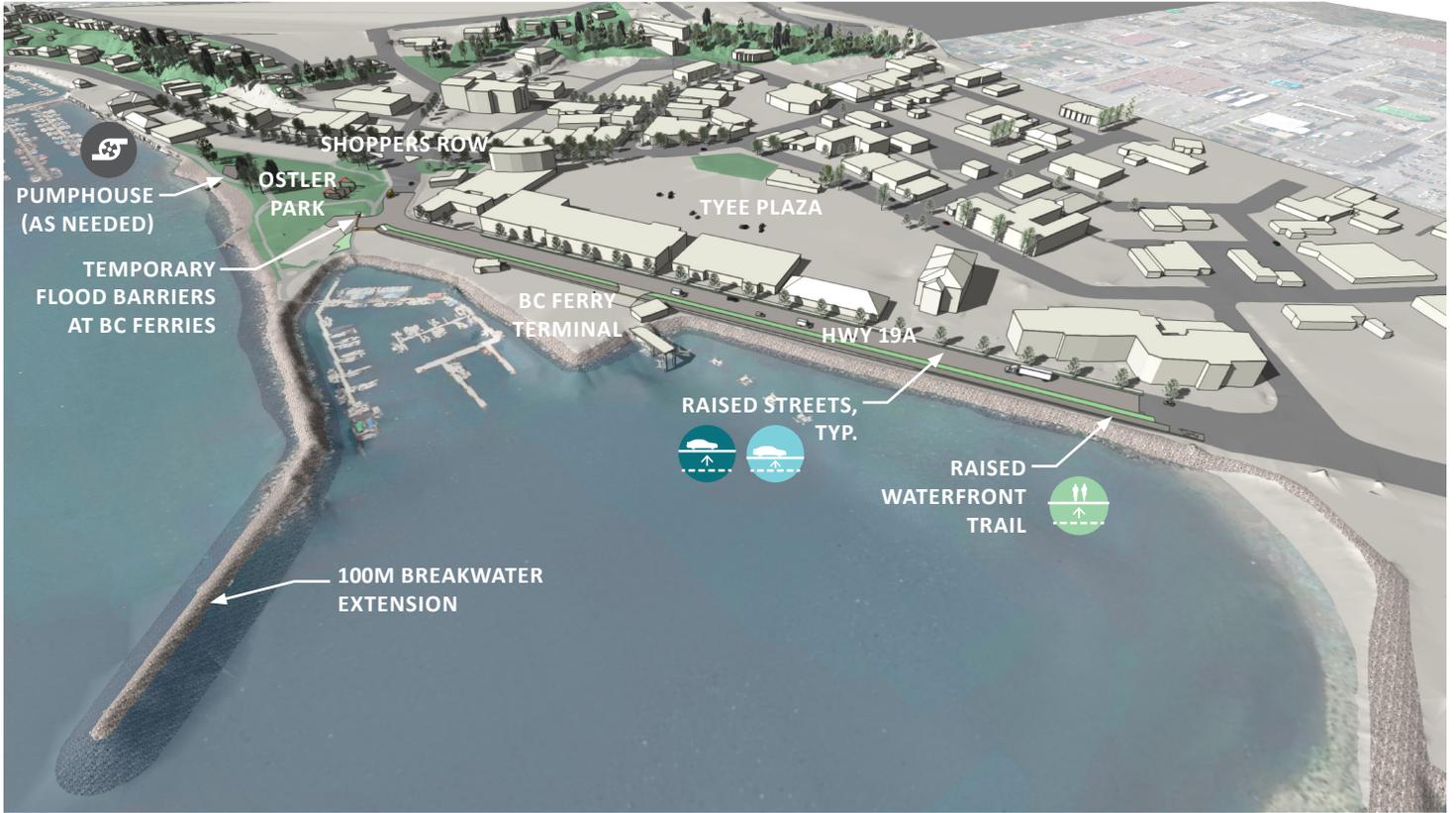


Figure 23: Birdseye View of Option C



Raise major streets / utilities above DFL in one lift



Raise minor 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



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



Raise waterfront trail to established FCLs as sea levels rise.

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

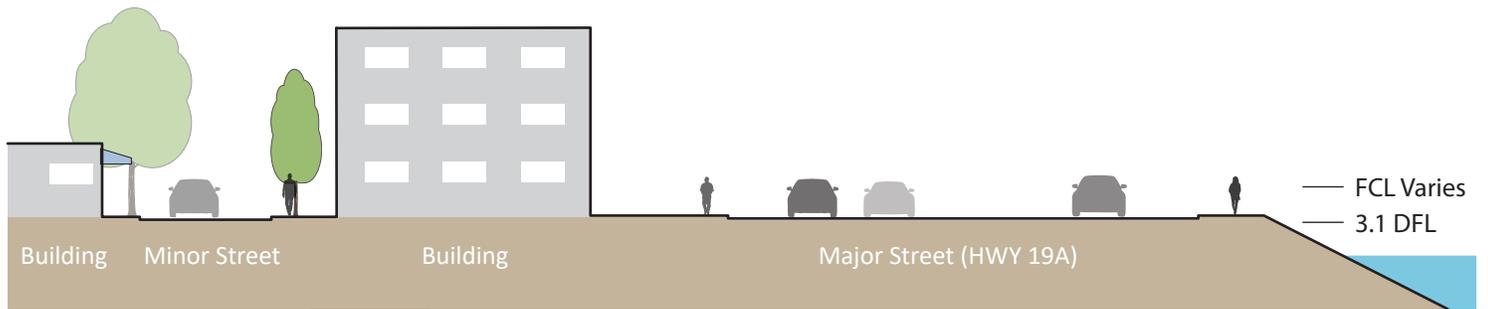


Figure 24: Existing Downtown Conditions

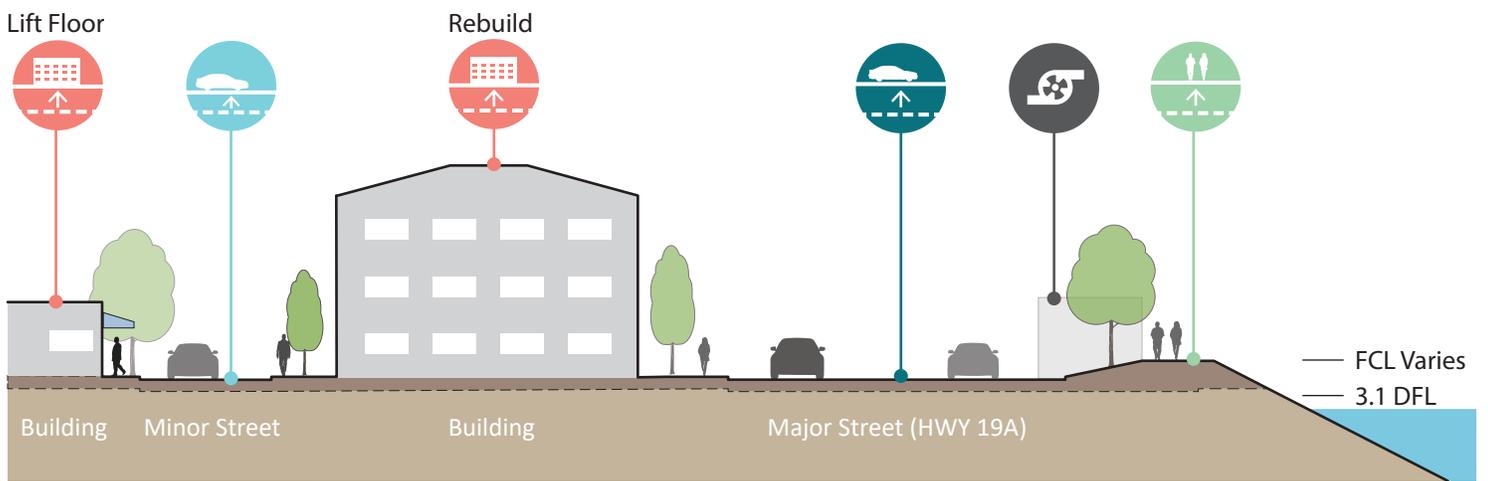


Figure 25: Option C

# Figure 26: Sequoia Park Option A



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SP A1: Raise Revetments on City Lands

SP A1: Raise Revetments on City Lands

## SEQUOIA PARK (MHC TO EVERGREEN) OPTION A

The Concept: Parcel-Scale Adaptation, Minimum Community Intervention

No public intervention encroachment in crown foreshore. On private land, DP language is adjusted to define acceptable private SLR adaptation above natural boundary, which in most cases is likely to rely on extended existing revetments higher. On city lands, a similar extended revetment is used. Flood Management Bylaw requires that all buildings are brought to FCL at reconstruction.

### SP A1: Raise Revetments on City Lands

Sequoia Park and a vacant property immediately south of the Maritime Heritage Centre are existing City properties in this area. In both cases this option considers minimum shoreline revetment adjustments to adapt to rising seas.

- Removals
- Revetment Adjustments
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad

Calculated Budget: \$1,217,770

**Calculated Total Budget for Works Associated with Public Property: \$1,217,770**

# Figure 27: Sequoia Park Option B



SP B1: City Frontage Headland/Beach

SP B2: Private Frontage Headland/Beach (One Phase)

SP B1: City Frontage Headland/Beach

SP B2: Private Frontage Headland/Beach (One Phase)



## SEQUOIA PARK (MHC TO EVERGREEN) OPTION B

The Concept: Neighbourhood Scale Adaptation, Extensive Community Intervention

The City will pursue funding for foreshore constructed 'pocket beaches' that are protected by offshore headlands, with rights gained to extend the beach to meet grade on private land. Beach design will provide continuous and more accessible surface for public access along the beach on crown foreshore or acquired property, other than when closed in a severe storm, connecting to the Seawalk. Flood Management Bylaw requires that all buildings are brought to FCL at reconstruction.

### SP B1: City Frontage Headland/Beach

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

- Removals
- Rock Headland Installation
- Raised Beach Installation Allowance
- Upper Beach Access Surfacing Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad

Calculated Budget: \$2,280,059

### SP B2: Private Frontage Headland/Beach

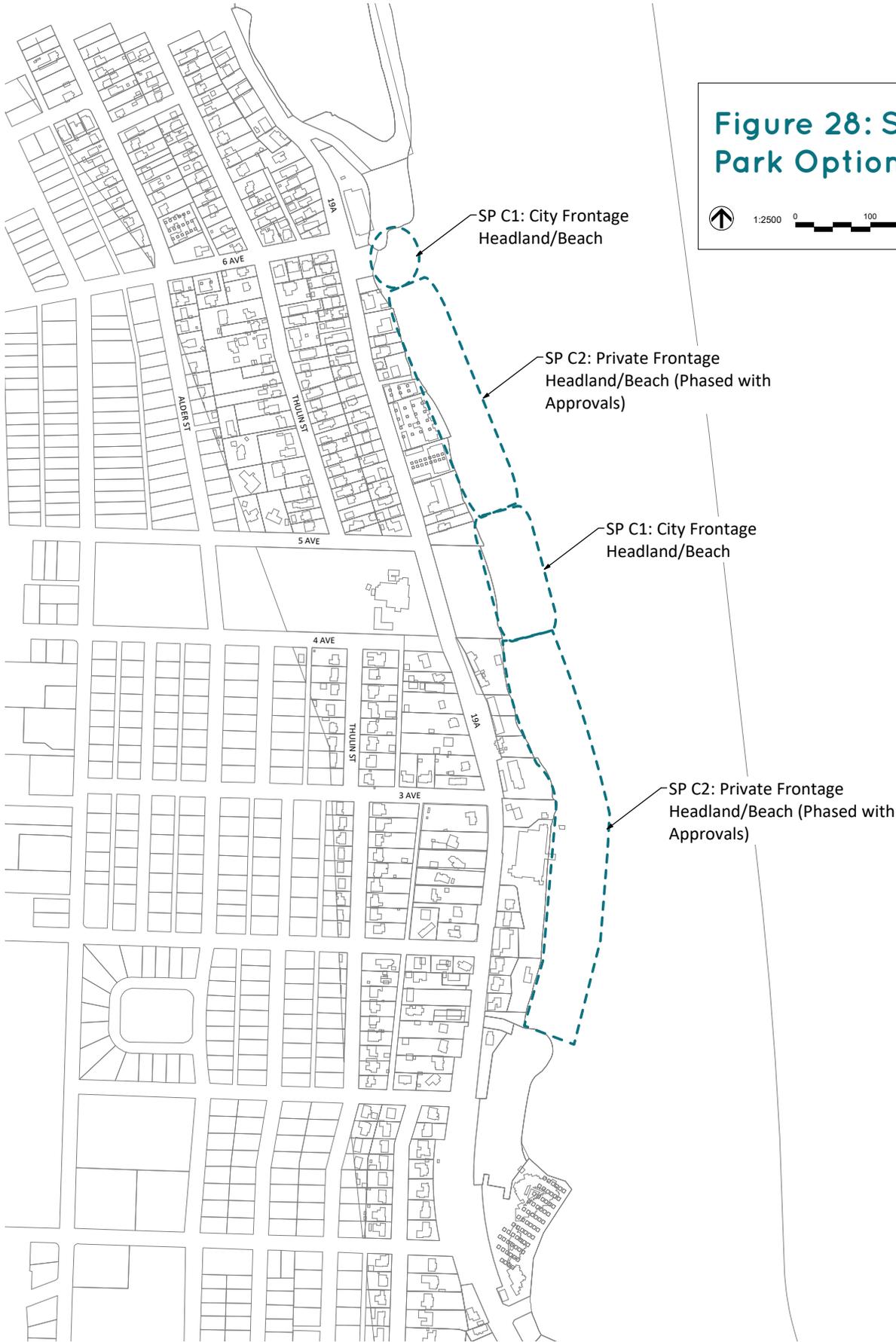
To provide continuity of public access along the beach, as well as improved environments for forage fish like surf smelt and sand lance, Pocket Beach / Headland projects are extended along the private frontage to link Hidden Harbour and Maritime Heritage Centre. Foreshore tenure would need to be gained.

- Removals
- Rock Headland Installation
- Raised Beach Installation Allowance
- Upper Beach Access Surfacing Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad

Calculated Budget: \$8,336,679

**Calculated Total Budget for Works Associated with Public Property: \$10,616,738**

# Figure 28: Sequoia Park Option C



## SEQUOIA PARK (MHC TO EVERGREEN) OPTION C

The Concept: Balanced Intervention with Limited Neighbourhood Scale Priorities

On the foreshore at public lands and where riparian rights are granted fronting private land, constructed 'pocket beaches' are protected by offshore headlands. Where riparian rights are not granted, existing foreshore remains as exists and upland owners manage their flood risk above the natural boundary. With gradual land acquisition or granting of rights this Option C may strive for Option B (continuous waterfront pocket/headland/access in long-term. Flood Management Bylaw requires that all buildings are brought to FCL at reconstruction.

### 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.

- Removals
- Rock Headland Installation
- Raised Beach Installation Allowance
- Upper Beach Access Surfacing Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad

Calculated Budget: \$2,280,059

### SP C2: Private Frontage Headland/Beach

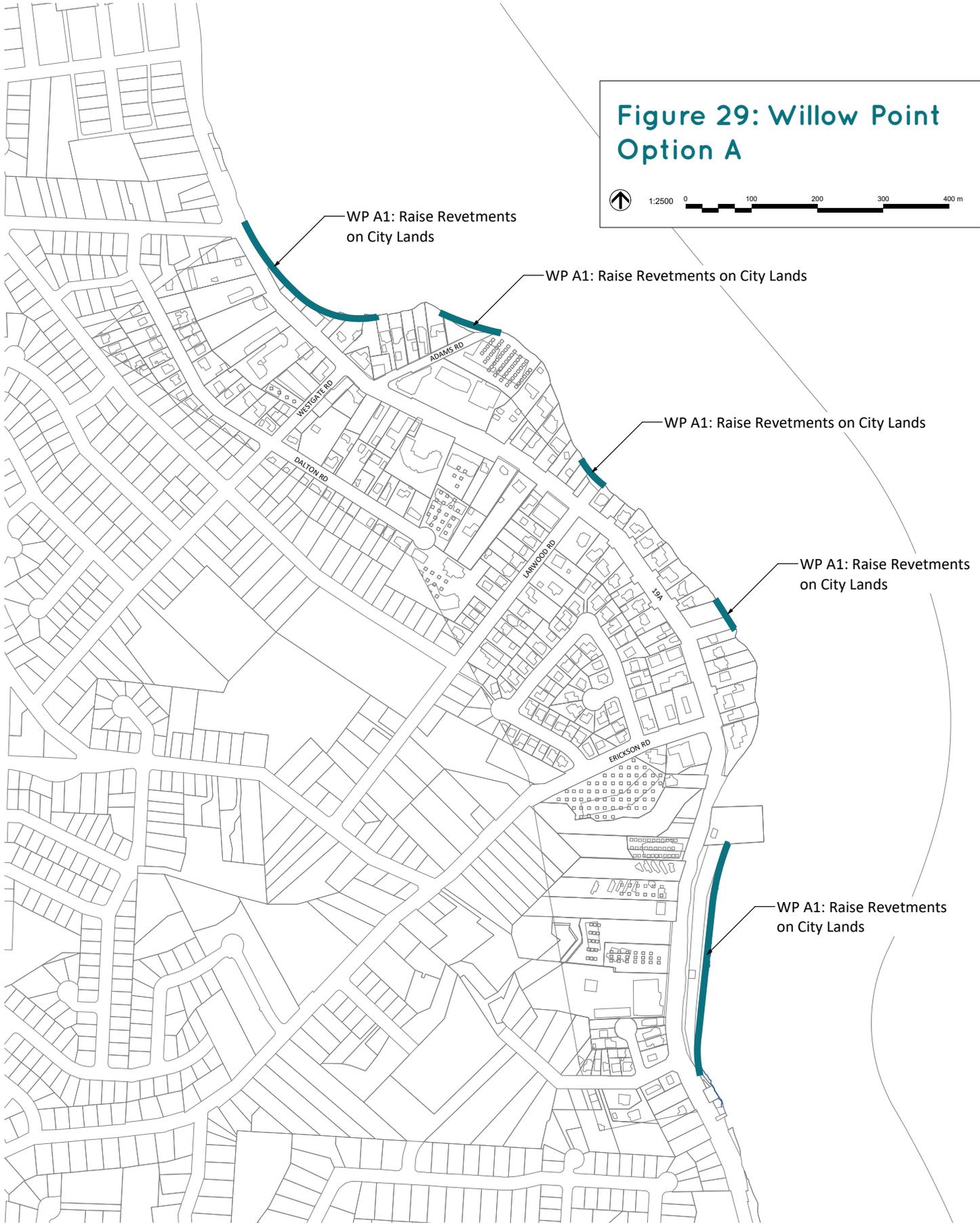
To provide continuity of public access along the beach, as well as improved environments for forage fish like surf smelt and sand lance, Pocket Beach / Headland projects are extended along the private frontage to link Hidden Harbour and Maritime Heritage Centre. Foreshore tenure would need to be gained. Option C, in contrast to Option B, envisions a more slowly phased process of improvements fronting private property.

- Removals
- Rock Headland Installation
- Raised Beach Installation Allowance
- Upper Beach Access Surfacing Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad

Calculated Budget: \$8,336,679

**Calculated Total Budget for Works Associated with Public Property: \$10,616,738**

**Figure 29: Willow Point Option A**



## WILLOW POINT AND SOUTH OPTION A

The Concept: Parcel-Scale Adaptation, Minimum Community Intervention

No public intervention encroachment in crown foreshore. On private land, DP language is adjusted to define acceptable private SLR adaptation above natural boundary, which in most cases is likely to rely on extended existing revetments higher. On city lands, a similar extended revetment is used. Flood Management Bylaw requires that all buildings are brought to FCL at reconstruction.

### WP A1: Raise Revetments on City Lands

Frank James Park, Adams Park, Larwood Park, Jaycee Park and the Glen Ford Boat Ramp are existing City properties in this area. In all cases this option considers minimum shoreline revetment adjustments to adapt to rising seas.

- Removals
- Revetment Adjustments
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad

Calculated Budget: \$2,995,776

**Calculated Total Budget for Works Associated with Public Property: \$2,995,776**

**Figure 30: Willow Point Option B**



WP B1: Pocket Beach /  
Nature Shore Demo on  
City Lands

WP B2: Revetment  
Window/Inland Beach  
Environment at City  
Park



## WILLOW POINT AND SOUTH OPTION B

The Concept: Neighbourhood Scale Adaptation, Extensive Community Intervention

Where shoreline exposure would support, the City will pursue funding for foreshore constructed 'pocket beaches' that are protected by offshore headlands, with rights gained to extend the beach to meet grade on private land. This concept of foreshore intervention is not likely feasible south of Willow Point due to high wave exposure. In these exposed areas, an investigation at City parks would consider adapting existing shoreline revetment to have narrow openings to inland park areas that offer habitat and 'beachlike' improvements as well as the Seawalk. On private land, DP language is adjusted to define acceptable private treatment above natural boundary, which in most cases is likely to be extended revetment. Flood Management Bylaw requires that all buildings are brought to FCL at reconstruction.

### WP B1: Pocket Beach / Nature Shore Demo on City Lands

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

- Removals
- Rock Headland Installation
- Raised Beach Installation Allowance
- Upper Beach Access Surfacing Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad

Calculated Budget: \$671,624

### WP B2: Revetment Window/Inland Beach Environment at City Park

Fronting on Larwood or Jaycee Park or similar, a demonstration of adapting 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.

- Removals
- Rock Revetment Window / Adjustments
- Inland Raised Beach Installation Allowance
- Environmental Feature Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Manicured Grass/Tree Landscape
- Manicured Shrub/Tree Landscape
- Concrete Stair (2m wide with metal handrail)
- Infiltration Swale (bioswale)
- Primary Paved Trail (4m asphalt) Seawalk
- Secondary Paved trail (2m asphalt)
- Bench, Table or Bike Rack on concrete pad

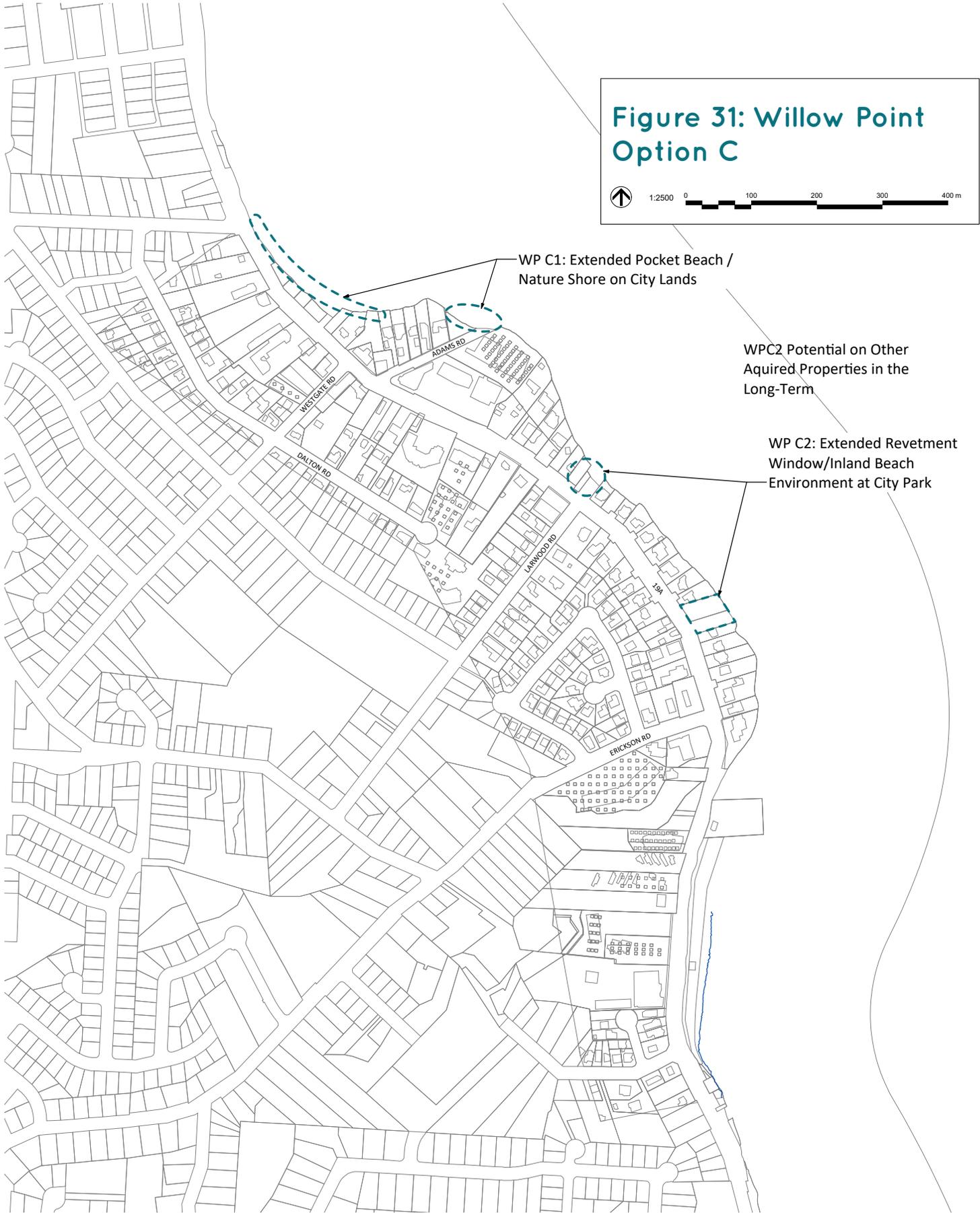
Calculated Budget: \$2,688,426

**Calculated Total Budget for Works Associated with Public Property: \$3,540,390**

**Figure 31: Willow Point Option C**



1:2500 0 100 200 300 400 m



WP C1: Extended Pocket Beach / Nature Shore on City Lands

WP C2 Potential on Other Aquired Properties in the Long-Term

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

## WILLOW POINT AND SOUTH OPTION C

### The Concept: Balanced Intervention with Limited Neighbourhood Scale Priorities

A long-term land acquisition policy will continue to purchase waterfront homes on a willing seller basis or innovative lease if pricing is favorable. When sufficient length of public waterfront is available, the City will pursue funding to improve shoreline public views and environmental performance through additional revetment window/inland beach environment approaches. The Seawalk would meander between inland beach and roadside depending on property. On private land, DP language is adjusted to define acceptable private treatment above natural boundary, which in most cases is likely to be extended revetment. Flood Management Bylaw requires that all buildings are brought to FCL at reconstruction. Streets are brought to DFL or higher at time of reconstruction.

#### WP C1: Extended Pocket Beach / Nature Shore on City Lands

In a greater length of frontage on Frank James Park and Adams Park compared to Option B, a demonstration of offshore headlands / groins and beach nourishment would be provided in concert with upgrades to the Park. Consideration of eventual further raising of the Sybil Andrews Cottage and associated grounds would be required in the latter part of the century.

- Removals
- Rock Headland Installation
- Raised Beach Installation Allowance
- Upper Beach Access Surfacing Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad

Calculated Budget: \$2,822,656

#### 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.

- Removals
- Rock Revetment Window / Adjustments
- Inland Raised Beach Installation Allowance
- Environmental Feature Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Manicured Grass/Tree Landscape
- Manicured Shrub/Tree Landscape
- Concrete Stair (2m wide with metal handrail)

- Infiltration Swale (bioswale)
- Primary Paved Trail (4m asphalt) Seawalk
- Secondary Paved trail (2m asphalt)
- Bench, Table or Bike Rack on concrete pad

Calculated Budget: \$2,960,792

#### Enhancement: Willow Creek Flood Barriers

In rare circumstances when both a coastal design storm with high tide and an inland rainfall event causes 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 Willow Creek.

- Removals
- Rock Revetment Installation
- Dike Installation Allowance
- Naturalized Grass/Tree Landscape
- Naturalized Shrub/Tree Landscape
- Bench, Table or Bike Rack on concrete pad
- Park Interpretive Sign and Shelter

**Calculated Total Budget for Works Associated with Public Property: \$5,783,448**

## 5.0 MAKING CHOICES AMONG OPTIONS

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Community values are an important factor to consider when evaluating options. A Multiple Account Evaluation (MAE) process is well suited to review Campbell River’s sea level rise adaptation choices. Rather than focusing solely on monetary or quantitative values, an MAE also includes qualitative values, such as social, environmental or recreational considerations.

For Campbell River, the MAE process is being undertaken in two parallel process – a technical evaluation by the consulting team and City staff, and a community evaluation through public workshops and on-line input. The draft recommendations will be informed by both streams.

In the end, Council must accept or refine the sea level rise adaptation strategy. As a long-term and on-going process, Council and private landowners will also make many small steps to implement the strategy. There is a need to refine the strategy, and component projects, as more information becomes available on the pace of climate change and as opportunities for partnerships or co-funding become evident.

### TECHNICAL EVALUATION PROCESS

Consultants and staff reviewed a long list of potential evaluation criteria – attempting to define what values were most important. Figure 32 shows the criteria considered, and how they were ranked by a group of staff with representation across City departments.

The grouping and ranking of these criteria have allowed the choice of ‘key indicators’ – selected criteria which represent others under that heading. For example, under the People heading, highest # protected became a key indicator. This indicator also represents other people considerations, including people displaced, community social equity, community health and fitness, and people with remaining flood risk.

Results of the technical evaluation are summarized in Figure 32.

### VALUES CRITERIA

Values criteria with key indicators include people, economy, environment, recreation and infrastructure. For each of these values criteria, the three options are compared to a business as usual scenario.

### IMPACT OF RISK AND FAILURE

Risk is defined as the likelihood of failure of an option multiplied by the consequence (impact) of that failure. For example, if a raised waterfront shoreline defense in Ostler Park were to break during a severe design storm after sea level rise, storm surge floodwaters and waves could quickly flow into the low-lying areas of downtown if they were not raised. If the break were sudden, the flow of water could be rapid. Situations like this in other locations (Katrina, Netherlands) have led to severe flooding and loss of life, in particular if the breach occurs when people are sleeping in low areas subject to a flood ‘wave’. In this example, the consequence would be extreme. The likelihood of failure may be low initially but increase over time as sea level rise gets higher. Eventually this combination could present a very high risk.

In a second downtown example, if shoreline raised defenses and a pump station were installed but low downtown areas were not raised, the stormwater collecting in downtown low areas during an extreme storm could be removed by the pumps. Failure would involve the pumps malfunctioning or being under capacity. However, since the rise of waters would be relatively slow, and since there would be warning when the pumps fail, the consequence of this flooding would likely be on goods and property rather than life. The mix of moderate to low consequence with moderate likelihood make this a moderate risk.

# SLR Option Evaluation

Current run (last updated Dec 21, 2018 11:53am)

8

Polls

11

Participants

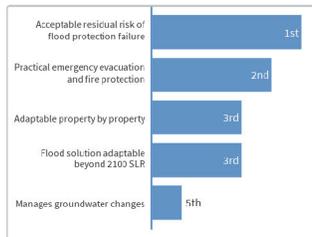
10

Average responses



Average engagement

## How important are these RISK MANAGEMENT values in selecting SLR Mitigation Options?



Response options	Rank
Acceptable residual risk of flood protection failure	1st
Practical emergency evacuation and fire protection	2nd
Adaptable property by property	3rd
Flood solution adaptable beyond 2100 SLR	3rd
Manages groundwater changes	4th



Engagement

## How important are these RECREATION/CULTURE values in selecting SLR Mitigation Options?

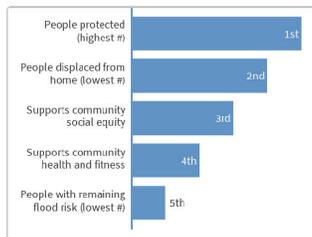


Response options	Rank
Continuous Seawalk access	1st
Allows on-beach walk in most tidal cycles	2nd
Adds to community aesthetics / FN pride	3rd
Recreation adaptable beyond 2100 SLR	4th
Ocean views from Seawalk and 19A	5th
Ocean views from waterfront homes	6th



Engagement

## How important are these PEOPLE evaluation criteria related to Sea Level Rise Mitigation Options?

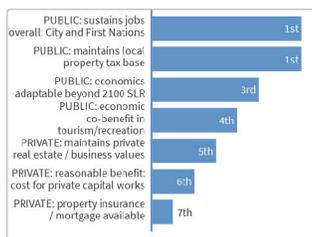


Response options	Rank
People protected (highest #)	1st
People displaced from home (lowest #)	2nd
Supports community social equity	3rd
Supports community health and fitness	4th
People with remaining flood risk (lowest #)	5th



Engagement

## How important are these ECONOMIC values in selecting SLR Options?

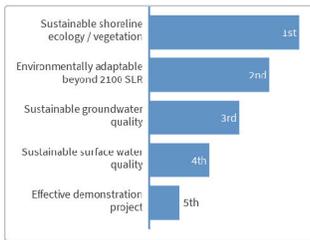


Response options	Rank
PUBLIC: sustains jobs overall: City and First Nations	1st
PUBLIC: maintains local property tax base	1st
PUBLIC: economics adaptable beyond 2100 SLR	2nd
PUBLIC: economic co-benefit in tourism/recreation	3rd
PRIVATE: maintains private real estate / business values	4th
PRIVATE: reasonable benefit: cost for private capital works	5th



Engagement

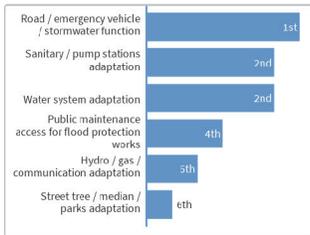
## How important are these ENVIRONMENTAL values in selecting SLR Mitigation Options



Response options	Rank
Sustainable shoreline ecology / vegetation	1st
Environmentally adaptable beyond 2100 SLR	2nd
Sustainable groundwater quality	3rd
Sustainable surface water quality	4th
Effective demonstration project	5th



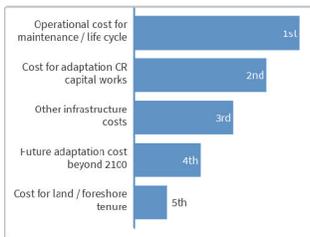
## How important are these INFRASTRUCTURE values to evaluating SLR Options?



Response options	Rank
Road / emergency vehicle / stormwater function	1st
Sanitary / pump stations adaptation	2nd
Water system adaptation	2nd
Public maintenance access for flood protection works	3rd
Hydro / gas / communication adaptation	4th
Street tree / median / parks adaptation	5th



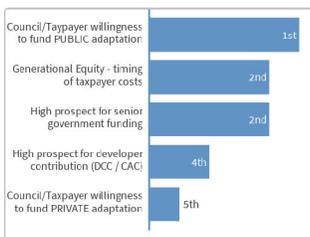
## How important are these COST COMPARISON values in selecting SLR Mitigation Options



Response options	Rank
Operational cost for maintenance / life cycle	1st
Cost for adaptation CR capital works	2nd
Other infrastructure costs	3rd
Future adaptation cost beyond 2100	4th
Cost for land / foreshore tenure	5th



## How important are these FUNDING POTENTIAL values in selecting SLR Mitigation Options



Response options	Rank
Council/Taxpayer willingness to fund PUBLIC adaptation	1st
Generational Equity - timing of taxpayer costs	2nd
High prospect for senior government funding	2nd
High prospect for developer contribution (DCC / CAC)	3rd
Council/Taxpayer willingness to fund PRIVATE adaptation	4th



## COST AND PHASING ANALYSIS

Appendix E provides project budget comparison for each option, both before and after inflation.

The project budget figures are for comparison purposes only and will vary considerably depending on detailed scope of each project, and especially depending on timing of the project, as inflation has a very significant effect on the total cost.

Assumptions in the project budgets include:

1. Budgets are calculated for four focus areas – Painter Barclay, Downtown, Sequoia Park area, and Willow Point and South. Other areas of City waterfront are not included. First Nations lands are not included.
2. Budgets are for public (City of Campbell River) and partner government agency investments only. Private sector costs are not included.
3. Projects are spread out over a 50+ year timeline. As far as possible, sea level rise adaptation projects are undertaken as incidental to public works (e.g. utility or street upgrades) undertaken as a part of regular asset management.
4. Where projects are specifically to address sea level rise and not related to other goals, their proposed funding is based on ‘just in time’ delivery. Several projects may be beyond a 50-year timeline.
5. Inflation is allowed for at an average of 12.5% for a 5-year period. Differences in inflation allowance or project timing may have a dramatic effect on project budgets.
6. Unit costs are based on recent experience. They include a 30% allowance for design and administration, and 30% contingency, in accordance with City of Campbell River policy for Class D (order of magnitude) estimates.

Appendix E provides detailed spreadsheets to document assumed unit prices, project scope and quantities, and to summarize project budget scenarios and timing for each option.

Although these costs are calculated to the nearest dollar, they should be interpreted as broad guidelines (to the nearest \$10,000), and to a +/- 30% accuracy in 2018 dollars. Projects are intended to be implemented over a multi-decade timeline, and thus the effect of inflation as well as changes in market conditions will have a major impact on final costs and budgets. For these reasons, the capital costs shown should be used for relative comparison among options, as opposed to absolute figures for budgeting purposes.

## ENGAGEMENT RESULTS

Refer to Appendix F for the Community Engagement Plan and engagement results.

## 6.0 RECOMMENDED STRATEGY AND IMPLEMENTATION PLAN

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### RECOMMENDATIONS

Primer IV provides recommended strategies to adapt to sea level rise in Campbell River. Each strategy includes suggested projects for the four study areas - Painter Barclay, Downtown, Sequoia Park, and Willow Point and South.

### IMPLICATIONS FOR OTHER WATERFRONT AREAS

The review of options and sea level rise technical assessments lead to strategic observations that are likely to apply throughout the Campbell River waterfront area.

1. Integrate sea level rise adaptation with Asset Renewal- SLR budgets should be for incremental cost, rather than driving new projects.
2. Inflation is a significant cost long-term- earlier implementation would be at a lower dollar cost.
3. Generational Equity is a conundrum- some costs can be pushed to mid/late century. Which generation should pay?
4. Waterfront single family lots could likely have one more building generation but will be challenged by ongoing sea level rise after that.
5. As sea level rise increases over the longer term, unprotected soft shore beaches will likely be stable only in protected areas of Campbell River, or if protected by constructed offshore headlands or breakwaters.
6. In more exposed parklands, headlands might be existing riprap, with controlled 'windows' from park to sea.
7. Caution is required re up-zonings in the coastal flood area – up-zoning in the Inland or higher areas is more resilient to sea level rise.
8. Funding partnerships may drive strategy choices e.g. can downtown offshore breakwaters be co-funded?
9. Public capital projects for sea level rise are not urgent- other than advance planning/feasibility to integrate with ongoing asset renewal. However, advance engineering studies and design are required to define how utilities and streets will be raised or adapted to sea level rise. This is very important in the lower areas of downtown to provide detailed guidance on what future street elevations will front on commercial storefronts in higher density areas.
10. Continuing land acquisition along the waterfront would warrant a review of priorities and timing, to consider how to balance public interest in open space and seawalk improvements with objectives to maintain tax base and to allow one more generation of waterfront homes where lot sizes are sufficient.
11. Where public or private projects are being designed or constructed on the waterfront, it is critical that they implement shoreline and building designs that reflect the proposed flood construction levels to make them resilient to sea level rise risks for the service time of the asset or building (approximately Year 2100). FCL regulation should be done on a priority basis to avoid risks getting worse.

Ongoing public and technical capacity building and engagement will be required to ease implementation.

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# APPENDICES

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## **APPENDIX A:**

SEA LEVEL RISE PRIMER PART I: INTRODUCTION TO SLR, RISKS AND ADAPTATION IDEAS

## **APPENDIX B:**

SEA LEVEL RISE PRIMER PART II: SEA LEVEL RISE ADAPTATION BEST PRACTICES

## APPENDIX C:

### SEA LEVEL RISE PRIMER PART III: LOCAL ADAPTATION OPTIONS AND EVALUATION PROCESS

## **APPENDIX D:**

SEA LEVEL RISE PRIMER PART IV: SEA LEVEL RISE STRATEGY AND ACTION PLAN RECOMMENDATIONS

**APPENDIX E:**  
DETAILED COST DATA

Current Unit Costs

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Component	Unit	Quantity
<b>Removals</b>	<b>sq.m.</b>	<b>400</b>
<b>Description: typical street removals prior to lift (20 x 20)</b>		
- mobilization and site safety	l.s.	1
- pavement and curb removal	sq.m.	300
- CB, SD and SS manhole surface salvage	allow	1
- service connection surface appurtenance salvage	allow	1
- landscape area clearing and grubbing	sq.m.	100
- Site furniture / lighting removal or salvage	allow	1
Total		
Design & Administration	%	30%
Contingency	%	30%
<b>Pit Run Granular Fill</b>	<b>cu.m.</b>	<b>500</b>
<b>Description: pit run fill average 500 mm depth to street or park</b>		
- sub-grade scarification / prep	sq.m.	250
- Pit run granular fill 150mm lifts compacted	cu.m.	500
- utility box / manhole lift allowance	allow	1
- electrical / hydro adjustments	allow	1
- repair/control at site boundaries	allow	1
- temporary erosion control	sq.m.	250
Total		
Design & Administration	%	30%
Contingency	%	30%
<b>Revetment Repair / Improve</b>	<b>l.m.</b>	<b>100</b>
<b>Description: upgrade filter rock, toe, rock armour</b>		
- mob / de mob / traffic control / disposal	allow	1
- remove and sort existing riprap on shoreline	l.m.	100
- regrade slope above tideline	l.m.	0
- crushed granular base 150 mm fill below filter rock	cu.m.	0
- filter rock (small riprap 20-50 kg)	cu.m.	80
- armour rock (small riprap 300-2500 kg)	cu.m.	500
Total		
Design & Administration	%	30%
Contingency	%	30%
<b>Revetment New - Small</b>	<b>l.m.</b>	<b>100</b>
<b>Description: embankment shaping, new filter and armour</b>		
- mob / de mob / traffic control / disposal	allow	1
- remove and sort existing riprap on shoreline	l.m.	100
- regrade slope above tideline	l.m.	100
- crushed granular base 150 mm fill below filter rock	cu.m.	300
- filter rock (small riprap 20-50 kg)	cu.m.	270
- armour rock (small riprap 300-2500 kg)	cu.m.	600
Total		
Design & Administration	%	30%
Contingency	%	30%
<b>Revetment New - Large Face (elevation change 6m to 10m)</b>	<b>l.m.</b>	<b>100</b>
<b>Description: embankment shaping, new filter and armour</b>		
- mob / de mob / traffic control / disposal	allow	1
- remove and sort existing riprap on shoreline	l.m.	100
- regrade slope above tideline	l.m.	100
- crushed granular base 150 mm fill below filter rock	cu.m.	500
- filter rock (small riprap 20-50 kg)	cu.m.	420
- armour rock (small riprap 300-2500 kg)	cu.m.	1100
Total		
Design & Administration	%	30%
Contingency	%	30%
<b>Breakwater Extension Allowance</b>	<b>l.m.</b>	<b>100</b>
<b>Description: Crest 4.0, assumed seabed ~-6.0</b>		
- mob / de mob included in unit rates		
- Minor dredging of seabed to level surface, remove fine sediments	cu.m.	2050
- supply and install core rock	cu.m.	9800
- supply and install filter rock	cu.m.	1450
- supply and install armour rock	cu.m.	6000
- aids to navigation (market light at end of breakwater)	allow	1
Total		
Design & Administration	%	30%

Lanarc Unit Costs (2018)				Engineering Unit Costs (2019)				Current Unit Costs			
								these prices are used in project budgets			
Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit
						\$19,840	\$50			\$19,840	\$50
\$3,500.00	\$3,500			\$3,500.00	\$3,500			\$3,500.00	\$3,500		
\$20.00	\$6,000			\$20.00	\$6,000			\$20.00	\$6,000		
\$600.00	\$600			\$600.00	\$600			\$600.00	\$600		
\$300.00	\$300			\$300.00	\$300			\$300.00	\$300		
\$15.00	\$1,500			\$15.00	\$1,500			\$15.00	\$1,500		
\$500.00	\$500			\$500.00	\$500			\$500.00	\$500		
					\$12,400				\$12,400		
					\$3,720				\$3,720		
					\$3,720				\$3,720		
						\$64,800	\$130			\$80,800	\$162
\$5.00	\$1,250			\$5.00	\$1,250			\$5.00	\$1,250		
\$65.00	\$32,500			\$65.00	\$32,500			\$85.00	\$42,500		
\$1,500.00	\$1,500			\$1,500.00	\$1,500			\$1,500.00	\$1,500		
\$2,500.00	\$2,500			\$2,500.00	\$2,500			\$2,500.00	\$2,500		
\$1,500.00	\$1,500			\$1,500.00	\$1,500			\$1,500.00	\$1,500		
\$5.00	\$1,250			\$5.00	\$1,250			\$5.00	\$1,250		
					\$40,500				\$50,500		
					\$12,150				\$15,150		
					\$12,150				\$15,150		
						\$192,297	\$1,923			\$204,240	\$2,042
\$19,350.00	\$19,350			\$19,350.00	\$19,350			\$19,350.00	\$19,350		
\$129.00	\$12,900			\$129.00	\$12,900			\$129.00	\$12,900		
\$43.00	\$0			\$43.00	\$0			\$43.00	\$0		
\$75.25	\$0			\$75.25	\$0			\$75.25	\$0		
\$91.38	\$7,310			\$91.38	\$7,310			\$130.00	\$10,400		
\$161.25	\$80,625			\$170.00	\$85,000			\$170.00	\$85,000		
					\$120,185				\$127,650		
					\$36,056				\$38,295		
					\$36,056				\$38,295		
						\$288,876	\$2,889			\$313,960	\$3,140
\$19,350.00	\$19,350			\$19,350.00	\$19,350			\$19,350.00	\$19,350		
\$129.00	\$12,900			\$129.00	\$12,900			\$129.00	\$12,900		
\$43.00	\$4,300			\$43.00	\$4,300			\$43.00	\$4,300		
\$75.25	\$22,575			\$75.25	\$22,575			\$75.25	\$22,575		
\$91.38	\$24,673			\$130.00	\$35,100			\$130.00	\$35,100		
\$161.25	\$96,750			\$170.00	\$102,000			\$170.00	\$102,000		
					\$180,548				\$196,225		
					\$54,164				\$58,868		
					\$54,164				\$58,868		
						\$463,887	\$4,639			\$505,240	\$5,052
\$19,350.00	\$19,350			\$19,350.00	\$19,350			\$19,350.00	\$19,350		
\$129.00	\$12,900			\$129.00	\$12,900			\$129.00	\$12,900		
\$43.00	\$4,300			\$43.00	\$4,300			\$43.00	\$4,300		
\$75.25	\$37,625			\$75.25	\$37,625			\$75.25	\$37,625		
\$91.38	\$38,380			\$130.00	\$54,600			\$130.00	\$54,600		
\$161.25	\$177,375			\$170.00	\$187,000			\$170.00	\$187,000		
					\$289,930				\$315,775		
					\$86,979				\$94,733		
					\$86,979				\$94,733		
						\$3,625,640	\$36,256			\$4,336,920	\$43,369
					\$0				\$0		
86	\$176,300			86	\$176,300			86	\$176,300		
65	\$637,000			80	\$784,000			80	\$784,000		
151	\$218,950			170	\$246,500			170	\$246,500		
205	\$1,230,000			250	\$1,500,000			250	\$1,500,000		
3775	\$3,775			3775	\$3,775			3775	\$3,775		
					\$2,266,025				\$2,710,575		
					\$679,808				\$813,173		

Current Unit Costs

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

			Lanarc Unit Costs (2018)				Engineering Unit Costs (2019)				Current Unit Costs <small>these prices are used in project budgets</small>			
Component	Unit	Quantity	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit
Contingency	%	30%						\$679,808				\$813,173		
<b>Rock Headland Allowance (typ headland intertidal)</b>	<b>I.m.</b>	<b>25</b>							\$83,160	<b>\$3,326</b>			\$100,640	<b>\$4,026</b>
<b>Description: New Headland Mound Offshore</b>														
- mob / de mob included in unit rates								\$0				\$0		
- Minor dredging of seabed to level surface, remove fine sediments	cu.m.	50					33	\$1,650			33	\$1,650		
-supply and install core rock	cu.m.	0					0	\$0			75	\$0		
- supply and install filter rock	cu.m.	100					91	\$9,100			130	\$13,000		
- supply and install armour rock	cu.m.	225					161	\$36,225			170	\$38,250		
- permitting and habitat compensation allowance	allow	1					5000	\$5,000			10000	\$10,000		
Total								\$51,975				\$62,900		
Design & Administration	%	30%						\$15,593				\$18,870		
Contingency	%	30%						\$15,593				\$18,870		
<b>Rock Groin Allowance</b>	<b>I.m.</b>	<b>25</b>							\$73,808	<b>\$2,952</b>			\$89,680	<b>\$3,587</b>
<b>Description: New Tapered Groin in Upper Shore</b>														
- mob / de mob included in unit rates								\$0				\$0		
- Minor dredging of seabed to level surface, remove fine sediments	cu.m.	50					33	\$1,650			33	\$1,650		
-supply and install core rock	cu.m.	0					65	\$0			75	\$0		
- supply and install filter rock	cu.m.	80					91	\$7,280			130	\$10,400		
- supply and install armour rock	cu.m.	200					161	\$32,200			170	\$34,000		
- permitting and habitat compensation allowance	allow	1					5000	\$5,000			10000	\$10,000		
Total								\$46,130				\$56,050		
Design & Administration	%	30%						\$13,839				\$16,815		
Contingency	%	30%						\$13,839				\$16,815		
<b>Beach Nourishment Allowance</b>	<b>I.m.</b>	<b>100</b>							\$441,760	<b>\$4,418</b>			\$680,800	<b>\$6,808</b>
<b>Description: Cobble Beach Placed Over Existing Foreshore</b>														
- mob / de mob included in unit rates								\$0				\$0		
- Minor dredging of seabed to level surface, remove fine sediments	cu.m.	0					33	\$0			33	\$0		
-supply and install upper berm	cu.m.	600					91	\$54,600			130	\$78,000		
- supply and install sand/gravel mix	cu.m.	4500					47	\$211,500			75	\$337,500		
- supply and install armour rock	cu.m.	0					161	\$0			170	\$0		
- permitting and habitat compensation allowance	allow	1					10000	\$10,000			10000	\$10,000		
Total								\$276,100				\$425,500		
Design & Administration	%	30%						\$82,830				\$127,650		
Contingency	%	30%						\$82,830				\$127,650		
<b>Upper Beach Access Surfacing Allowance</b>	<b>sq.m.</b>	<b>3000</b>							\$169,600	<b>\$57</b>			\$169,600	<b>\$57</b>
<b>Description: Beach Ridge Granular Walk/Bike Surface (temp)</b>														
- sub-grade cut/fill (on site balance)	sq.m.	3000					\$5.00	\$15,000			\$5.00	\$15,000		
- select granular base 150mm	cu.m.	450					\$70.00	\$31,500			\$70.00	\$31,500		
- drain crossings (100 m o.c. average)	I.m.	30					\$150.00	\$4,500			\$150.00	\$4,500		
- Log/stone informal edging	I.m.	1000					\$5.00	\$5,000			\$5.00	\$5,000		
- surface granular (50mm)	sq.m.	2000					\$10.00	\$20,000			\$10.00	\$20,000		
- 1.5m verge area seeded or plugs dunegrass (allowance)	sq.m.	1500					\$20.00	\$30,000			\$20.00	\$30,000		
Total								\$106,000				\$106,000		
Design & Administration	%	30%						\$31,800				\$31,800		
Contingency	%	30%						\$31,800				\$31,800		
<b>Dike Installation Allowance</b>	<b>cu.m.</b>	<b>1000</b>							\$109,200	<b>\$109</b>			\$104,800	<b>\$105</b>
<b>Description: 3:1 Grass Sideslopes / Top Trail/Access</b>														
- mobilization (based on larger contract)	allow	1					\$1,500.00	\$1,500			\$1,500.00	\$1,500		
- Site preparation / excavation	cu.m.	100					\$40.00	\$4,000			\$35.00	\$3,500		
-supply and install dike materials	cu.m.	850					\$50.00	\$42,500			\$50.00	\$42,500		
- supply and install dike surface materials	cu.m.	150					\$85.00	\$12,750			\$70.00	\$10,500		
- repair/control at site boundaries	allow	1					\$5,000.00	\$5,000			\$5,000.00	\$5,000		
- habitat compensation allowance	allow	1					\$2,500.00	\$2,500			\$2,500.00	\$2,500		
Total								\$68,250				\$65,500		
Design & Administration	%	30%						\$20,475				\$19,650		
Contingency	%	30%						\$20,475				\$19,650		
<b>Temporary Flood Barrier Allowance</b>	<b>I.m.</b>	<b>12</b>							\$29,760	<b>\$2,480</b>			\$27,360	<b>\$2,280</b>
<b>Description: Reinforced Bollard Posts / Metal Drop-in Panels</b>														
- shop drawings and mobilization	allow	1					\$3,000.00	\$3,000			\$1,500.00	\$1,500		
- Site preparation / excavation	cu.m.	12					\$50.00	\$600			\$50.00	\$600		
-supply and install bollards and channels (900 ht)	each	3					\$1,500.00	\$4,500			\$1,500.00	\$4,500		
- supply and install temporary panels (900 ht)	each	2					\$3,000.00	\$6,000			\$3,000.00	\$6,000		
- repair/control at site boundaries	allow	1					\$2,000.00	\$2,000			\$2,000.00	\$2,000		
- signage allowance	allow	1					\$2,500.00	\$2,500			\$2,500.00	\$2,500		
Total								\$18,600				\$17,100		

Current Unit Costs

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

			Lanarc Unit Costs (2018)				Engineering Unit Costs (2019)				Current Unit Costs <small>these prices are used in project budgets</small>			
Component	Unit	Quantity	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit
Design & Administration	%	30%						\$5,580				\$5,130		
Contingency	%	30%						\$5,580				\$5,130		
<b>Retaining Wall Allowance</b>	<b>I.m.</b>	<b>10</b>							\$7,936	<b>\$794</b>			\$39,200	<b>\$3,920</b>
<b>Description: 1.0-1.4 m ht. Reinforced Concrete</b>														
- shop drawings and mobilization	allow	1					\$500.00	\$500			\$1,500.00	\$1,500		
- Site preparation / excavation / granular fill	cu.m.	10					\$50.00	\$500			\$50.00	\$500		
-supply and install foundation	cu.m.	3					\$280.00	\$840			\$2,000.00	\$6,000		
- supply and install vertical wall	each	4					\$280.00	\$1,120			\$3,000.00	\$12,000		
- repair/control at site boundaries	allow	1					\$800.00	\$800			\$2,000.00	\$2,000		
- finish	allow	1					\$1,200.00	\$1,200			\$2,500.00	\$2,500		
Total								\$4,960				\$24,500		
Design & Administration	%	30%						\$1,488				\$7,350		
Contingency	%	30%						\$1,488				\$7,350		
<b>Large Flood Gate (vehicle - two lane)</b>	<b>unit</b>	<b>1</b>							\$160,000	<b>\$160,000</b>			\$160,000	<b>\$160,000</b>
<b>Description: automatic flood gate with tie in to retaining wall</b>														
- Lump	allow	1					\$100,000.00	\$100,000			\$100,000.00	\$100,000		
								\$0				\$0		
								\$0				\$0		
								\$0				\$0		
								\$0				\$0		
								\$0				\$0		
Total								\$100,000				\$100,000		
Design & Administration	%	30%						\$30,000				\$30,000		
Contingency	%	30%						\$30,000				\$30,000		
<b>Street Paving w/ Curbs, Lights, Sidewalks 20 m ROW (warrants City Review)</b>	<b>I.m.</b>	<b>100</b>							\$702,240	<b>\$7,022</b>			\$702,240	<b>\$7,022</b>
<b>Description: new base courses, curb, pavement, utility adjust</b>														
- pit run sub-base	cu.m.	800					\$50.00	\$40,000			\$50.00	\$40,000		
- base course	cu.m.	230					\$80.00	\$18,400			\$80.00	\$18,400		
- curb and gutter	I.m.	200					\$90.00	\$18,000			\$90.00	\$18,000		
- asphalt paving (50mm)	sq.m.	1000					\$35.00	\$35,000			\$35.00	\$35,000		
- unit paving (60mm)	sq.m.	400					\$100.00	\$40,000			\$100.00	\$40,000		
- tree planting in urban sidewalk	each	15					\$1,500.00	\$22,500			\$1,500.00	\$22,500		
- CB, SS and SD manhole adjustments allowance	each	10					\$1,000.00	\$10,000			\$1,000.00	\$10,000		
- service box/hydro/tel/gas adjustments allowance	allow	1					\$15,000.00	\$15,000			\$15,000.00	\$15,000		
- ROW edge retaining/landscape allowance	I.m.	200					\$1,200.00	\$240,000			\$1,200.00	\$240,000		
Total								\$438,900				\$438,900		
Design & Administration	%	30%						\$131,670				\$131,670		
Contingency	%	30%						\$131,670				\$131,670		
<b>Pump Station Downtown</b>	<b>per</b>	<b>1</b>							\$4,480,000	<b>\$4,480,000</b>			\$4,480,000	<b>\$4,480,000</b>
<b>Description: building, mechanical, site works</b>														
Total	per	1					\$2,800,000.00	\$2,800,000			\$2,800,000.00	\$2,800,000		
								\$0				\$0		
								\$0				\$0		
								\$0				\$0		
								\$0				\$0		
								\$0				\$0		
								\$0				\$0		
Total		1						\$2,800,000				\$2,800,000		
Design & Administration	%	30%						\$840,000				\$840,000		
Contingency	%	30%						\$840,000				\$840,000		
<b>Underground Storage Tank</b>	<b>cu.m.</b>	<b>1000</b>							\$152,000	<b>\$152</b>			\$152,000	<b>\$152</b>
<b>Description: underground tank, mechanical, site works</b>														
- bulk fill, excavation, backfill	cu.m.	1000					\$18.00	\$18,000			\$18.00	\$18,000		
- structure allowance	sq.m.	250					\$220.00	\$55,000			\$220.00	\$55,000		
- mechanical allowance	allow	2					\$8,000.00	\$16,000			\$8,000.00	\$16,000		
								\$0				\$0		
- utility servicing allowance	allow	1					\$6,000.00	\$6,000			\$6,000.00	\$6,000		
- adjacent amenity / education package	allow	0						\$0				\$0		
Total								\$95,000				\$95,000		
Design & Administration	%	30%						\$28,500				\$28,500		
Contingency	%	30%						\$28,500				\$28,500		
<b>Primary Paved Trail (4m asphalt)</b>	<b>I.m.</b>	<b>500</b>			\$232,800	<b>\$466</b>							\$232,800	<b>\$466</b>
<b>Description: base course, wood edging, drainage and paving</b>														
- sub-grade cut/fill (on site balance)	sq.m.	3000	\$5.00	\$15,000							\$5.00	\$15,000		
- crushed granular base 150mm	cu.m.	450	\$70.00	\$31,500							\$70.00	\$31,500		

Current Unit Costs

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

			Lanarc Unit Costs (2018)				Engineering Unit Costs (2019)				Current Unit Costs <small>these prices are used in project budgets</small>			
Component	Unit	Quantity	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit
- drain crossings (100 m o.c. average)	l.m.	30	\$150.00	\$4,500							\$150.00	\$4,500		
- pavement edging	l.m.	1000	\$5.00	\$5,000							\$5.00	\$5,000		
- asphalt paving (50mm)	sq.m.	2000	\$35.00	\$70,000							\$35.00	\$70,000		
- 1.5m verge area seeded grass (allowance)	sq.m.	1500	\$13.00	\$19,500							\$13.00	\$19,500		
Total				\$145,500								\$145,500		
Design & Administration	%	30%		\$43,650								\$43,650		
Contingency	%	30%		\$43,650								\$43,650		
<b>Secondary Paved Trail (2m asphalt)</b>	<b>l.m.</b>	<b>500</b>			<b>\$130,800</b>	<b>\$262</b>							<b>\$130,800</b>	<b>\$262</b>
<b>Description: base course, wood edging, drainage and paving</b>														
- sub-grade cut/fill (on site balance)	sq.m.	2000	\$5.00	\$10,000							\$5.00	\$10,000		
- crushed granular base 150mm	cu.m.	225	\$70.00	\$15,750							\$70.00	\$15,750		
- drain crossings (100 m o.c. average)	l.m.	20	\$150.00	\$3,000							\$150.00	\$3,000		
- pavement edging	l.m.	1000	\$5.00	\$5,000							\$5.00	\$5,000		
- asphalt paving (50mm)	sq.m.	1000	\$35.00	\$35,000							\$35.00	\$35,000		
- 1.0m verge area seeded grass (allowance)	sq.m.	1000	\$13.00	\$13,000							\$13.00	\$13,000		
Total				\$81,750								\$81,750		
Design & Administration	%	30%		\$24,525								\$24,525		
Contingency	%	30%		\$24,525								\$24,525		
<b>Infiltration Swale (Bioswale)</b>	<b>l.m.</b>	<b>500</b>			<b>\$124,976</b>	<b>\$250</b>							<b>\$124,976</b>	<b>\$250</b>
<b>Description: drain rock reservoir, subdrain, landscape filter</b>														
- perforated drains	l.m.	500	\$25.00	\$12,500							\$25.00	\$12,500		
- drain inlets at driveways (additional to basic street need - allow 100m o.c.)	l.m.	500	\$15.00	\$7,500							\$15.00	\$7,500		
- sand/organic growing medium 300mm	cu.m.	375	\$55.00	\$20,625							\$55.00	\$20,625		
- drain rock reservoir	cu.m.	250	\$50.00	\$12,500							\$50.00	\$12,500		
- irrigation	sq.m.	1250	\$7.50	\$9,375							\$7.50	\$9,375		
- 75% area sodding & establishment maintenance	sq.m.	938	\$5.00	\$4,690							\$5.00	\$4,690		
- 25% area shrub and tree landscape	sq.m.	312	\$35.00	\$10,920							\$35.00	\$10,920		
Total				\$78,110								\$78,110		
Design & Administration	%	30%		\$23,433								\$23,433		
Contingency	%	30%		\$23,433								\$23,433		
<b>Manicured Grass / Tree Landscape</b>	<b>sq.m.</b>	<b>100</b>			<b>\$5,126</b>	<b>\$51</b>							<b>\$5,126</b>	<b>\$51</b>
<b>Description: park grass and trees, drained, irrigated</b>														
- sub-grade cut/fill (on site balance)	sq.m.	100	\$5.00	\$500							\$5.00	\$500		
- perforated drains (10m o.c.)	l.m.	10	\$25.00	\$250							\$25.00	\$250		
- growing medium 200mm	cu.m.	20	\$46.00	\$920							\$46.00	\$920		
- irrigation	sq.m.	100	\$7.50	\$750							\$7.50	\$750		
- seeding & establishment maintenance	sq.m.	100	\$2.84	\$284							\$2.84	\$284		
- 6 cm cal. tree and planting	each	1	\$500.00	\$500							\$500.00	\$500		
Total				\$3,204								\$3,204		
Design & Administration	%	30%		\$961								\$961		
Contingency	%	30%		\$961								\$961		
<b>Manicured Shrub /Tree Landscape</b>	<b>sq.m.</b>	<b>100</b>			<b>\$9,184</b>	<b>\$92</b>							<b>\$9,184</b>	<b>\$92</b>
<b>Description: shrub bed and trees, drained, irrigated</b>														
- sub-grade cut/fill (on site balance)	sq.m.	100	\$5.00	\$500							\$5.00	\$500		
- perforated drains (10m o.c.)	l.m.	10	\$25.00	\$250							\$25.00	\$250		
- growing medium 400mm	cu.m.	40	\$46.00	\$1,840							\$46.00	\$1,840		
- irrigation	sq.m.	100	\$7.50	\$750							\$7.50	\$750		
- mulching	sq.m.	100	\$2.50	\$250							\$2.50	\$250		
- shrub planting (#2 pots 900 o.c.)	sq.m.	100	\$16.50	\$1,650							\$16.50	\$1,650		
- 6 cm cal. tree and planting	each	1	\$500.00	\$500							\$500.00	\$500		
Total				\$5,740								\$5,740		
Design & Administration	%	30%		\$1,722								\$1,722		
Contingency	%	30%		\$1,722								\$1,722		
<b>Naturalized Grass / Tree Landscape</b>	<b>sq.m.</b>	<b>100</b>			<b>\$2,390</b>	<b>\$24</b>							<b>\$2,390</b>	<b>\$24</b>
<b>Description: rough grass and small tree, not drained or irrigated</b>														
- sub-grade cut/fill (on site balance)	sq.m.	100	\$5.00	\$500							\$5.00	\$500		
- growing medium 100mm	cu.m.	10	\$46.00	\$460							\$46.00	\$460		
- seeding & establishment maintenance	sq.m.	100	\$2.84	\$284							\$2.84	\$284		
- 4 cm cal. tree and planting	each	1	\$250.00	\$250							\$250.00	\$250		
Total				\$1,494								\$1,494		
Design & Administration	%	30%		\$448								\$448		
Contingency	%	30%		\$448								\$448		
<b>Naturalized Shrub / Tree Landscape</b>	<b>sq.m.</b>	<b>100</b>			<b>\$5,128</b>	<b>\$51</b>							<b>\$5,128</b>	<b>\$51</b>
<b>Description: native shrubs and small tree, not drained or irrigated</b>														
- sub-grade cut/fill (on site balance)	sq.m.	100	\$5.00	\$500							\$5.00	\$500		

Current Unit Costs

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

			Lanarc Unit Costs (2018)				Engineering Unit Costs (2019)				Current Unit Costs <small>these prices are used in project budgets</small>			
Component	Unit	Quantity	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit
- growing medium 300mm	cu.m.	30	\$46.00	\$1,380			\$46.00	\$1,380			\$46.00	\$1,380		
- mulching	sq.m.	100	\$2.50	\$250			\$2.50	\$250			\$2.50	\$250		
- shrub planting (#1 pots 900 o.c.)	sq.m.	100	\$8.25	\$825			\$8.25	\$825			\$8.25	\$825		
- 4 cm cal. tree and planting	each	1	\$250.00	\$250			\$250.00	\$250			\$250.00	\$250		
Total				\$3,205				\$3,205				\$3,205		
Design & Administration	%	30%		\$962				\$962				\$962		
Contingency	%	30%		\$962				\$962				\$962		
<b>Concrete Stair (2m wide with metal handrail)</b>	<b>l.m.</b>	<b>2</b>			<b>\$4,425</b>	<b>\$2,212</b>							<b>\$4,425</b>	<b>\$2,212</b>
<b>Description: CIP concrete on 2:1 grade with handrail both sides</b>														
- sub-grade cut/fill (on site balance)	sq.m.	10	\$5.00	\$50			\$5.00	\$50			\$5.00	\$50		
- crushed granular base 150mm	cu.m.	6.25	\$70.00	\$438			\$70.00	\$438			\$70.00	\$438		
- CIP concrete steps (formwork, concrete)	l.m. nose	15	\$80.00	\$1,200			\$80.00	\$1,200			\$80.00	\$1,200		
- metal handrail (could include wood elements)	l.m.	4	\$250.00	\$1,000			\$250.00	\$1,000			\$250.00	\$1,000		
- 1.0m verge area seeded grass (allowance)	sq.m.	6	\$13.00	\$78			\$13.00	\$78			\$13.00	\$78		
Total				\$2,766				\$2,766				\$2,766		
Design & Administration	%	30%		\$830				\$830				\$830		
Contingency	%	30%		\$830				\$830				\$830		
<b>Boardwalk / Pedestrian Bridge (3m wide with metal handrail)</b>	<b>l.m.</b>	<b>10</b>			<b>\$95,232</b>	<b>\$9,523</b>							<b>\$95,232</b>	<b>\$9,523</b>
<b>Description: timber or concrete with handrail both sides</b>														
- site access / mobilization / delivery	allow	1	\$2,000.00	\$2,000			\$2,000.00	\$2,000			\$2,000.00	\$2,000		
- foundations / substructure	allow	2	\$2,500.00	\$5,000			\$2,500.00	\$5,000			\$2,500.00	\$5,000		
- timber frame & decking for spans (or precast concrete)	sq.m.	30	\$1,500.00	\$45,000			\$1,500.00	\$45,000			\$1,500.00	\$45,000		
- metal handrail (could include wood elements)	l.m.	20	\$350.00	\$7,000			\$350.00	\$7,000			\$350.00	\$7,000		
- 1.0m verge area seeded grass (allowance)	sq.m.	40	\$13.00	\$520			\$13.00	\$520			\$13.00	\$520		
Total				\$59,520				\$59,520				\$59,520		
Design & Administration	%	30%		\$17,856				\$17,856				\$17,856		
Contingency	%	30%		\$17,856				\$17,856				\$17,856		
<b>Fence with Concrete Mow Strip</b>	<b>l.m.</b>	<b>10</b>			<b>\$2,256</b>	<b>\$226</b>							<b>\$2,256</b>	<b>\$226</b>
<b>Description: vinyl coated chain link with concrete strip</b>														
- sub-grade cut/fill (on site balance)	sq.m.	10	\$5.00	\$50			\$5.00	\$50			\$5.00	\$50		
- CIP concrete strip (formwork, concrete)	l.m.	10	\$30.00	\$300			\$30.00	\$300			\$30.00	\$300		
- 1.2m ht chain link fence (vinyl coated)	l.m.	10	\$93.00	\$930			\$93.00	\$930			\$93.00	\$930		
- 1.0m verge area seeded grass (allowance)	sq.m.	10	\$13.00	\$130			\$13.00	\$130			\$13.00	\$130		
Total				\$1,410				\$1,410				\$1,410		
Design & Administration	%	30%		\$423				\$423				\$423		
Contingency	%	30%		\$423				\$423				\$423		
<b>Bench, Table or Bike Rack on concrete pad</b>	<b>each</b>	<b>1</b>			<b>\$4,054</b>	<b>\$4,054</b>							<b>\$4,054</b>	<b>\$4,054</b>
<b>Description: site furniture with concrete pad</b>														
- sub-grade cut/fill (on site balance)	sq.m.	10	\$5.00	\$50			\$5.00	\$50			\$5.00	\$50		
- CIP concrete pad (formwork, concrete)	sq.m.	10	\$30.00	\$300			\$30.00	\$300			\$30.00	\$300		
- Bench or picnic table	each	1	\$1,950.00	\$1,950			\$1,950.00	\$1,950			\$1,950.00	\$1,950		
- 1.0m verge area seeded grass (allowance)	sq.m.	18	\$13.00	\$234			\$13.00	\$234			\$13.00	\$234		
Total				\$2,534				\$2,534				\$2,534		
Design & Administration	%	30%		\$760				\$760				\$760		
Contingency	%	30%		\$760				\$760				\$760		
<b>Litter Receptacle on Concrete Pad</b>	<b>each</b>	<b>1</b>			<b>\$2,136</b>	<b>\$2,136</b>							<b>\$2,136</b>	<b>\$2,136</b>
<b>Description: decorative litter container on concrete pad</b>														
- sub-grade cut/fill (on site balance)	sq.m.	1	\$10.00	\$10			\$10.00	\$10			\$10.00	\$10		
- CIP concrete pad (formwork, concrete)	sq.m.	1	\$60.00	\$60			\$60.00	\$60			\$60.00	\$60		
- Litter receptacle (varies)	each	1	\$1,200.00	\$1,200			\$1,200.00	\$1,200			\$1,200.00	\$1,200		
- 1.0m verge area seeded grass (allowance)	sq.m.	5	\$13.00	\$65			\$13.00	\$65			\$13.00	\$65		
Total				\$1,335				\$1,335				\$1,335		
Design & Administration	%	30%		\$401				\$401				\$401		
Contingency	%	30%		\$401				\$401				\$401		
<b>Urban Plaza (hard landscape area)</b>	<b>sq.m.</b>	<b>400</b>			<b>\$149,600</b>	<b>\$374</b>							<b>\$149,600</b>	<b>\$374</b>
<b>Description: unit pavers with concrete edging, special features</b>														
- sub-grade cut/fill (on site balance)	sq.m.	425	\$10.00	\$4,250			\$10.00	\$4,250			\$10.00	\$4,250		
- crushed granular base 150mm	cu.m.	425	\$70.00	\$29,750			\$70.00	\$29,750			\$70.00	\$29,750		
- drainage (CB plus SD)	400 sq.m.	1	\$5,500.00	\$5,500			\$5,500.00	\$5,500			\$5,500.00	\$5,500		
- pavement edging	l.m.	80	\$50.00	\$4,000			\$50.00	\$4,000			\$50.00	\$4,000		
- unit paving (60mm)	sq.m.	400	\$100.00	\$40,000			\$100.00	\$40,000			\$100.00	\$40,000		
- special furniture, signage or features (allowance)	allow	1	\$10,000.00	\$10,000			\$10,000.00	\$10,000			\$10,000.00	\$10,000		
Total				\$93,500				\$93,500				\$93,500		
Design & Administration	%	30%		\$28,050				\$28,050				\$28,050		
Contingency	%	30%		\$28,050				\$28,050				\$28,050		

Current Unit Costs

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

			Lanarc Unit Costs (2018)				Engineering Unit Costs (2019)				Current Unit Costs <small>these prices are used in project budgets</small>			
Component	Unit	Quantity	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit	Unit-Price	Subtotal	Calculated Total	Budget Price / Unit
<b>Parking Area (asphalt with curbs &amp; lighting)</b>	<b>stall</b>	<b>20</b>			\$91,080	\$4,554							\$91,080	\$4,554
<b>Description: 550 sq.m. asphalt with curbs, double loaded, lighted</b>														
- sub-grade cut/fill (on site balance)	sq.m.	600	\$10.00	\$6,000							\$10.00	\$6,000		
- crushed granular base 150mm	cu.m.	90	\$70.00	\$6,300							\$70.00	\$6,300		
- drainage (CB plus SD)	550 sq.m.	1	\$5,500.00	\$5,500							\$5,500.00	\$5,500		
- curbing	l.m.	75	\$65.00	\$4,875							\$65.00	\$4,875		
- asphalt paving	sq.m.	550	\$35.00	\$19,250							\$35.00	\$19,250		
- lighting (decorative fixture)	each	2	\$5,000.00	\$10,000							\$5,000.00	\$10,000		
- gate, signage or features (allowance)	allow	1	\$5,000.00	\$5,000							\$5,000.00	\$5,000		
Total				\$56,925								\$56,925		
Design & Administration	%	30%		\$17,078								\$17,078		
Contingency	%	30%		\$17,078								\$17,078		
<b>Washroom Building - full services 30 sq.m.</b>	<b>each</b>	<b>1</b>			\$154,960	\$154,960							\$154,960	\$154,960
<b>Description: masonry construction, frame roof, flush toilets, sinks</b>														
- sub-grade cut/fill (on site balance)	sq.m.	40	\$5.00	\$200							\$5.00	\$200		
- building construction	sq.m.	30	\$2,000.00	\$60,000							\$2,000.00	\$60,000		
- utility servicing (allow 30m distance, storm, san, water & electrical)	l.m.	120	\$300.00	\$36,000							\$300.00	\$36,000		
- 6.0m verge area seeded grass (allowance)	sq.m.	50	\$13.00	\$650							\$13.00	\$650		
Total				\$96,850								\$96,850		
Design & Administration	%	30%		\$29,055								\$29,055		
Contingency	%	30%		\$29,055								\$29,055		
<b>Park Entrance Sign</b>	<b>each</b>	<b>1</b>			\$9,069	\$9,069							\$9,069	\$9,069
<b>Description: character design, two posts, mixed materials, not lit</b>														
- site preparation	sq.m.	10	\$20.00	\$200							\$20.00	\$200		
- sign construction	sq.m.	3	\$1,500.00	\$4,500							\$1,500.00	\$4,500		
- installation	allow	1	\$500.00	\$500							\$500.00	\$500		
- 6.0m verge area seeded grass (allowance)	sq.m.	36	\$13.00	\$468							\$13.00	\$468		
Total				\$5,668								\$5,668		
Design & Administration	%	30%		\$1,700								\$1,700		
Contingency	%	30%		\$1,700								\$1,700		
<b>Park Interpretive Signs &amp; Shelter</b>	<b>each</b>	<b>1</b>			\$27,309	\$27,309							\$27,309	\$27,309
<b>Description: timber posts and roof, stone foundation, custom signage</b>														
- site preparation	sq.m.	20	\$20.00	\$400							\$20.00	\$400		
- sign construction	sq.m.	5	\$1,500.00	\$7,500							\$1,500.00	\$7,500		
- shelter construction	sq.m.	6	\$1,200.00	\$7,200							\$1,200.00	\$7,200		
- installation	allow	1	\$1,500.00	\$1,500							\$1,500.00	\$1,500		
- 6.0m verge area seeded grass (allowance)	sq.m.	36	\$13.00	\$468							\$13.00	\$468		
Total				\$17,068								\$17,068		
Design & Administration	%	30%		\$5,120								\$5,120		
Contingency	%	30%		\$5,120								\$5,120		
<b>Downtown Inland Streets Raising Concurrent with 'Refresh'</b>	<b>l.m.</b>	<b>100</b>						\$104,000	\$1,040				\$104,000	\$1,040
<b>Description: fill, assist with storefront access adjustments</b>														
- ROW edge retaining/landscape allowance	l.m.	200					\$1,200.00	\$240,000			\$1,200.00	\$240,000		
- pit run sub-base fill (utilities / base course / surfacing funded under 'Refresh')	cu.m.	800	\$50.00	\$40,000			\$50.00	\$40,000			\$50.00	\$40,000		
- assistance for adjustments at low storefronts (based on 15% of street)	each	1					\$25,000.00	\$25,000			\$20,000.00	\$25,000		
Total				\$0				\$65,000				\$65,000		
Design & Administration	%	30%		\$0				\$19,500				\$19,500		
Contingency	%	30%		\$0				\$19,500				\$19,500		
<b>Other (from Unit Cost)</b>	<b>sq.m.</b>	<b>1</b>			\$0	\$0			\$0	\$0			\$0	\$0
<b>Description:</b>														
Total				\$0				\$0				\$0		
Design & Administration	%	30%		\$0				\$0				\$0		
Contingency	%	30%		\$0				\$0				\$0		







## PB A1 Raise Revetments on City Frontage

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	60								
Average Site Width	l.m.									
		NOTE: insert quantities								
Revetment New - Large Face (elevation change 6m to 10m)	l.m.	140	5,052	\$707,336			100%	\$707,336	3	\$21,220
Naturalized Shrub / Tree Landscape	sq.m.	1200	51	\$61,536			100%	\$61,536	3	\$1,846
Concrete Stair (2m wide with metal handrail)	l.m.	25	2,212	\$55,310			100%	\$55,310	4	\$2,212
<b>Subtotals for Project</b>				<b>\$824,182</b>				<b>\$824,182</b>		<b>\$25,279</b>

## PB B1 Publicly Funded Headland/Beach at Bluffs

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	1920								
Average Site Width	l.m.	0								
		NOTE: insert quantities								
Rock Groin Allowance	l.m.	500	3,587	\$1,793,600			100%	\$1,793,600	3	\$53,808
Beach Nourishment Allowance	l.m.	1860	6,808	\$12,662,880			100%	\$12,662,880	5	\$633,144
<b>Subtotals for Project</b>				<b>\$14,456,480</b>				<b>\$14,456,480</b>		<b>\$686,952</b>



## DT A1 Major Streets Raised Ph 1

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	32240								
Total Centreline Length	l.m.	1430								
Average Site Width	l.m.	23								
Removals	sq.m.	32240	50	\$1,599,104			100%	\$1,599,104	0	\$0
Pit Run Granular Fill	cu.m.	29000	162	\$4,686,400			100%	\$4,686,400	0	\$0
Street Paving w/ Curbs, Lights, Sidewalks 20 m ROW (warrants City Review)	l.m.	1430	7,022	\$10,042,032			100%	\$10,042,032	4	\$401,681
<b>Subtotals for Project</b>				<b>\$16,327,536</b>				<b>\$16,327,536</b>		<b>\$401,681</b>

NOTE: insert quantities

### DT A2 Minor Streets Raised Ph 1

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	68020								
Total Centreline Length	l.m.	3289								
Average Site Width	l.m.	21								
Removals	sq.m.	68020	50	\$3,373,792			100%	\$3,373,792	0	\$0
Pit Run Granular Fill	cu.m.	13116	162	\$2,119,546			100%	\$2,119,546	0	\$0
Street Paving w/ Curbs, Lights, Sidewalks 20 m ROW (warrants City Review)	l.m.	3289	7,022	\$23,096,674			100%	\$23,096,674	4	\$923,867
<b>Subtotals for Project</b>				<b>\$28,590,011</b>				<b>\$28,590,011</b>		<b>\$923,867</b>

NOTE: insert quantities

## DT A3 Major Streets Raised Ph 2

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	32240								
Total Centreline Length	l.m.	1430								
Average Site Width	l.m.	23								
Removals	sq.m.	32240	50	\$1,599,104			100%	\$1,599,104	0	\$0
Pit Run Granular Fill	cu.m.	29000	162	\$4,686,400			100%	\$4,686,400	0	\$0
Street Paving w/ Curbs, Lights, Sidewalks 20 m ROW (warrants City Review)	l.m.	1430	7,022	\$10,042,032			100%	\$10,042,032	4	\$401,681
<b>Subtotals for Project</b>				<b>\$16,327,536</b>				<b>\$16,327,536</b>		<b>\$401,681</b>

NOTE: insert quantities

## DT A4 Minor Streets Raised Ph 2

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	68020								
Total Centreline Length	l.m.	3289								
Average Site Width	l.m.	21								
		NOTE: insert quantities								
Removals	sq.m.	68020	50	\$3,373,792			100%	\$3,373,792	0	\$0
Pit Run Granular Fill	cu.m.	20400	162	\$3,296,640			100%	\$3,296,640	0	\$0
Street Paving w/ Curbs, Lights, Sidewalks 20 m ROW (warrant)	l.m.	3289	7,022	\$23,096,674			100%	\$23,096,674	4	\$923,867
<b>Subtotals for Project</b>				<b>\$29,767,106</b>				<b>\$29,767,106</b>		<b>\$923,867</b>

## DT B1 Ostler Park Barrier/Trail Ph 1

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1								
Total Centreline Length	l.m.	1								
Average Site Width	l.m.	1								
		NOTE: insert quantities								
Removals	sq.m.	2400	50	\$119,040			100%	\$119,040	0	\$0
Pit Run Granular Fill	cu.m.	1680	162	\$271,488			100%	\$271,488	0	\$0
Revetment Repair / Improve	l.m.	240	2,042	\$490,176			100%	\$490,176	2	\$9,804
Revetment New - Small	l.m.	240	3,140	\$753,504			100%	\$753,504	3	\$22,605
Primary Paved Trail (4m asphalt)	l.m.	240	466	\$111,744			100%	\$111,744	5	\$5,587
Manicured Grass / Tree Landscape	sq.m.	1440	51	\$73,820			100%	\$73,820	5	\$3,691
Bench, Table or Bike Rack on concrete pad	each	5	4,054	\$20,272			100%	\$20,272	5	\$1,014
<b>Subtotals for Project</b>				<b>\$1,840,044</b>				<b>\$1,840,044</b>		<b>\$42,700</b>

## DT B2 BC Ferries Barrier/Trail Ph 1

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1425								
Total Centreline Length	l.m.									
Average Site Width	l.m.									
		NOTE: insert quantities								
Removals	sq.m.	1425	50	\$70,680			100%	\$70,680	0	\$0
Pit Run Granular Fill	cu.m.	570	162	\$92,112			100%	\$92,112	0	\$0
Retaining Wall Allowance	l.m.	190	3,920	\$744,800			100%	\$744,800	4	\$29,792
Primary Paved Trail (4m asphalt)	l.m.	190	466	\$88,464			100%	\$88,464	5	\$4,423
Manicured Shrub /Tree Landscape	sq.m.	665	92	\$61,074			100%	\$61,074	5	\$3,054
Fence with Concrete Mow Strip	l.m.	190	226	\$42,864			100%	\$42,864	5	\$2,143
Bench, Table or Bike Rack on concrete pad	each	2	4,054	\$8,109			100%	\$8,109	5	\$405
<b>Subtotals for Project</b>								<b>\$1,108,102</b>		<b>\$39,818</b>

## DT B3 BC Ferries Temporary Barrier Ph 1

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1080								
Total Centreline Length	l.m.									
Average Site Width	l.m.									
		NOTE: insert quantities								
Removals	sq.m.	1080	50	\$53,568			100%	\$53,568	0	\$0
Pit Run Granular Fill	cu.m.	432	162	\$69,811			100%	\$69,811	0	\$0
Temporary Flood Barrier Allowance	l.m.	60	2,280	\$136,800			100%	\$136,800	5	\$6,840
Parking Area (asphalt with curbs & lighting)	stall	36	4,554	\$163,944			100%	\$163,944	4	\$6,558
<b>Subtotals for Project</b>				<b>\$424,123</b>				<b>\$424,123</b>		<b>\$13,398</b>

## DT B4 Hwy 19A Lift Ph 1

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	18960								
Total Centreline Length	l.m.	790								
Average Site Width	l.m.	24								
		NOTE: insert quantities								
Removals	sq.m.	18960	50	\$940,416			100%	\$940,416	0	\$0
Pit Run Granular Fill	cu.m.	17064	162	\$2,757,542			100%	\$2,757,542	0	\$0
Street Paving w/ Curbs, Lights, Sidewalks 20 m ROW (w:	l.m.	790	7,022	\$5,547,696			100%	\$5,547,696	4	\$221,908
<b>Subtotals for Project</b>				<b>\$9,245,654</b>				<b>\$9,245,654</b>		<b>\$221,908</b>

## DT B5 Barrier/Trail at Hwy 19A Ph 1

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	2175								
Total Centreline Length	l.m.	290								
Average Site Width	l.m.	7.5								
		NOTE: insert quantities								
Removals	sq.m.	2175	50	\$107,880			100%	\$107,880	0	\$0
Pit Run Granular Fill	cu.m.	1740	162	\$281,184			100%	\$281,184	0	\$0
Revetment Repair / Improve	l.m.	290	2,042	\$592,296			100%	\$592,296	2	\$11,846
Revetment New - Small	l.m.	290	3,140	\$910,484			100%	\$910,484	3	\$27,315
Primary Paved Trail (4m asphalt)	l.m.	290	466	\$135,024			100%	\$135,024	5	\$6,751
Manicured Shrub /Tree Landscape	sq.m.	1015	92	\$93,218			100%	\$93,218	5	\$4,661
Bench, Table or Bike Rack on concrete pad	each	4	4,054	\$16,218			100%	\$16,218	5	\$811
<b>Subtotals for Project</b>				<b>\$2,136,303</b>				<b>\$2,136,303</b>		<b>\$51,383</b>

## DT B6 Barrier Trail at City Waterfront Property Ph 1

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1200								
Total Centreline Length	l.m.	160								
Average Site Width	l.m.	7.5								
		NOTE: insert quantities								
Removals	sq.m.	1200	50	\$59,520			100%	\$59,520	0	\$0
Pit Run Granular Fill	cu.m.	960	162	\$155,136			100%	\$155,136	0	\$0
Revetment Repair / Improve	l.m.	160	2,042	\$326,784			100%	\$326,784	2	\$6,536
Revetment New - Small	l.m.	160	3,140	\$502,336			100%	\$502,336	3	\$15,070
Primary Paved Trail (4m asphalt)	l.m.	160	466	\$74,496			100%	\$74,496	5	\$3,725
Manicured Shrub /Tree Landscape	sq.m.	560	92	\$51,430			100%	\$51,430	5	\$2,572
Bench, Table or Bike Rack on concrete pad	each	4	4,054	\$16,218			100%	\$16,218	5	\$811
<b>Subtotals for Project</b>				<b>\$1,185,920</b>				<b>\$1,185,920</b>		<b>\$28,713</b>

## DT B7a Underground Stomwater Tank Ostler Park

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1500								
Total Centreline Length	l.m.	50								
Average Site Width	l.m.	30								
		NOTE: insert quantities								
Removals	sq.m.	5000	50	\$248,000			100%	\$248,000	0	\$0
Underground Storage Tank	cu.m.	4950	152	\$752,400			100%	\$752,400	5	\$37,620
Secondary Paved Trail (2m asphalt)	l.m.	50	262	\$13,080			100%	\$13,080	5	\$654
Manicured Grass / Tree Landscape	sq.m.	3000	51	\$153,792			100%	\$153,792	5	\$7,690
Manicured Shrub /Tree Landscape	sq.m.	5000	92	\$459,200			100%	\$459,200	5	\$22,960
Bench, Table or Bike Rack on concrete pad	each	2	4,054	\$8,109			100%	\$8,109	5	\$405
Litter Receptacle on Concrete Pad	each	2	2,136	\$4,272			100%	\$4,272	5	\$214
Park Interpretive Signs & Shelter	each	1	27,309	\$27,309			100%	\$27,309	5	\$1,365
<b>Subtotals for Project</b>				<b>\$1,666,162</b>				<b>\$1,666,162</b>		<b>\$70,908</b>

## DT B7b Pump Station Ostler Park

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1								
Total Centreline Length	l.m.	1								
Average Site Width	l.m.	1								
		NOTE: insert quantities								
Removals	sq.m.	1000	50	\$49,600			100%	\$49,600	0	\$0
Pump Station Downtown	per	1	4,480,000	\$4,480,000			100%	\$4,480,000	7	\$313,600
Primary Paved Trail (4m asphalt)	l.m.	50	466	\$23,280			100%	\$23,280	5	\$1,164
Secondary Paved Trail (2m asphalt)	l.m.	50	262	\$13,080			100%	\$13,080	5	\$654
Infiltration Swale (Bioswale)	l.m.	50	250	\$12,498			100%	\$12,498	7	\$875
Manicured Grass / Tree Landscape	sq.m.	500	51	\$25,632			100%	\$25,632	5	\$1,282
Manicured Shrub /Tree Landscape	sq.m.	500	92	\$45,920			100%	\$45,920	5	\$2,296
Bench, Table or Bike Rack on concrete pad	each	4	4,054	\$16,218			100%	\$16,218	5	\$811
Litter Receptacle on Concrete Pad	each	2	2,136	\$4,272			100%	\$4,272	5	\$214
Urban Plaza (hard landscape area)	sq.m.	200	374	\$74,800			100%	\$74,800	5	\$3,740
Washroom Building - full services 30 sq.m.	each	1	154,960	\$154,960			100%	\$154,960	5	\$7,748
Park Interpretive Signs & Shelter	each	1	27,309	\$27,309			100%	\$27,309	5	\$1,365
<b>Subtotals for Project</b>				<b>\$4,927,568</b>				<b>\$4,927,568</b>		<b>\$333,748</b>

## DT B7c Underground Stormwater Tank Nunns Creek

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1500								
Total Centreline Length	l.m.	50								
Average Site Width	l.m.	30								
		NOTE: insert quantities								
Removals	sq.m.	3000	50	\$148,800			100%	\$148,800	0	\$0
Underground Storage Tank	cu.m.	4950	152	\$752,400			100%	\$752,400	5	\$37,620
Secondary Paved Trail (2m asphalt)	l.m.	50	262	\$13,080			100%	\$13,080	5	\$654
Naturalized Grass / Tree Landscape	sq.m.	3000	24	\$71,712			100%	\$71,712	4	\$2,868
Naturalized Shrub / Tree Landscape	sq.m.	1500	51	\$76,920			100%	\$76,920	3	\$2,308
Bench, Table or Bike Rack on concrete pad	each	2	4,054	\$8,109			100%	\$8,109	5	\$405
Litter Receptacle on Concrete Pad	each	1	2,136	\$2,136			100%	\$2,136	5	\$107
Parking Area (asphalt with curbs & lighting)	stall	3	4,554	\$13,662			100%	\$13,662	4	\$546
Park Interpretive Signs & Shelter	each	1	27,309	\$27,309			100%	\$27,309	5	\$1,365
<b>Subtotals for Project</b>				<b>\$1,114,128</b>				<b>\$1,114,128</b>		<b>\$45,874</b>

## DT B7d Pump Station Nunns Creek

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1								
Total Centreline Length	l.m.	1								
Average Site Width	l.m.	1								
		NOTE: insert quantities								
Removals	sq.m.	1000	50	\$49,600			100%	\$49,600	0	\$0
Pump Station Downtown	per	1	4,480,000	\$4,480,000			100%	\$4,480,000	7	\$313,600
Primary Paved Trail (4m asphalt)	l.m.	50	466	\$23,280			100%	\$23,280	5	\$1,164
Infiltration Swale (Bioswale)	l.m.	50	250	\$12,498			100%	\$12,498	7	\$875
Manicured Grass / Tree Landscape	sq.m.	500	51	\$25,632			100%	\$25,632	5	\$1,282
Manicured Shrub /Tree Landscape	sq.m.	500	92	\$45,920			100%	\$45,920	5	\$2,296
Fence with Concrete Mow Strip	l.m.	200	226	\$45,120			100%	\$45,120	5	\$2,256
Bench, Table or Bike Rack on concrete pad	each	2	4,054	\$8,109			100%	\$8,109	5	\$405
Litter Receptacle on Concrete Pad	each	100	2,136	\$213,600			100%	\$213,600	5	\$10,680
Urban Plaza (hard landscape area)	sq.m.	3	374	\$1,122			100%	\$1,122	5	\$56
Park Interpretive Signs & Shelter	each	1	27,309	\$27,309			100%	\$27,309	5	\$1,365
<b>Subtotals for Project</b>				<b>\$4,932,189</b>				<b>\$4,932,189</b>		<b>\$333,979</b>

## DT B8 Ostler Park Barrier/Trail Lift Ph 2

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1								
Total Centreline Length	l.m.	1								
Average Site Width	l.m.	1								
		NOTE: insert quantities								
Removals	sq.m.	2400	50	\$119,040			100%	\$119,040	0	\$0
Pit Run Granular Fill	cu.m.	1680	162	\$271,488			100%	\$271,488	0	\$0
Revetment New - Small	l.m.	240	3,140	\$753,504			100%	\$753,504	3	\$22,605
Primary Paved Trail (4m asphalt)	l.m.	240	466	\$111,744			100%	\$111,744	5	\$5,587
Manicured Grass / Tree Landscape	sq.m.	1440	51	\$73,820			100%	\$73,820	5	\$3,691
Bench, Table or Bike Rack on concrete pad	each	5	4,054	\$20,272			100%	\$20,272	5	\$1,014
<b>Subtotals for Project</b>				<b>\$1,349,868</b>				<b>\$1,349,868</b>		<b>\$32,897</b>

## DT B9 BC Ferries Barrier/Trail Lift Ph 2

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1425								
Total Centreline Length	l.m.									
Average Site Width	l.m.									
		NOTE: insert quantities								
Removals	sq.m.	1425	50	\$70,680			100%	\$70,680	0	\$0
Pit Run Granular Fill	cu.m.	715	162	\$115,544			100%	\$115,544	0	\$0
Retaining Wall Allowance	l.m.	190	3,920	\$744,800			100%	\$744,800	4	\$29,792
Primary Paved Trail (4m asphalt)	l.m.	190	466	\$88,464			100%	\$88,464	5	\$4,423
Manicured Shrub /Tree Landscape	sq.m.	665	92	\$61,074			100%	\$61,074	5	\$3,054
Fence with Concrete Mow Strip	l.m.	190	226	\$42,864			100%	\$42,864	5	\$2,143
Bench, Table or Bike Rack on concrete pad	each	2	4,054	\$8,109			100%	\$8,109	5	\$405
<b>Subtotals for Project</b>				<b>\$1,131,534</b>				<b>\$1,131,534</b>		<b>\$39,818</b>



## DT B11 Barrier/Trail at Hwy 19A Ph 2

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	2175								
Total Centreline Length	l.m.	290								
Average Site Width	l.m.	7.5								
		NOTE: insert quantities								
Removals	sq.m.	2175	50	\$107,880			100%	\$107,880	0	\$0
Pit Run Granular Fill	cu.m.	1740	162	\$281,184			100%	\$281,184	0	\$0
Revetment Repair / Improve	l.m.	290	2,042	\$592,296			100%	\$592,296	2	\$11,846
Retaining Wall Allowance	l.m.	290	3,920	\$1,136,800			100%	\$1,136,800	4	\$45,472
Manicured Shrub /Tree Landscape	sq.m.	1015	92	\$93,218			100%	\$93,218	5	\$4,661
Boardwalk / Pedestrian Bridge (3m wide with metal handrail)	l.m.	290	9,523	\$2,761,728			100%	\$2,761,728	5	\$138,086
Retaining Wall Allowance	l.m.	290	3,920	\$1,136,800			100%	\$1,136,800	4	\$45,472
Bench, Table or Bike Rack on concrete pad	each	4	4,054	\$16,218			100%	\$16,218	5	\$811
<b>Subtotals for Project</b>				<b>\$6,126,123</b>				<b>\$6,126,123</b>		<b>\$246,348</b>

## DT B12 Barrier/Trail at City Waterfront Property Ph 2

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1200								
Total Centreline Length	l.m.	160								
Average Site Width	l.m.	7.5								
		NOTE: insert quantities								
Removals	sq.m.	1200	50	\$59,520			100%	\$59,520	0	\$0
Pit Run Granular Fill	cu.m.	960	162	\$155,136			100%	\$155,136	0	\$0
Revetment New - Small	l.m.	160	3,140	\$502,336			100%	\$502,336	3	\$15,070
Retaining Wall Allowance	l.m.	160	3,920	\$627,200			100%	\$627,200	4	\$25,088
Boardwalk / Pedestrian Bridge (3m wide with metal handrail)	l.m.	160	9,523	\$1,523,712			100%	\$1,523,712	5	\$76,186
Retaining Wall Allowance	l.m.	160	3,920	\$627,200			100%	\$627,200	4	\$25,088
Bench, Table or Bike Rack on concrete pad	each	4	4,054	\$16,218			100%	\$16,218	5	\$811
<b>Subtotals for Project</b>				<b>\$3,511,322</b>				<b>\$3,511,322</b>		<b>\$142,243</b>

## DT C1a Offshore Breakwater Extension BC Ferries

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate). This cost estimate is for the construction of the breakwater and does not account for additional infrastructure or utilities costs that may arise.

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1								
Total Centreline Length	I.m.	1								
Average Site Width	I.m.	1								
		NOTE: insert quantities								
Breakwater Extension Allowance	I.m.	100	43,369	\$4,336,920			100%	\$4,336,920	1	\$43,369
<b>Subtotals for Project</b>				<b>\$4,336,920</b>				<b>\$4,336,920</b>		<b>\$43,369</b>

### DT C1b Offshore Breakwater Extension Small Craft Harbour

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1								
Total Centreline Length	l.m.	1								
Average Site Width	l.m.	1								
		NOTE: insert quantities								
Breakwater Extension Allowance	l.m.	100	43,369	\$4,336,920			100%	\$4,336,920	1	\$43,369
<b>Subtotals for Project</b>				<b>\$4,336,920</b>				<b>\$4,336,920</b>		<b>\$43,369</b>

## DT C2 Ostler Park Barrier/Trail Ph 1

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1								
Total Centreline Length	l.m.	1								
Average Site Width	l.m.	1								
		NOTE: insert quantities								
Removals	sq.m.	2400	50	\$119,040			100%	\$119,040	0	\$0
Pit Run Granular Fill	cu.m.	2592	162	\$418,867			100%	\$418,867	0	\$0
Revetment Repair / Improve	l.m.	240	2,042	\$490,176			100%	\$490,176	2	\$9,804
Revetment New - Small	l.m.	240	3,140	\$753,504			100%	\$753,504	3	\$22,605
Primary Paved Trail (4m asphalt)	l.m.	240	466	\$111,744			100%	\$111,744	5	\$5,587
Manicured Grass / Tree Landscape	sq.m.	1440	51	\$73,820			100%	\$73,820	5	\$3,691
Bench, Table or Bike Rack on concrete pad	each	5	4,054	\$20,272			100%	\$20,272	5	\$1,014
<b>Subtotals for Project</b>				<b>\$1,987,423</b>				<b>\$1,987,423</b>		<b>\$42,700</b>

### DT C3 Hwy 19A & DT Lift if 100m Breakwater

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	18960								
Total Centreline Length	l.m.	790								
Average Site Width	l.m.	24								
		NOTE: insert quantities								
Removals	sq.m.	18960	50	\$940,416			100%	\$940,416	0	\$0
Pit Run Granular Fill	cu.m.	9480	162	\$1,531,968			100%	\$1,531,968	0	\$0
Street Paving w/ Curbs, Lights, Sidewalks 20 m ROW (warrants City Rev)	l.m.	790	7,022	\$5,547,696			100%	\$5,547,696	4	\$221,908
<b>Subtotals for Project</b>				<b>\$8,020,080</b>				<b>\$8,020,080</b>		<b>\$221,908</b>

NOTE: Assumes surface replace Hwy 19A but other streets only fill allowance and assumed remainder is funded due to street refresh

## DT C4 BC Ferries Barrier/Trail If 100 m Breakwater

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1425								
Total Centreline Length	l.m.	190								
Average Site Width	l.m.	7.5								
		NOTE: insert quantities								
Removals	sq.m.	1425	50	\$70,680			100%	\$70,680	0	\$0
Pit Run Granular Fill	cu.m.	1285	162	\$207,656			100%	\$207,656	0	\$0
Retaining Wall Allowance	l.m.	190	3,920	\$744,800			100%	\$744,800	4	\$29,792
Primary Paved Trail (4m asphalt)	l.m.	190	466	\$88,464			100%	\$88,464	5	\$4,423
Manicured Shrub /Tree Landscape	sq.m.	665	92	\$61,074			100%	\$61,074	5	\$3,054
Fence with Concrete Mow Strip	l.m.	190	226	\$42,864			100%	\$42,864	5	\$2,143
Bench, Table or Bike Rack on concrete pad	each	2	4,054	\$8,109			100%	\$8,109	5	\$405
<b>Subtotals for Project</b>				<b>\$1,223,646</b>				<b>\$1,223,646</b>		<b>\$39,818</b>

### DT C5 BC Ferries Temporary Barrier If 100 m Breakwater

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.									
Total Centreline Length	l.m.									
Average Site Width	l.m.									
		NOTE: insert quantities								
Removals	sq.m.	600	50	\$29,760			100%	\$29,760	0	\$0
Pit Run Granular Fill	cu.m.	480	162	\$77,568			100%	\$77,568	0	\$0
Temporary Flood Barrier Allowance	l.m.	60	2,280	\$136,800			100%	\$136,800	5	\$6,840
Parking Area (asphalt with curbs & lighting)	stall	20	4,554	\$91,080			100%	\$91,080	4	\$3,643
<b>Subtotals for Project</b>				<b>\$335,208</b>				<b>\$335,208</b>		<b>\$10,483</b>

### DT C6 Barrier/Trail at Hwy 19A If 100 m Breakwater

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	2175								
Total Centreline Length	l.m.	290								
Average Site Width	l.m.	7.5								
		NOTE: insert quantities								
Removals	sq.m.	2175	50	\$107,880			100%	\$107,880	0	\$0
Pit Run Granular Fill	cu.m.	2537	162	\$409,979			100%	\$409,979	0	\$0
Revetment Repair / Improve	l.m.	290	2,042	\$592,296			100%	\$592,296	2	\$11,846
Revetment New - Small	l.m.	290	3,140	\$910,484			100%	\$910,484	3	\$27,315
Retaining Wall Allowance	l.m.	290	3,920	\$1,136,800			100%	\$1,136,800	4	\$45,472
Primary Paved Trail (4m asphalt)	l.m.	290	466	\$135,024			100%	\$135,024	5	\$6,751
Manicured Shrub /Tree Landscape	sq.m.	1015	92	\$93,218			100%	\$93,218	5	\$4,661
Bench, Table or Bike Rack on concrete pad	each	4	4,054	\$16,218			100%	\$16,218	5	\$811
<b>Subtotals for Project</b>				<b>\$3,401,898</b>				<b>\$3,401,898</b>		<b>\$96,855</b>



## DT C7b Pump Station Ostler Park

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1								
Total Centreline Length	l.m.	1								
Average Site Width	l.m.	1								
		NOTE: insert quantities								
Removals	sq.m.	1000	50	\$49,600			100%	\$49,600	0	\$0
Pump Station Downtown	per	1	4,480,000	\$4,480,000			100%	\$4,480,000	7	\$313,600
Primary Paved Trail (4m asphalt)	l.m.	50	466	\$23,280			100%	\$23,280	5	\$1,164
Secondary Paved Trail (2m asphalt)	l.m.	50	262	\$13,080			100%	\$13,080	5	\$654
Infiltration Swale (Bioswale)	l.m.	50	250	\$12,498			100%	\$12,498	7	\$875
Manicured Grass / Tree Landscape	sq.m.	500	51	\$25,632			100%	\$25,632	5	\$1,282
Manicured Shrub /Tree Landscape	sq.m.	500	92	\$45,920			100%	\$45,920	5	\$2,296
Bench, Table or Bike Rack on concrete pad	each	4	4,054	\$16,218			100%	\$16,218	5	\$811
Litter Receptacle on Concrete Pad	each	2	2,136	\$4,272			100%	\$4,272	5	\$214
Urban Plaza (hard landscape area)	sq.m.	200	374	\$74,800			100%	\$74,800	5	\$3,740
Washroom Building - full services 30 sq.m.	each	1	154,960	\$154,960			100%	\$154,960	5	\$7,748
Park Interpretive Signs & Shelter	each	1	27,309	\$27,309			100%	\$27,309	5	\$1,365
<b>Subtotals for Project</b>				<b>\$4,927,568</b>				<b>\$4,927,568</b>		<b>\$333,748</b>



## DT C7d Pump Station Nunns Creek

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1								
Total Centreline Length	l.m.	1								
Average Site Width	l.m.	1								
		NOTE: insert quantities								
Removals	sq.m.	1000	50	\$49,600			100%	\$49,600	0	\$0
Pump Station Downtown	per	1	4,480,000	\$4,480,000			100%	\$4,480,000	7	\$313,600
Primary Paved Trail (4m asphalt)	l.m.	50	466	\$23,280			100%	\$23,280	5	\$1,164
Infiltration Swale (Bioswale)	l.m.	50	250	\$12,498			100%	\$12,498	7	\$875
Manicured Grass / Tree Landscape	sq.m.	500	51	\$25,632			100%	\$25,632	5	\$1,282
Manicured Shrub /Tree Landscape	sq.m.	500	92	\$45,920			100%	\$45,920	5	\$2,296
Fence with Concrete Mow Strip	l.m.	200	226	\$45,120			100%	\$45,120	5	\$2,256
Bench, Table or Bike Rack on concrete pad	each	2	4,054	\$8,109			100%	\$8,109	5	\$405
Litter Receptacle on Concrete Pad	each	100	2,136	\$213,600			100%	\$213,600	5	\$10,680
Urban Plaza (hard landscape area)	sq.m.	3	374	\$1,122			100%	\$1,122	5	\$56
Park Interpretive Signs & Shelter	each	1	27,309	\$27,309			100%	\$27,309	5	\$1,365
<b>Subtotals for Project</b>				<b>\$4,932,189</b>				<b>\$4,932,189</b>		<b>\$333,979</b>

## DT C8 Barrier/Trail at City Waterfront Prop if 100 m BW

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1200								
Total Centreline Length	l.m.	160								
Average Site Width	l.m.	7.5								
		NOTE: insert quantities								
Removals	sq.m.	1200	50	\$59,520			100%	\$59,520	0	\$0
Pit Run Granular Fill	cu.m.	720	162	\$116,352			100%	\$116,352	0	\$0
Revetment Repair / Improve	l.m.	160	2,042	\$326,784			100%	\$326,784	2	\$6,536
Revetment New - Small	l.m.	160	3,140	\$502,336			100%	\$502,336	3	\$15,070
Retaining Wall Allowance	l.m.	160	3,920	\$627,200			100%	\$627,200	4	\$25,088
Primary Paved Trail (4m asphalt)	l.m.	160	466	\$74,496			100%	\$74,496	5	\$3,725
Manicured Shrub /Tree Landscape	sq.m.	560	92	\$51,430			100%	\$51,430	5	\$2,572
Bench, Table or Bike Rack on concrete pad	each	4	4,054	\$16,218			100%	\$16,218	5	\$811
<b>Subtotals for Project</b>				<b>\$1,774,336</b>				<b>\$1,774,336</b>		<b>\$53,801</b>

### DT C9 Ostler Park Barrier/Trail if 100 m BW

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1								
Total Centreline Length	l.m.	1								
Average Site Width	l.m.	1								
		NOTE: insert quantities								
Removals	sq.m.	2400	50	\$119,040			100%	\$119,040	0	\$0
Pit Run Granular Fill	cu.m.	1200	162	\$193,920			100%	\$193,920	0	\$0
Revetment New - Small	l.m.	240	3,140	\$753,504			100%	\$753,504	3	\$22,605
Primary Paved Trail (4m asphalt)	l.m.	240	466	\$111,744			100%	\$111,744	5	\$5,587
Manicured Grass / Tree Landscape	sq.m.	1440	51	\$73,820			100%	\$73,820	5	\$3,691
Bench, Table or Bike Rack on concrete pad	each	5	4,054	\$20,272			100%	\$20,272	5	\$1,014
<b>Subtotals for Project</b>				<b>\$1,272,300</b>				<b>\$1,272,300</b>		<b>\$32,897</b>

### DT C10 Major Streets Raised with 'Refresh'

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	32240								
Total Centreline Length	l.m.	1430								
Average Site Width	l.m.	23								
		NOTE: insert quantities								
Pit Run Granular Fill	cu.m.	22568	162	\$3,646,989			100%	\$3,646,989	0	\$0
Downtown Inland Streets Raising Concurrent with 'Refresh'	l.m.	1430	1,040	\$1,487,200			100%	\$1,487,200	0	\$0
<b>Subtotals for Project</b>				<b>\$5,134,189</b>				<b>\$5,134,189</b>		<b>\$0</b>

## DT C11 Minor Streets Raised with Refresh

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	68020								
Total Centreline Length	l.m.	3289								
Average Site Width	l.m.	21								
		NOTE: insert quantities								
Pit Run Granular Fill	cu.m.	34010	162	\$5,496,016			100%	\$5,496,016	0	\$0
Downtown Inland Streets Raising Concurrent with 'Refresh'	l.m.	3289	1,040	\$3,420,560			100%	\$3,420,560	0	\$0
<b>Subtotals for Project</b>				<b>\$8,916,576</b>				<b>\$8,916,576</b>		<b>\$0</b>

## SP A1 Raise Revetments on City Lands

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	1175								
Total Centreline Length	l.m.	235								
Average Site Width	l.m.	5								
		NOTE: insert quantities								
Revetment Repair / Improve	l.m.	235	2,042	\$479,964			100%	\$479,964	2	\$9,599
Revetment New - Small	l.m.	235	3,140	\$737,806			100%	\$737,806	3	\$22,134
<b>Subtotals for Project</b>				<b>\$1,217,770</b>				<b>\$1,217,770</b>		<b>\$31,733</b>

## SP B1 City Frontage Headland/Beach

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	235								
Average Site Width	l.m.	0								
		NOTE: insert quantities								
Rock Headland Allowance (typ headland intertidal)	l.m.	118	4,026	\$475,021			100%	\$475,021	2	\$9,500
Beach Nourishment Allowance	l.m.	235	6,808	\$1,599,880			100%	\$1,599,880	5	\$79,994
Upper Beach Access Surfacing Allowance	sq.m.	2350	57	\$132,853			100%	\$132,853	8	\$10,628
Naturalized Shrub / Tree Landscape	sq.m.	1410	51	\$72,305			100%	\$72,305	3	\$2,169
<b>Subtotals for Project</b>				<b>\$2,280,059</b>				<b>\$2,280,059</b>		<b>\$102,292</b>

## SP B2 Private Frontage Headland/Beach

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	860								
Average Site Width	l.m.	0								
		NOTE: insert quantities								
Rock Headland Allowance (typ headland intertidal)	l.m.	430	4,026	\$1,731,008			100%	\$1,731,008	2	\$34,620
Beach Nourishment Allowance	l.m.	860	6,808	\$5,854,880			100%	\$5,854,880	5	\$292,744
Upper Beach Access Surfacing Allowance	sq.m.	8600	57	\$486,187			100%	\$486,187	8	\$38,895
Naturalized Shrub / Tree Landscape	sq.m.	5160	51	\$264,605			100%	\$264,605	3	\$7,938
<b>Subtotals for Project</b>				<b>\$8,336,679</b>				<b>\$8,336,679</b>		<b>\$374,197</b>

## SP C1 City Frontage Headland/Beach

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	235								
Average Site Width	l.m.	0								
		NOTE: insert quantities								
Rock Headland Allowance (typ headland intertidal)	l.m.	118	4,026	\$475,021			100%	\$475,021	2	\$9,500
Beach Nourishment Allowance	l.m.	235	6,808	\$1,599,880			100%	\$1,599,880	5	\$79,994
Upper Beach Access Surfacing Allowance	sq.m.	2350	57	\$132,853			100%	\$132,853	8	\$10,628
Naturalized Shrub / Tree Landscape	sq.m.	1410	51	\$72,305			100%	\$72,305	3	\$2,169
<b>Subtotals for Project</b>								<b>\$2,280,059</b>		<b>\$102,292</b>

## SP C2 Private Frontage Headland/Beach

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	860								
Average Site Width	l.m.	0								
		NOTE: insert quantities								
Rock Headland Allowance (typ headland intertidal)	l.m.	430	4,026	\$1,731,008			100%	\$1,731,008	2	\$34,620
Beach Nourishment Allowance	l.m.	860	6,808	\$5,854,880			100%	\$5,854,880	5	\$292,744
Upper Beach Access Surfacing Allowance	sq.m.	8600	57	\$486,187			100%	\$486,187	8	\$38,895
Naturalized Shrub / Tree Landscape	sq.m.	5160	51	\$264,605			100%	\$264,605	3	\$7,938
<b>Subtotals for Project</b>				<b>\$8,336,679</b>				<b>\$8,336,679</b>		<b>\$374,197</b>

## WP A1 Raise Revetments on City Lands

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	720								
Average Site Width	l.m.	0								
		NOTE: insert quantities								
Revetment Repair / Improve	l.m.	360	2,042	\$735,264			100%	\$735,264	2	\$14,705
Revetment New - Small	l.m.	720	3,140	\$2,260,512			100%	\$2,260,512	3	\$67,815
<b>Subtotals for Project</b>				<b>\$2,995,776</b>				<b>\$2,995,776</b>		<b>\$82,521</b>

## WP B1 Pocket Beach / Nature Shore Demo

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	75								
Average Site Width	l.m.	0								
		NOTE: insert quantities								
Rock Headland Allowance (typ headland intertidal)	l.m.	40	4,026	\$161,024			100%	\$161,024	2	\$3,220
Beach Nourishment Allowance	l.m.	75	6,808	\$510,600			100%	\$510,600	5	\$25,530
<b>Subtotals for Project</b>				<b>\$671,624</b>				<b>\$671,624</b>		<b>\$28,750</b>

## WP B2 Revetment Window/Inland Beach Environment

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	645								
Average Site Width	l.m.	0								
		NOTE: insert quantities								
Revetment Repair / Improve	l.m.	235	2,042	\$479,964			100%	\$479,964	2	\$9,599
Revetment New - Small	l.m.	595	3,140	\$1,868,062			100%	\$1,868,062	3	\$56,042
Beach Nourishment Allowance	l.m.	50	6,808	\$340,400			100%	\$340,400	5	\$17,020
<b>Subtotals for Project</b>				<b>\$2,688,426</b>				<b>\$2,688,426</b>		<b>\$82,661</b>

## WP C1 Extended Pocket Beach/Nature Shore

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	320								
Average Site Width	l.m.	0								
		NOTE: insert quantities								
Rock Headland Allowance (typ headland intertidal)	l.m.	160	4,026	\$644,096			100%	\$644,096	2	\$12,882
Beach Nourishment Allowance	l.m.	320	6,808	\$2,178,560			100%	\$2,178,560	5	\$108,928
<b>Subtotals for Project</b>				<b>\$2,822,656</b>				<b>\$2,822,656</b>		<b>\$121,810</b>

## WP C2 Extended Revetment Window/Inland Beach

General Note: Unit Costs indicated are suitable for general budgeting only, and are accurate only to +/- 30% (Class D estimate)

Cost Estimate	Unit	Quantity	Budget / Unit	Calculated Budget	% Labour By Own Forces (max 60%)	% Donated Labour / Materials (max 100%)	Net % Municipal Capital Budget	\$\$ Municipal Capital Budget	Added O&M (% of Calculated Budget)	\$\$ Annual Additional O&M Budget
Total Site Area	sq.m.	0								
Total Centreline Length	l.m.	260								
Average Site Width	l.m.	0								
		NOTE: insert quantities								
Revetment Repair / Improve	l.m.	130	2,042	\$265,512			100%	\$265,512	2	\$5,310
Revetment New - Small	l.m.	360	3,140	\$1,130,256			100%	\$1,130,256	3	\$33,908
Beach Nourishment Allowance	l.m.	130	6,808	\$885,040			100%	\$885,040	5	\$44,252
Primary Paved Trail (4m asphalt)	l.m.	260	466	\$121,056			100%	\$121,056	5	\$6,053
Secondary Paved Trail (2m asphalt)	l.m.	140	262	\$36,624			100%	\$36,624	5	\$1,831
Infiltration Swale (Bioswale)	l.m.	130	250	\$32,494			100%	\$32,494	7	\$2,275
Manicured Grass / Tree Landscape	sq.m.	4500	51	\$230,688			100%	\$230,688	5	\$11,534
Concrete Stair (2m wide with metal handrail)	l.m.	20	2,212	\$44,248			100%	\$44,248	4	\$1,770
Bench, Table or Bike Rack on concrete pad	each	10	4,054	\$40,544			100%	\$40,544	5	\$2,027
Litter Receptacle on Concrete Pad	each	4	2,136	\$8,544			100%	\$8,544	5	\$427
Urban Plaza (hard landscape area)	sq.m.	200	374	\$74,800			100%	\$74,800	5	\$3,740
Parking Area (asphalt with curbs & lighting)	stall	10	4,554	\$45,540			100%	\$45,540	4	\$1,822
Park Entrance Sign	each	2	9,069	\$18,138			100%	\$18,138	5	\$907
Park Interpretive Signs & Shelter	each	1	27,309	\$27,309			100%	\$27,309	5	\$1,365
<b>Subtotals for Project</b>				<b>\$2,960,792</b>				<b>\$2,960,792</b>		<b>\$117,221</b>

NOTE: LAND ACQUISITION IS NOT INCLUDED

**APPENDIX F:**  
COMMUNITY ENGAGEMENT PLAN AND RESULTS



# PUBLIC ENGAGEMENT SUMMARY

CAMPBELL RIVER  
RISING SEAS

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# 1.0 INTRODUCTION

## PROJECT OVERVIEW

The urbanized coast of Campbell River Stretches along the Strait of Georgia for over 15 Kilometres, providing sublime ocean views and abundant recreation opportunities. However, this area is also exposed to damaging waves during intense storms, which can threaten coastal land and infrastructure (Figure 1). Climate change is causing global sea level to rise, at an accelerating pace, increasing the risks already faced by coastal communities.



Figure 1. Damage to Ostler Park in Campbell River following violent storm in March 2012

*Campbell River Rising Seas* is a multi-year planning project to understand and prepare for the risks to our community from sea level rise. We want to create a resilient Campbell River in the face of climate change.

Main objectives of *Campbell River Rising Seas*:

- ▶ Technical Assessment - Conduct a series of studies to assess the risks to the built, natural and social environment due to 0.5m and 1m of sea level rise, identify feasible options to address these risks.
- ▶ Public Awareness and Education - Through community engagement increase awareness and understanding about sea level rise, identify community values and priorities, and gather feedback about sea level rise planning and adaptation

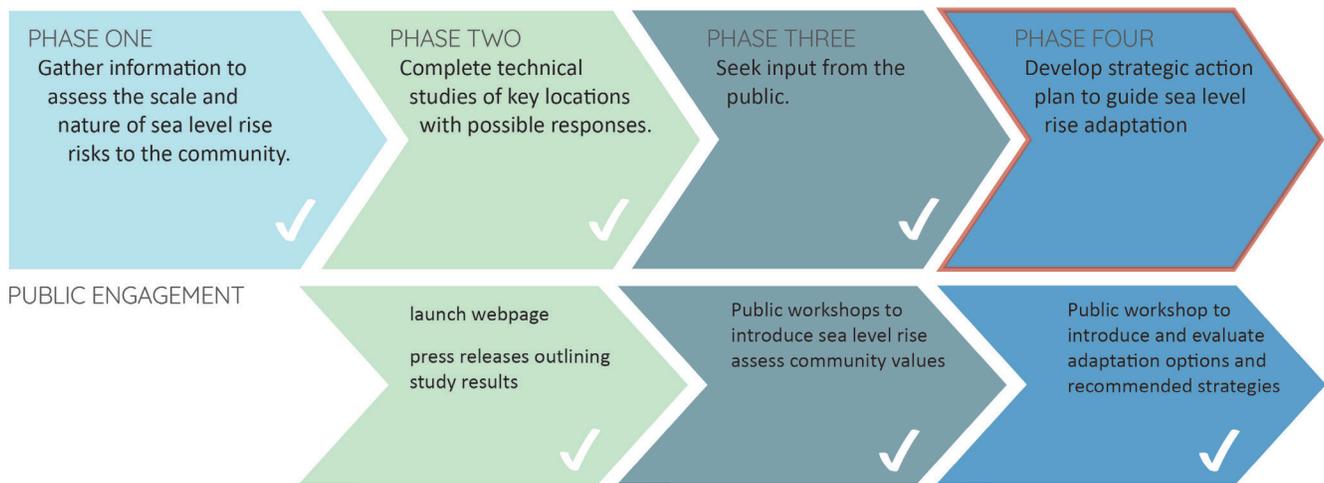


Figure 2. General framework for Campbell River Rising Seas to aimed at achieving project objectives

## PUBLIC ENGAGEMENT OVERVIEW

There are many options available to coastal communities for mitigating risks associated with sea level rise, and no one solution will be right for the entire city. Technical studies can identify these risks and the range of feasible options, but deciding what’s best for Campbell River requires understanding community values and priorities.

The *Rising Seas* Public Engagement Plan establishes four goals for public engagement:

1. Educate the community by providing timely, accurate information and up-to-date science;
2. Present the results of technical studies and the potential options available to address them;
3. Seek public input and opinion on preferred options and community priorities; and
4. Promote a transparent, democratic plan-making process.

Table 1. Tools used to achieve the *Rising Seas* public engagement goals.

Engagement Tool	Description	Public Engagement Goal(s) Addressed
Communication and Public Engagement Plans	1) Comprehensive Communications and Public Engagement Plan. 2) Specific engagement plan for public outreach	N/A
Project Website	Resources such as background information, upcoming workshop details, frequently asked questions, technical reports, public engagement materials, and project contacts were uploaded to the project website.	2, 4
Primers	A series of four locally branded primers to inform the public about sea level rise and its effects in Campbell River and keep the community up to date on the City’s sea level rise planning work.	1,2,4
Public Workshops	Three public workshops were held to: 1) introduce the topic of sea level rise in Campbell River 2) evaluate options for sea level rise adaptation, & 3) assess draft recommended strategies for addressing sea level rise.	1,2,3,4
Workbooks	Each workshop had an accompanying workbook where feedback was collected.	2,4
Multi-Media	Numerous animations, maps, 2D models, and videos were created by the City’s consultants to illustrate the effects of sea level rise, demonstrate possible adaptations, and outline the City Sea level rise planning project.	1,2
Social Media	Social media campaigns were used to promote the public workshops and online workbooks, as well as generate awareness about the project.	3,4
Traditional Media	Newspaper and radio advertisements were used to communicate upcoming workshops and sea level rise events to the community.	3,4
Project Email List	Email subscribers received updates about the project including information about upcoming workshops, surveys, workshop results, and website updates.	2,3,4
Youth Outreach	An interactive presentation was brought to multiple high school and elementary classrooms as well as the City’s Youth Action Committee.	1,2

## 2.0 METHODS

### COMMUNICATIONS AND PUBLIC ENGAGEMENT PLANS

#### Project Wide Plan

City staff prepared a preliminary communications and public engagement plan defining: goals of engagement, target audiences, partnership opportunities, tools for engagement, and draft time lines. The plan also introduced the mini-brand created for the project, named *Campbell River Rising Seas* (or *Rising Seas*), which defined the colors, fonts, and messaging that should be used for all promotional material related to the initiative. This plan guided the public engagement process throughout the *Rising Seas* initiative, helping to ensure ongoing, consistent communication and engagement. This brand can be maintained in future sea level rise planning updates.



Figure 2. Branding and design scheme for *Campbell River Rising Seas*

#### Detailed Engagement Plan

The City's consulting team developed a detailed plan specific to the project's public consultation. A three phase public engagement process was developed. Each phase had a specific focus and set of engagement components. Phase one focused on introducing the topic of sea level rise, phase two on evaluating potential adaptation options, and phase three on draft recommended strategies for sea level rise adaptation.

## WEBSITE

A sea level rise section was added to the City website, providing a public resource for information about the City's sea level rise planning. Content includes completed sea level rise studies, upcoming public engagement opportunities, answers to FAQ, and sea level rise primers. The website will continue to be updated with new information regarding sea level rise and related City planning.

## SEA LEVEL RISE PRIMERS

A series of four locally branded primers were created to educate and guide the community through the City's sea level rise planning process. Their content generally reflects the three phases defined in the sea level rise public engagement plan. The first two primers introduce the topic of sea level rise, the third presents feasible adaptation options for Campbell River, and the fourth outlines draft recommended strategies for Campbell River. The content of the primers formed the foundation of the public workshops and their release was coordinated with their respective workshops. In addition, the primers were a tool to convey the results of the technical sea level rise studies to the community in an understandable way and facilitate a transparent planning process.

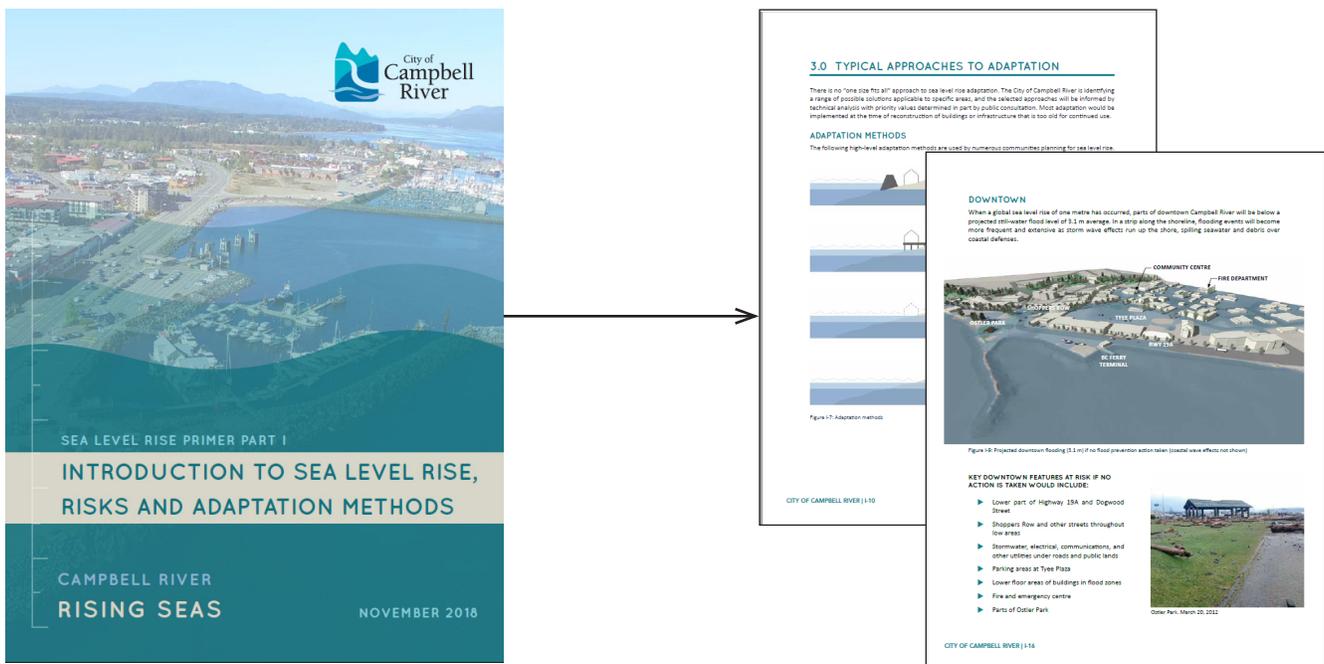


Figure 3. Primer one provided an introduction to sea level rise, including the risks to Campbell River if no action is taken.

## PUBLIC WORKSHOPS

Three public workshops were held over the course of seven months to increase community understanding about sea level rise, determine community values and priorities, and gather feedback about the City's sea level rise planning. The workshops were largely led by the City's consulting team, and consisted of a presentation, group discussion about sea level rise adaption, and general Q & A. At each workshop, participants were given a workbook with questions related to community values and sea level rise adaptation. Space was also provided for general feedback. An online version of the workbook was made available for community members who didn't finish their workbook at the event, or who could not attend the event. The full results of each workshop can be found on the City website at: <http://www.campbellriver.ca/planning-building-development/sea-level-rise/get-involved>



Figure 4. Community members at the third *Rising Seas* workshop on May 30, 2019, where over 40 people attended the

### **Workshop one**

The first workshop took place on two consecutive nights at the Anchor Inn and Willow Point Hall. Topics covered included an introduction to sea level rise, projected impacts in Campbell River, and the range of options available to coastal communities. Participants answered questions about sea level rise awareness/concern and valued waterfront features. In total, approximately 50 community members attended.

### **Workshop two**

The second workshop looked at specific adaptation options that could be implemented in Campbell River and determined criteria that could be used to evaluate these options based on community values and priorities. The event was held at the Maritime Heritage Center and was attended by approximately 22 community members.

### **Workshop three**

Following the second workshop, the draft adaptation options were refined to reflect the identified community values and priorities. The result was recommended strategies for addressing sea level rise in four key areas along the coast. These strategies were presented, discussed, and evaluated at the third workshop. The workshop was held at the Maritime Heritage Centre and was attended by over 40 community members (Figure 4).

## MULTI-MEDIA PRODUCTS

A variety of multi-media engagement tools were created to promote for the Rising Seas Initiative. They raised awareness about the project, promoted public workshops, and helped conveyed the results of technical studies.

### Planning for Climate Change Video

This brief informative video provides an introduction to sea level rise in Campbell River. It outlines some of the risks to the community, available adaptation options, pros and cons of different approaches and, at a high level, how the City is planning to adapt over the long term. The format allows the video to be shared across social media platforms such as, the City's Youtube channel, Facebook pages, and website, in order to reach a broad audience.



Figure 5. Still from the Campbell River Rising Seas Planning for Climate Change video.

### Sea Level Rise Adaptation Animations

The City's consulting team modeled parts of the Campbell River shoreline before and after sea level rise, under "business as usual" scenarios, and scenarios where adaptations were implemented. The results informed City staff and Council on the effectiveness of various adaptations and guided the development of the recommended strategies for addressing sea level rise. Several animations were created from this modeling to give the community a better idea of what some of the proposed adaptations look like, how they function, and what is at risk if no action is taken.

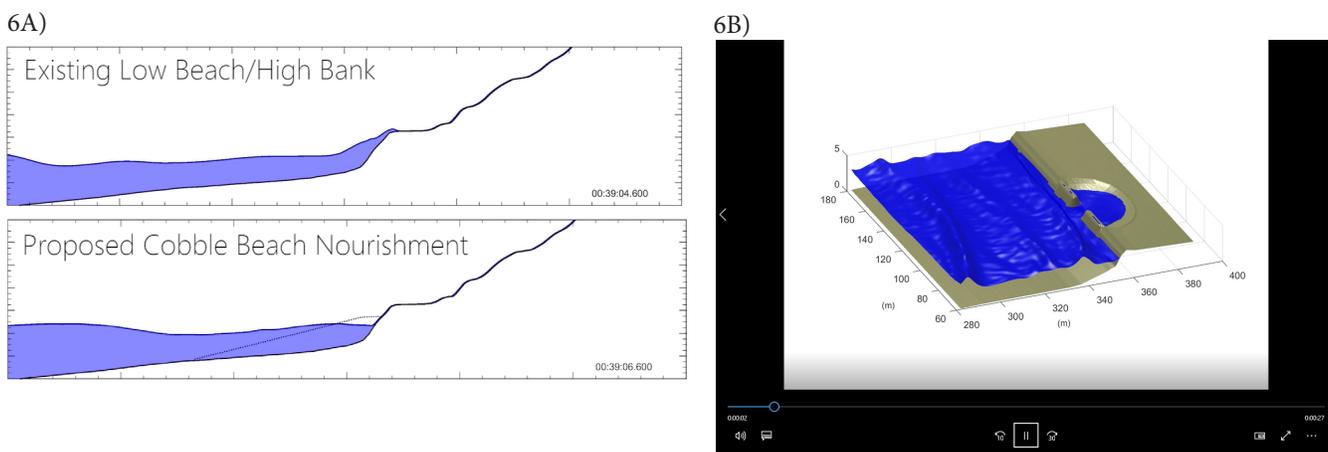


Figure 6. Stills from an animation of the Painter Barclay shoreline during a design storm after one metre of sea level rise (6A), without adaptation (Top) and with a cobble beach nourishment adaptation (Bottom). Still from an animation showing a pocket beach adaptation for the Willow Point area (6B).

## Maps

Maps are a powerful tool for conveying geographical information and are ideal for illustrating areas at risk from sea level rise. Throughout the Rising Seas Initiative, maps were used to show the projected flood risk along the Campbell River coast and the recommended flood construction levels after 0.5m and 1m of sea level rise. These maps provide a tool for current and prospective homeowners to plan for the future make informed decisions when buying or building in vulnerable areas.

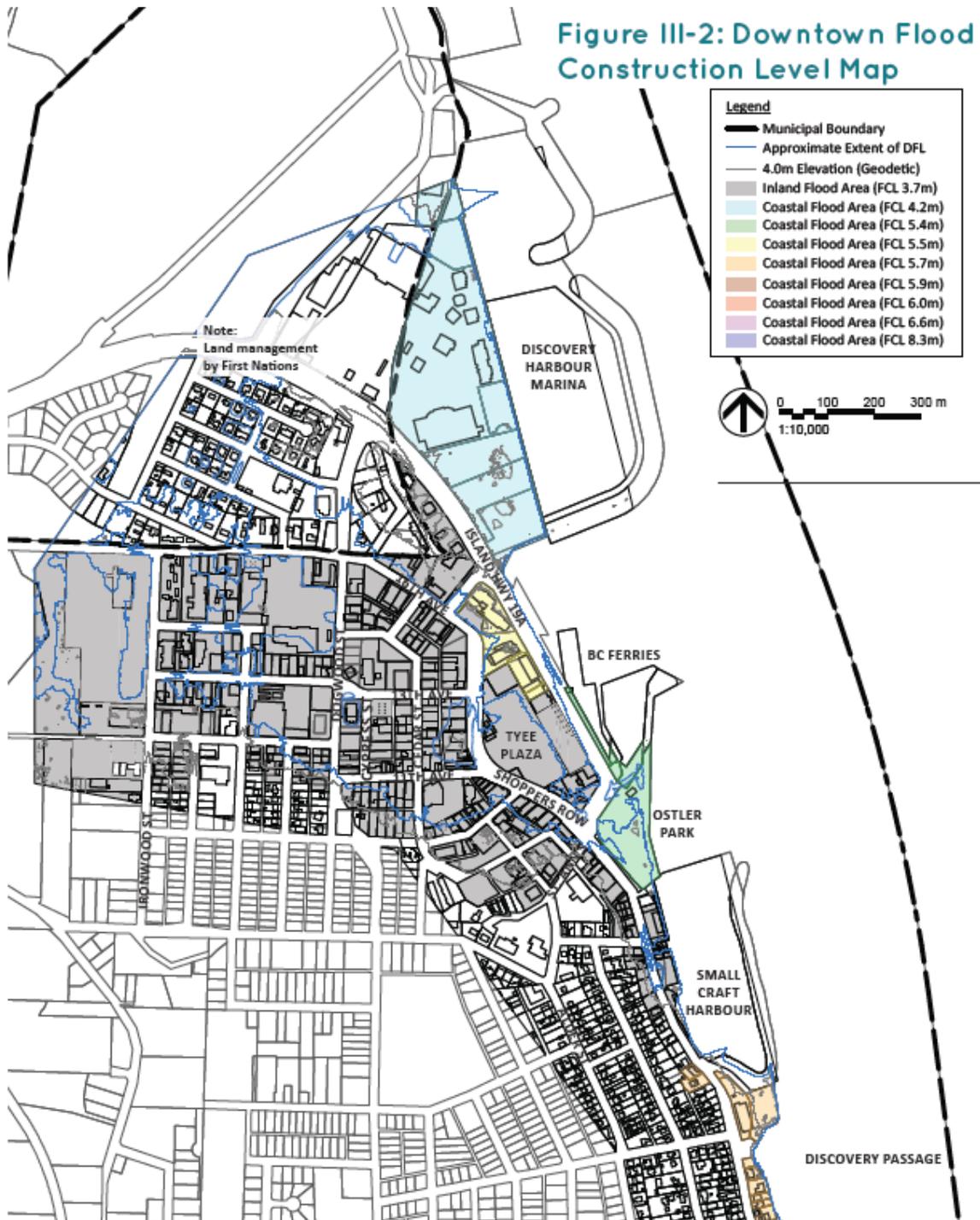
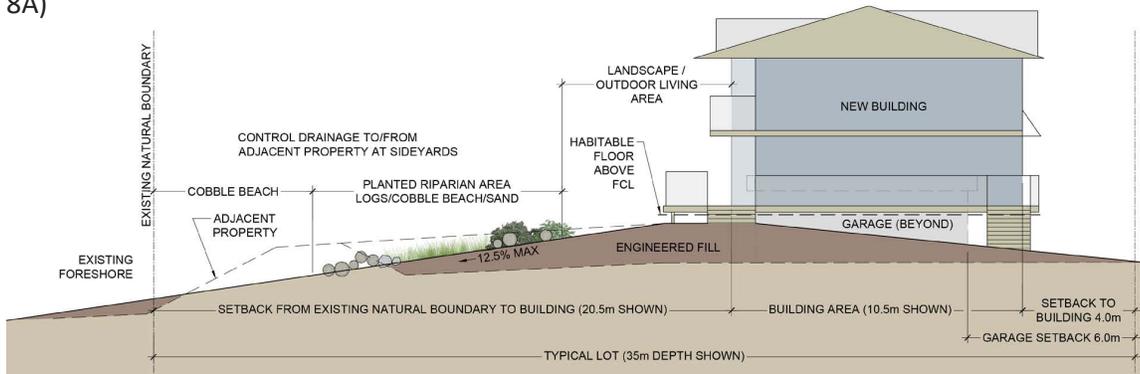


Figure 7. Projected flood construction levels for the Downtown area after one metre of sea level rise. Map from Primer III.

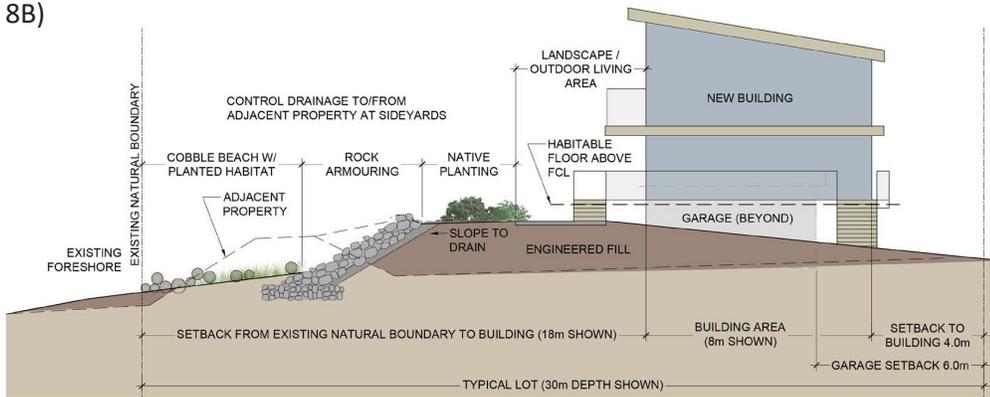
## Conceptual Development Permit Guideline Updates

Sea level rise adaptation will include regulatory updates such as changes to development permit guidelines. A series of conceptual designs were created to show what buildings might look like according to potential development permit guidelines that regulate building in areas vulnerable to sea level rise. They show how buildings may look on regular sized lots (Figure 8A), shallower lots (Figure 8B), and lots with existing stands of trees (Figure 8C). These also form the basis of a future amendment to the Official Community Plan<sup>1</sup>, to create a marine flooding development permit area.

8A)



8B)



8C)

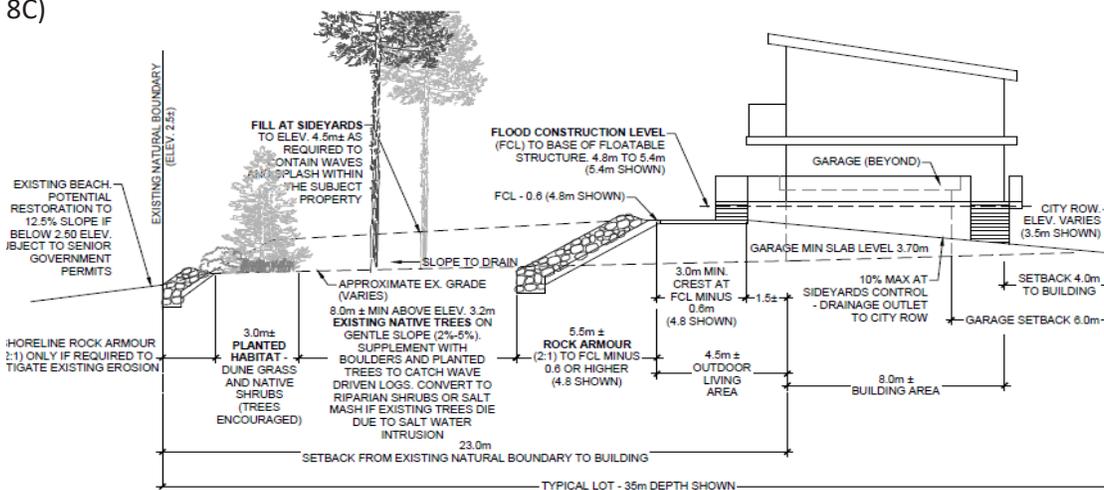


Figure 8. Waterfront development with conceptual development permit guidelines for a typical lot (8A), shallow lot (8B), and lot with native vegetation between the building and shoreline (8C).

1. City of Campbell River (2017). City of Campbell River Sustainable Official Community Plan, Schedule A. Updated 2017.

## Postcards

Custom postcards were created to promote the project and upcoming public workshops. The minimalist design and eye-catching colours are attractive and easy to read. They were distributed at City Hall as well as various City events, and posted on community information boards.

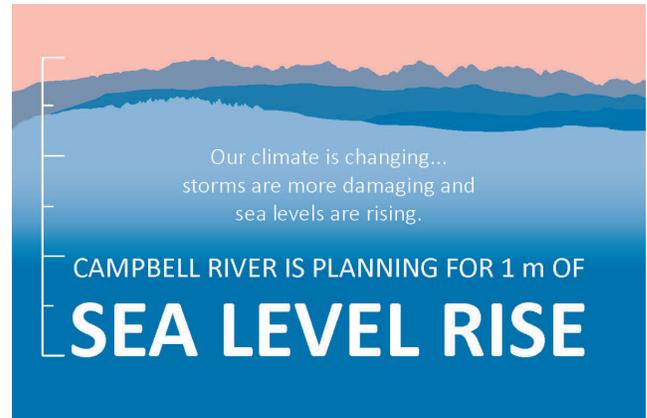
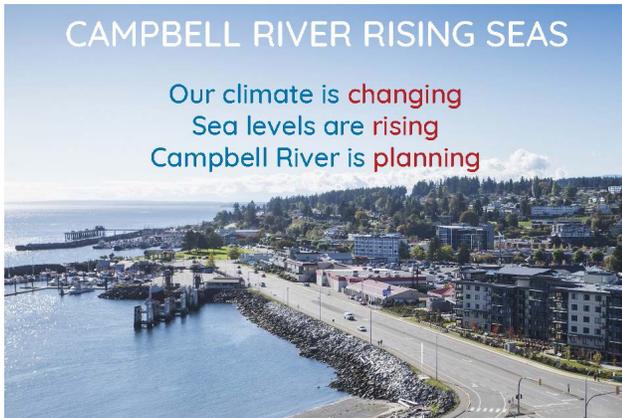


Figure 9. *Rising Seas* post cards.

## MEDIA

### Social Media Engagement

Various forms of social media were used to share information about the Rising Seas initiative and specifically speak to a younger demographic. Two of the City's Facebook pages, *Campbell River City Hall* and *Sustainable Campbell River*, were used to post information about upcoming workshops, opportunities to provide feedback, and new educational materials. Occasionally, paid Facebook advertisements were used to promote workshops, in order to reach an audience beyond those who follow City Facebook pages. Sea level rise videos were posted on the City's Youtube channel and cross-promoted through the City's Facebook pages and website.

### Traditional Media

Advertisements were created for the Rising Seas workshops and promoted in the city newspaper, the Campbell River Mirror. For one workshop, a radio ad was also created, which ran on a local radio station leading up to the workshop.

An advertisement for a workshop, framed with a dashed border. At the top left is the "City Currents" logo. At the top right is the "City of Campbell River" logo with contact information: "301 St. Ann's Road Campbell River, BC V9W 4C7 Telephone: 250-286-5700 info@campbellriver.ca www.campbellriver.ca". Below the logo is a black box with white text: "COMMUNITY UPDATE MARCH 13, 2019". The main content area has a background image of a pier over water. The text reads: "CAMPBELL RIVER RISING SEAS ADAPTATION OPTION EVALUATION WORKSHOP - March 19". Below this, it says: "Campbell River is planning now for one metre of sea level rise by 2100 and we need your help evaluating potential adaptation options." Then, "JOIN US" is followed by: "Where: Maritime Heritage Centre", "When: March 19", "Time: 6:30 - 9:00 pm", and "Cost: Free, light refreshments provided". At the bottom, it says: "Space is limited, to register contact chloe.swabey@campbellriver.ca or call 250-286-5796".

Figure 10. *Rising Seas* workshop ad in Campbell River Mirror.

## RISING SEAS EMAIL LIST

Throughout the initiative, a list of email subscribers was gathered, including stakeholders such as BC Ferries and VIHA. They received email updates about upcoming workshops, online feedback forms, the results of previous workshops, and new Rising Seas public engagement materials. Community members could sign up for the email list through the City's Rising Seas Webpage or at the workshops. After the third workshop, there were 96 email subscribers.

## YOUTH PRESENTATIONS

Sea level rise is a gradual process that will continue for centuries, effecting future generations. It is our responsibility to educate youth so that they are aware of the future risks and prepared for the challenge of climate change adaptation. A youth friendly interactive session about climate change and sea level rise was created and brought to multiple high school and elementary classes, as well as the City's Youth Action Committee. Sessions began with a presentation followed by a hands on activity that used hydrology models to demonstrate how climate change causes sea level rise, and finished with a group discussion on how the city could adapt to higher seas.



Figure 11. Co-op student Natasha Guillo leading an interactive presentation with the City's Youth Action Committee.

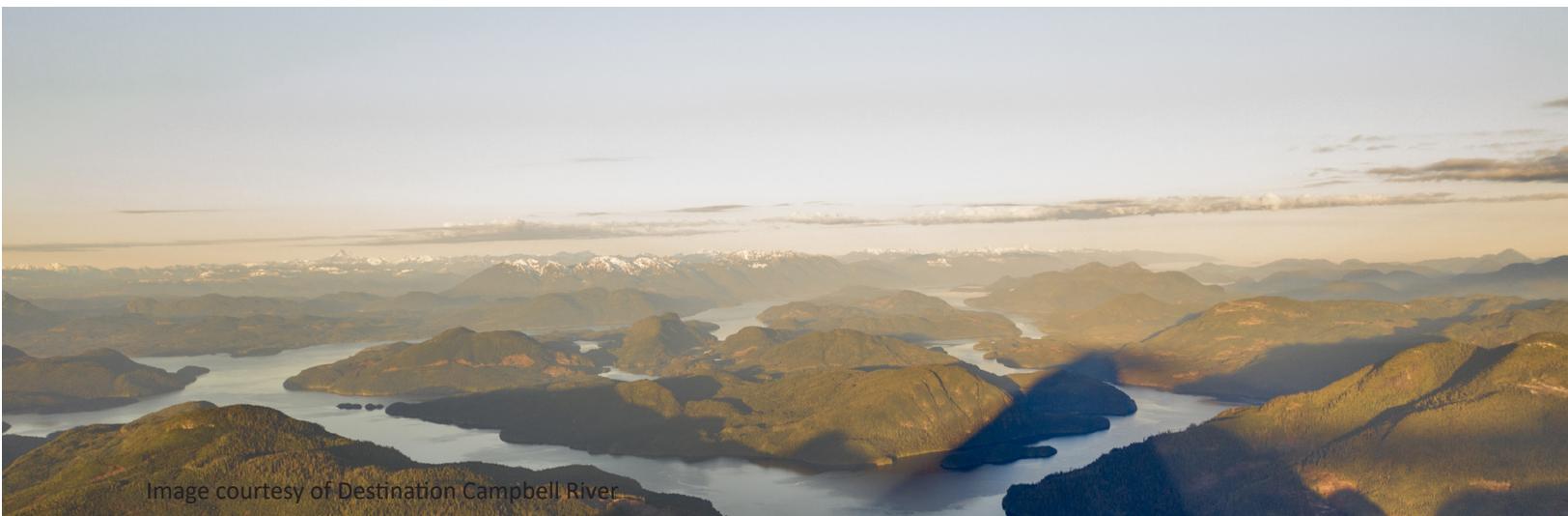
# 3.0 RESULTS

## REACH

Throughout the project community members were engaged, both directly, through public workshops, presentations, and surveys, and indirectly, using social and traditional media. Workshop participants attended 10 hours of instruction and 84 completed surveys were collected. A range of age groups were engaged, from children as young as 8 to people over 70.



Figure 12. Reach of *Rising Seas* public engagement program.



## CAPACITY BUILDING

According to Human Resources Development Canada<sup>1</sup>

“**Capacity is simply the ways and means needed to do what has to be done. It is much broader than simply skills, people and plans. It includes commitment, resources and all that is brought to bear on a process to make it successful.**”

In the context of sea level rise, capacity building involves improving community understanding. This was accomplished through the Rising Seas public workshops. The workshops educated community members about sea level rise, facilitated dialogue about sea level rise adaptation, and gathered feedback about adaptation in Campbell River.

To assess the effectiveness of workshops, surveys were conducted after both the second and third *Rising Seas* Workshops. Results from both indicate that the workshops successfully improved participant’s knowledge about sea level rise. Therefore, the workshops appear to have been a successful method for building community capacity around sea level rise.

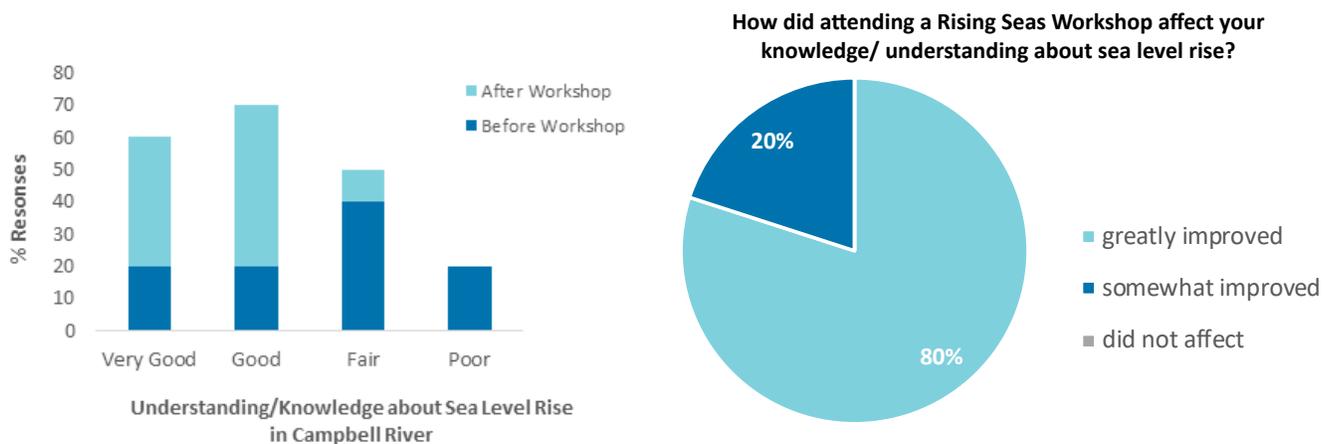


Figure 13. Results assessing the impact of the second workshop (left) and all workshops (right) on respondents understanding/ knowledge about sea level rise.

1. Frank, F., Smith, A., 1999. *The Community Development Handbook: A Tool to Build Community Capacity*. Human Resources and Development Canada. Ottawa - Ontario : Human Resources Development Canada.

## WORKSHOP RESULTS

In an uncertain future threatened by climate change, successful adaptation requires the participation of the community in order to ensure a plan is implemented that reflects the needs of the community as well as prudent planning. At each Rising Seas workshop participants were provided a workbook which included questions about sea level rise adaptation and community values, as well as space to provide general feedback. The results of each workbook informed the City's sea level rise planning and helped to refine the draft recommended strategies for sea level rise adaptation. The workbooks, in combination with post workshop surveys, were also used to improve the workshops, by assessing participant satisfaction with the content and overall setup of the workshops.

**100%** of survey respondents found the information they received at the workshops useful

Following the final workshop, the results from all three workbooks were combined and analyzed according to four categories:

- ▶ **Demographics;**
- ▶ **Awareness/concern about sea level rise;**
- ▶ **Community values and priorities; and**
- ▶ **Sea level rise adaptation.**

These results identify what community members value most about the foreshore and where their priorities lie in terms of sea level rise adaptation. They provide a framework for evaluating adaptations according to community values so that options can be compared on the basis of their social acceptability as well as other attributes.



Figure 14. Participants at the first *Rising Seas* workshops on Nov 28 and 29, 2018.

## Demographics

The majority of participants were over the age of 49, and over 90% were over the age of 29. The Central and Willow Point areas were the most highly represented, not surprising given their relative size, proportion of residential lots, and proximity to the ocean.

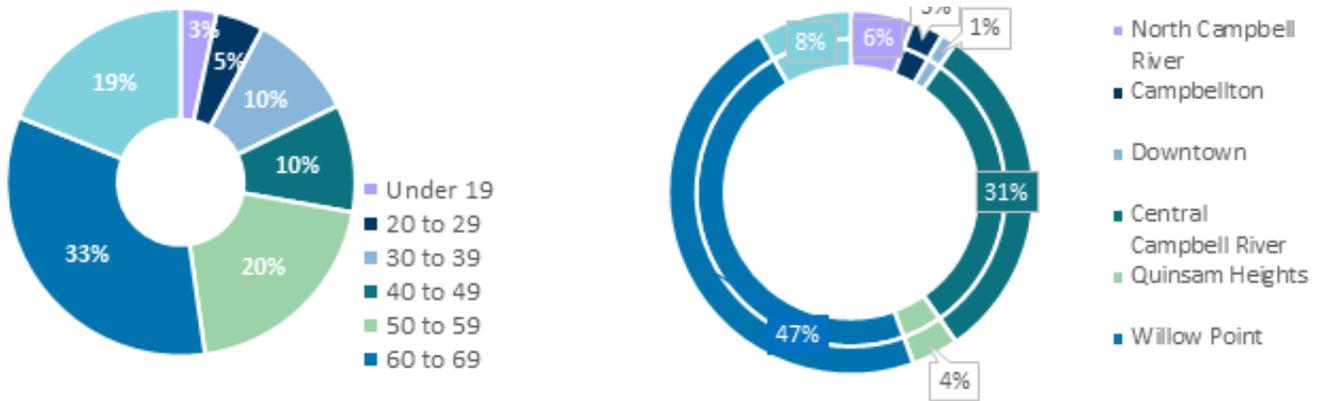


Figure 15. Demographic results of *Rising Seas* workshop attendance. The left graph shows the age distribution of workshop participants while the right graph shows their area of residence.

\*Central CR defined as between Downtown and Rockland Rd., Willow Point is defined as South of Rockland Rd. as per neighbourhood designations within the City's Official Community Plan (updated 2017).

## Awareness/Concern About Sea Level Rise

In general, the majority of workshop participants were at least somewhat concerned about sea level rise. Attending the workshops did not necessarily increase their concern about sea level rise and for some, concern was decreased after attending the workshops. This could be due to the results of the technical sea level rise studies indicating Campbell River is more resilient to sea level rise than flatter areas. The caveat to these findings is that the surveyed group was self selected. Community members who chose to attend the workshops may be more concerned about sea level rise than the average community member.

The overwhelming majority of participants felt parts of the Campbell River waterfront would need to be altered or improved to prepare for sea level rise impacts associated with storm waves.

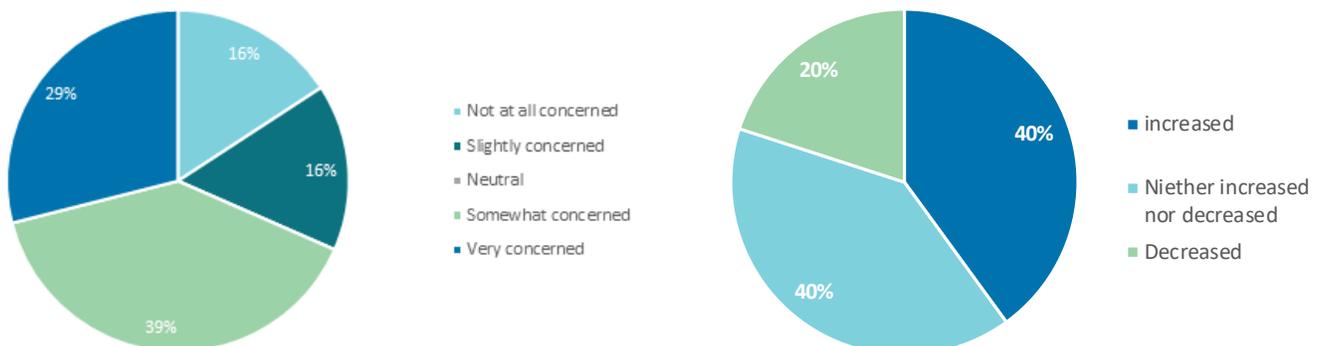


Figure 16. Results assessing participant concern about sea level rise (left) and the impact of *Rising Seas* workshop on these concerns (right).

### Community Values and Priorities

Community members were provided a list of waterfront features/amenities from which they chose the five they valued the most. The results suggest residents highly regard the foreshore as a recreational and environmental asset, with additional economic and infrastructure benefits.

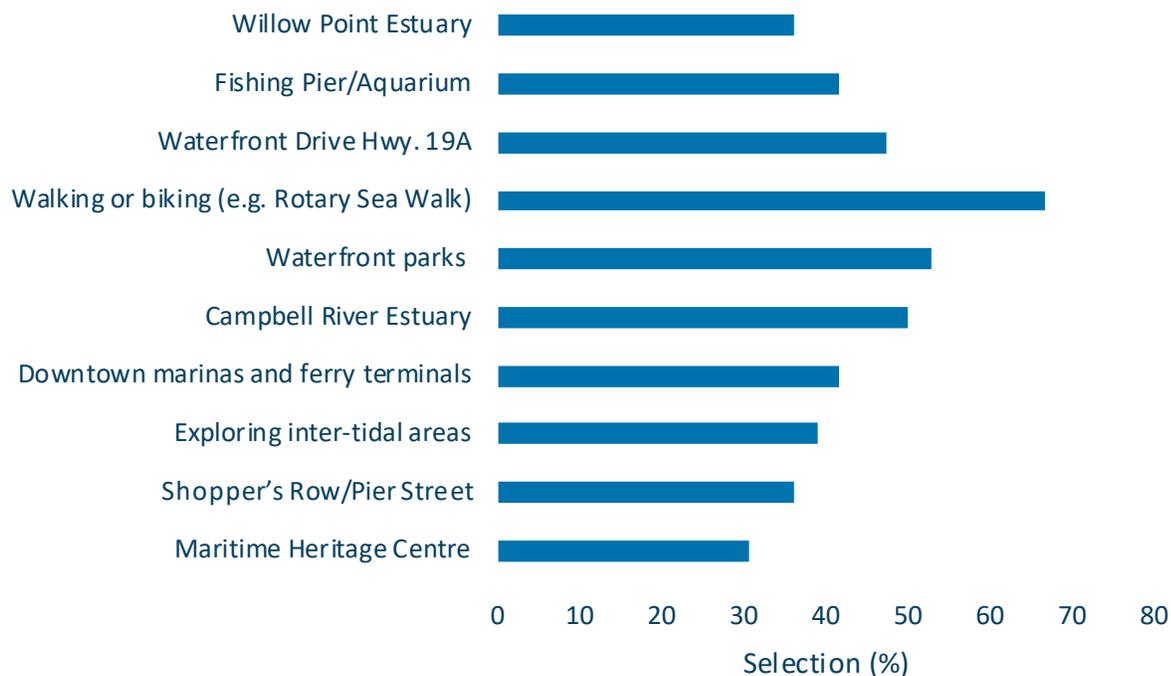


Figure 17. Top ten valued waterfront attributes of workshop participants.

## Evaluating Adaptation Options According To Community Values

In order to select adaptations that are best for Campbell River, options must be compared according to community values and priorities, not just objective costs and benefits. Community values can be difficult to measure. Therefore, we developed five potential values categories with corresponding values criteria that could be used to translate qualitative community values into more a more quantitative form (as shown below).



*Value Category*

*Values Criteria*

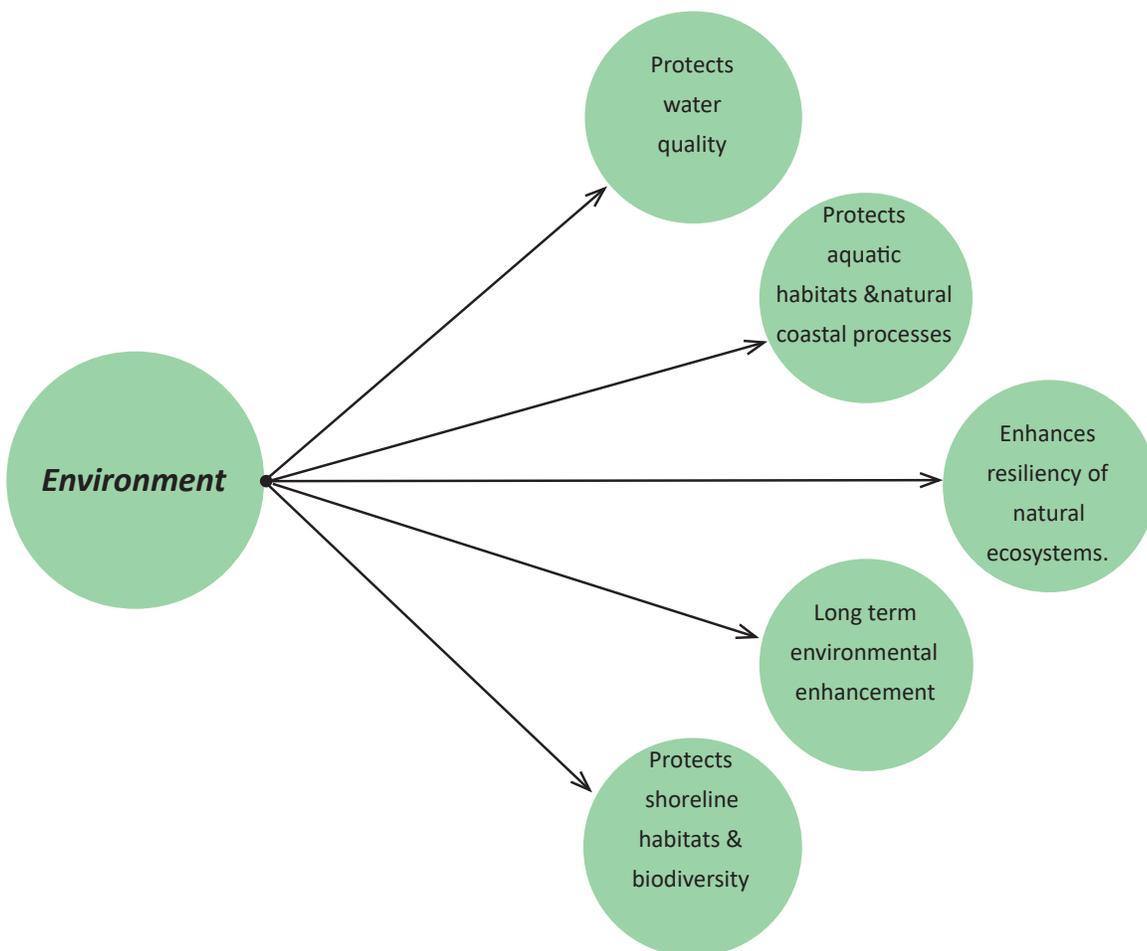


Figure 18. Five values potential values categories were defined (above). For each values category, specific, measurable values criteria were created.

Participants selected their top ten values criteria and ranked them in order of importance. Criteria were given a score based on the number and position of rankings they received. Results are shown below.



Figure 19. Values criteria scored according to number of votes and relative rankings. Asterisks identify top five highest scoring values criteria

## Sea Level Rise Adaptation : Options Evaluation

The City’s consulting team developed three general options that apply varying degrees of parcel scale adaption and neighbourhood scale adaptation, and require different amounts of public investment.

Table 1. General options developed for the *Rising Seas* project. General options served as the framework for developing location specific adaptation options.

Option A	Option B	Option C
Minimum Community Intervention	Extensive Community Intervention	Balanced Intervention by Priority
Adaptation at Property Scale	Adaptation at Neighbourhood Scale	Mixed Property/Neighbourhood Scale
City addresses adaptation in public streets and street ends, parks, infrastructure only	City pursues on-foreshore adaptation fronting private waterfront wherever possible, in addition to adaptation for public infrastructure	City pursues on-foreshore adaptation fronting private waterfront only where there is a community-wide benefit, in addition to adapting public infrastructure
Private waterfront owners protect shoreline independently and raise buildings/lots at time of reconstruction at their own expense	Private waterfront owners face reduced costs for shoreline protection. Owners raise buildings/lots at time of reconstruction at their own expense	Private waterfront owners and City share costs in proportion to benefits for neighbourhood shoreline protection where feasible. Private waterfront owners raise buildings/ lots at time of reconstruction at their own expense

These general options provided the framework for specific adaptation options in four key areas: Painter Barclay, Downtown, Sequoia Park, and Willow Point. For each area an option A, B, and C were created in accordance with the themes of the general options. The details of the options for each area, including their costs and benefits, can be found in Primer III on the City website at: <http://www.campbellriver.ca/planning-building-development/sea-level-rise/background>.

At the second public workshop the adaptation options for each area were presented. Participants were asked to rank options for each area one to three, with one being the most suitable and three being the least suitable. Average rankings were calculated for each area based on the number of first, second, and third place rankings they received. The lower the average ranking, the more suitable the community felt an option was. Consistently option C was felt to be the most suitable by participants (Right).

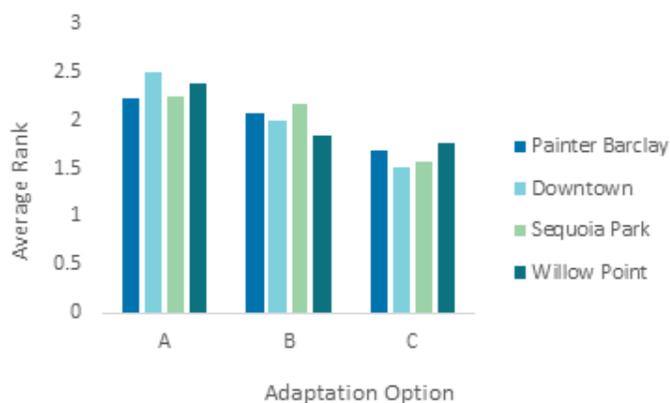


Figure 19. Average ranking for options in the four key areas.

Option C received the lowest average rank for all three areas and therefore was felt by the community to be the most appropriate in all locations. This options takes a balanced approach. The details of option C for each area are outlined below.

Table 2. Adaptation option C for the four key areas.

LOCATION			
Painter Barclay	Downtown	Sequoia Park	Willow Point
<p><b>Flood Protection:</b> Mostly beach nourishment and groynes.</p> <p><b>Public Foreshore:</b> Improved public access and habitat but timing less certain than Option B.</p> <p><b>Funding:</b> City provides engineering. Capital costs shared between neighbours (local improvement), City, and senior government grants.</p> <p><b>Phasing/Risk:</b> Timing depends on neighbourhood and grant funding approval.</p>	<p><b>Flood Protection:</b> Breakwaters extended at BC Ferries and Small Craft Harbour, shoreline and inland low streets/buildings raised in one moderate height lift, pump stations deferred</p> <p><b>Public Foreshore:</b> Shoreline walks and Hwy 19A raised on moderate height ridge, one lift.</p> <p><b>Funding:</b> Street and utility adaptation by City. Private land and building adaptation by landowner.</p> <p><b>Phasing/Risk:</b> One phase of lifting streets/utilities/buildings and shoreline. Lower requirements for commercial building elevations than residential</p>	<p><b>Flood Protection:</b> Offshore headlands and beach nourishment where riparian property rights granted, rock armour elsewhere.</p> <p><b>Public Foreshore:</b> Improved public access, beach and habitat but timing less certain or continuous than Option B.</p> <p><b>Funding:</b> Beach works by city if senior government assistance gained, rock armour by adjacent private landowners.</p> <p><b>Phasing/Risk:</b> Timing depends on property owner and grant funding approval.</p>	<p><b>Shoreline:</b> At four park frontages or other purchased property the city pursues funding for offshore headlands and/or pocket beaches. Private lots have raised grades at time of reconstruction.</p> <p><b>Public Foreshore:</b> Greater extent of improved public access and habitat at park sites. Reduced public access and habitat elsewhere as SLR progresses.</p> <p><b>Funding:</b> Beach works by city if senior government funding gained, rock armour by private landowners.</p> <p><b>Phasing/Risk:</b> Reduced risk if property retreats but depends on outside funding for city works. City accepts need for ongoing adaptation with SLR.</p>

## Sea Level Rise Adaptation: Draft Recommended Strategies

The adaptation options were refined according to the public consultation were to create the draft recommended strategies for sea level rise adaptation. These provide a series of recommendations for each of the four key areas, to address the risks associated with sea level rise.

These draft recommended strategies were reviewed by the community at the third Rising Seas workshop. The community gave feedback on the recommendations for each area, and indicated whether they supported, did not support, or would support with changes, each of the recommendations. Detailed descriptions of the draft recommended strategies can be found in Primer IV on our website at: <http://www.campbellriver.ca/planning-building-development/sea-level-rise/background>

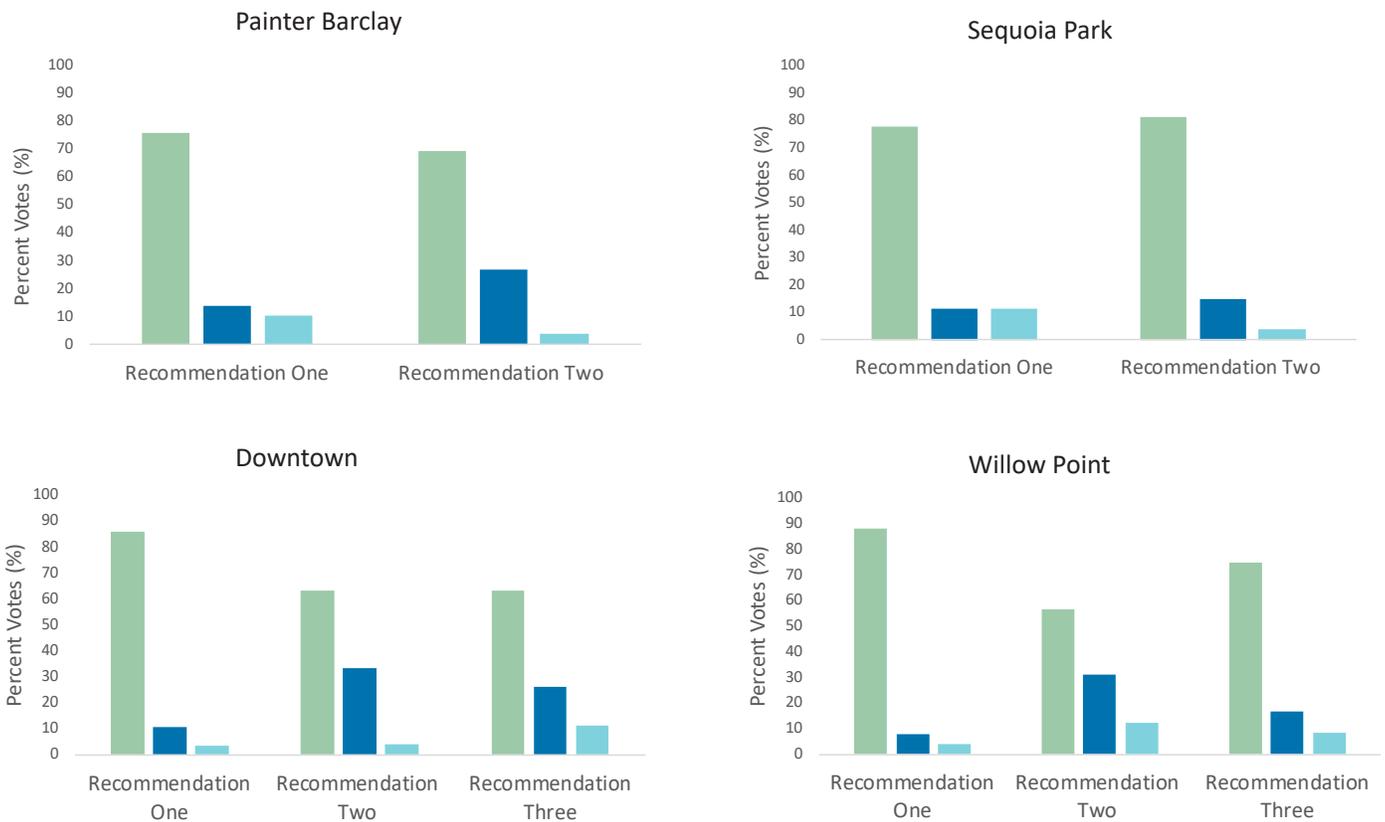
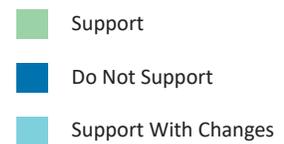


Figure 20. Support of workshop three participants for the draft recommended strategies for sea level rise adaptation.

### Role of the City

At each workshop participants were asked about what they felt the City’s role in sea level rise adaptation should involve. The results, shown below, indicate that all suggested roles were generally supported by workshop participants.

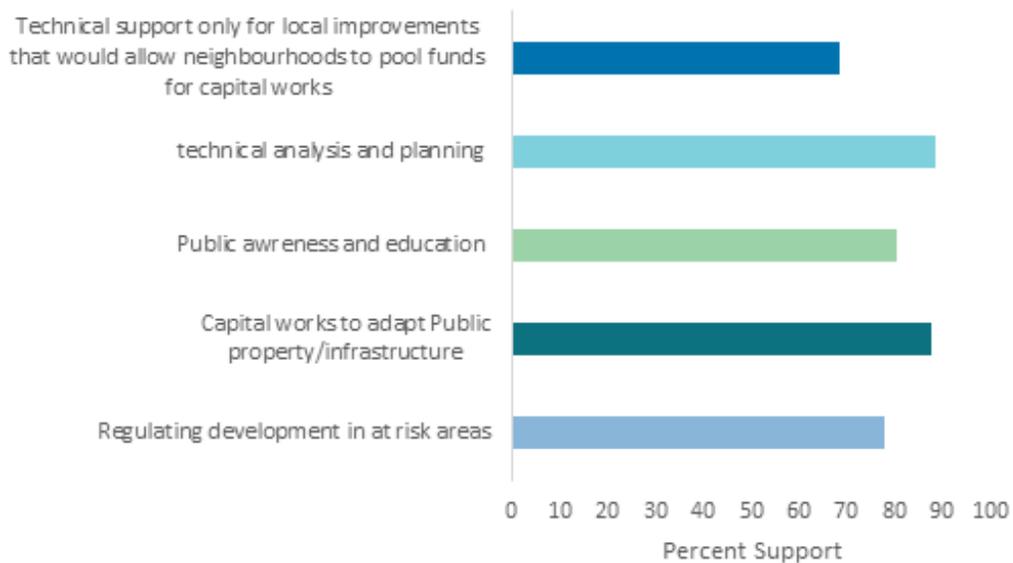


Figure 21. Workshop participants opinion on what the City’s role in sea level rise adaptation should be.





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northwest hydraulic consultants

**LANARC**