

# COASTAL ADAPTATION PLAN

FRASER RIVER FORESHORE

Community Workshop



Community Workshop

# Project Overview

# Climate Change & Coastal Floods

- Coastal cities around the world are facing same challenges of sea level rise
- Major floods in the Lower Mainland are expected to increase in magnitude and frequency (Fraser Basin Council report)
- Vancouver is exposed to sea level rise along the coast, Burrard Inlet and Fraser River

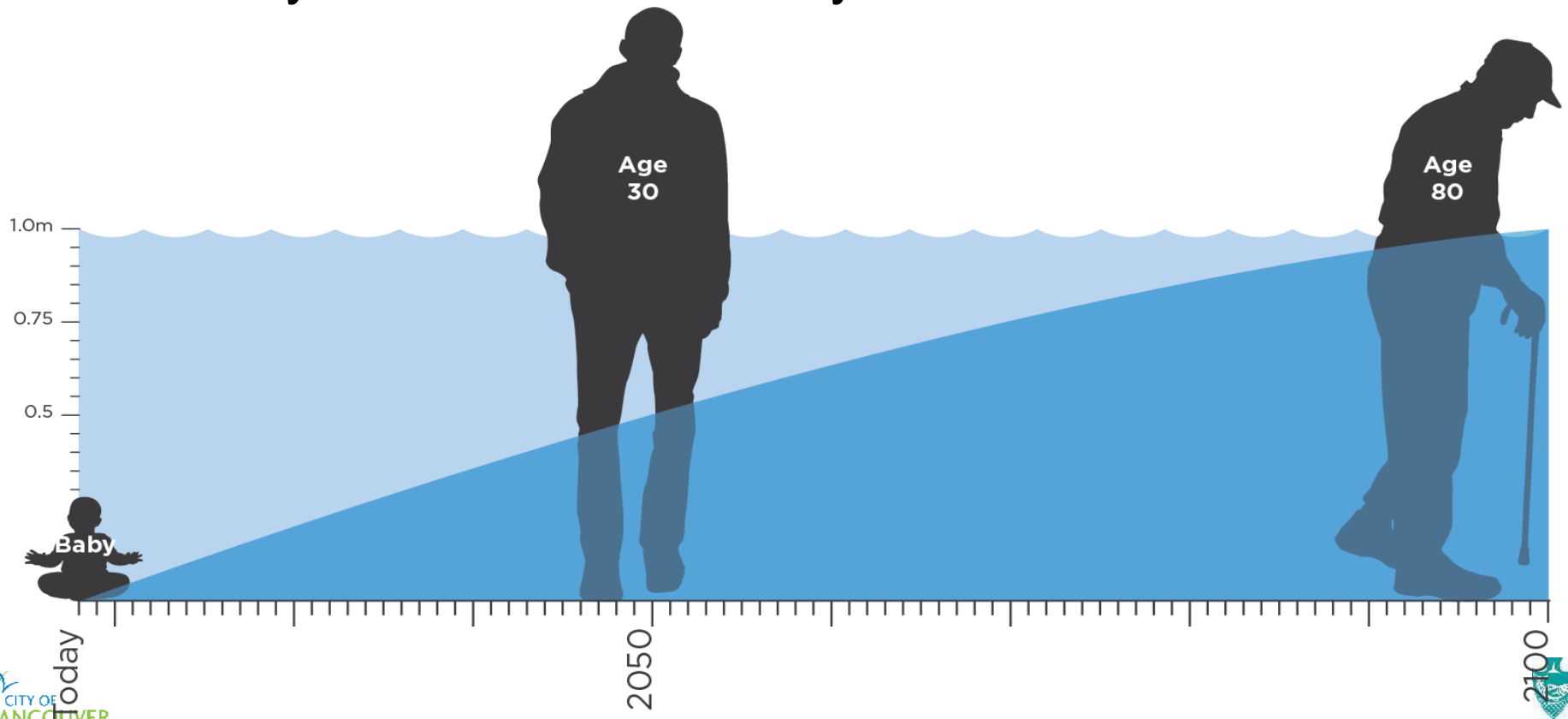


# Fraser River Freshet 2018

- May 2018 the Fraser valley experienced freshet flooding that was more significant than previous years
- Freshet flooding occurred due to unseasonably high temperatures and a higher than normal snowpack in the Fraser River Basin
- The City of Vancouver opened the Emergency Operations Centre in response to the event and carried out daily monitoring activities of the shoreline
- The City made several public announcements about possible swift water conditions along the Fraser River
- No flooding or erosion was observed within the City of Vancouver, along the Fraser River

# Sea Level Rise

- Climate change is driving sea level rise and a 50cm increase is projected for 2050 and 1 metre by 2100
- Province has advised municipalities to prepare for 1 metre by 2100 and 2 metres by 2200.



# Impacts from sea level rise include increased coastal flooding, erosion and storm damage



December 2012 storm surge and king tide event

# Major flood events

## Major flood

- Homes flooded
- Electricity failed
- Vehicles carried off roadways
- Residents evacuated



# Major flood event - Calgary 2013





# Major flood event - England 2016



# Major flood event - Houston 2017



# A history of flooding



Flooding in Southlands  
Date: January 12, 1959

# A history of flooding



Flooding in Southlands  
Date: January 12, 1959

# Flood Today



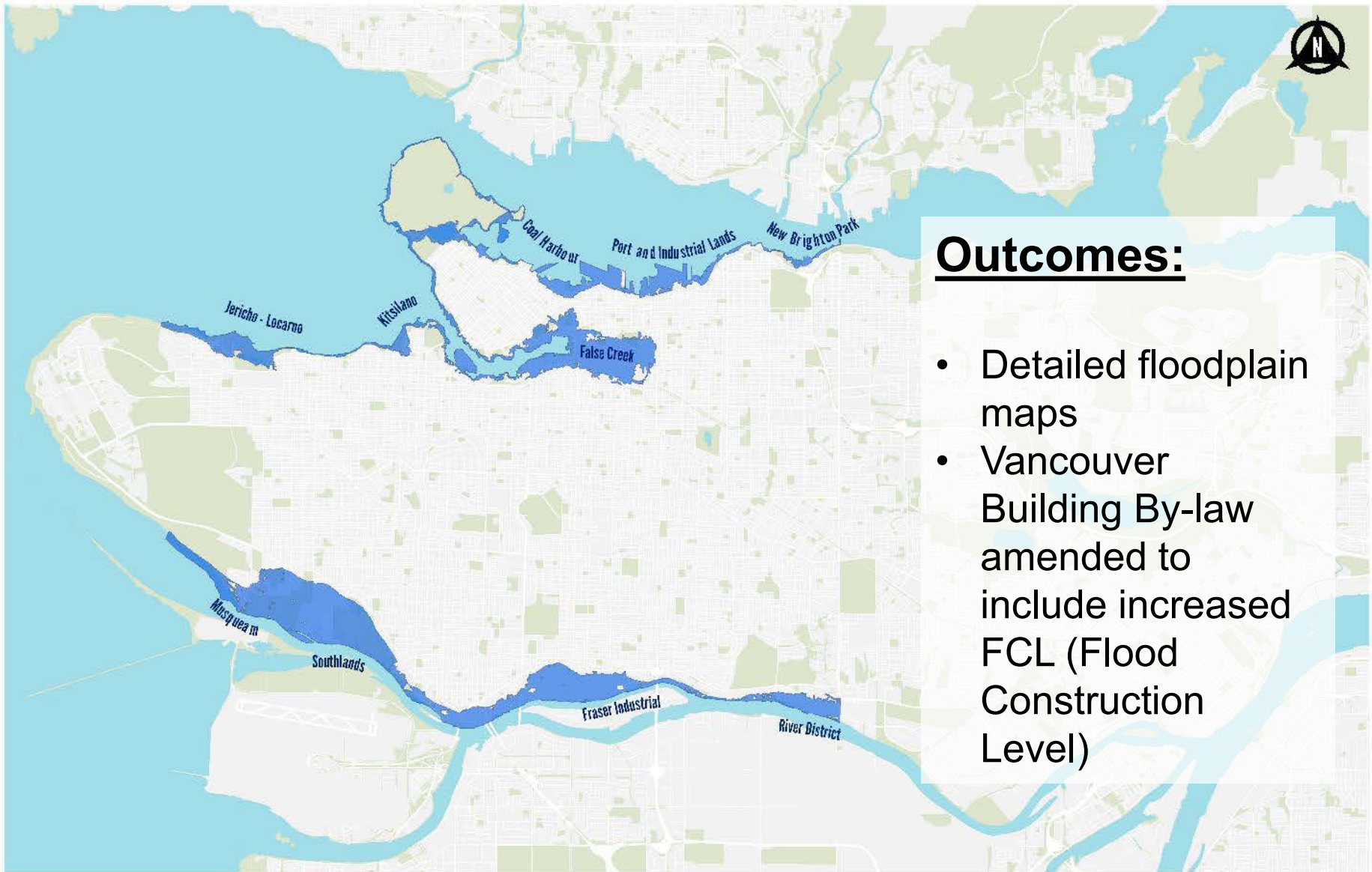
Electrical substation threatened in Grand Forks  
Date: May 14, 2018

# Flooding Today



Grand Forks more than 100 homes have been submerged in floodwater filled with sewage and debris  
Date: May 14, 2018

# Coastal Flood Risk Assessment (CFRA) - Phase I



## Outcomes:

- Detailed floodplain maps
- Vancouver Building By-law amended to include increased FCL (Flood Construction Level)

# Coastal Adaptation Plan (CAP)

## BUILDING SHARED UNDERSTANDING

- Coastal Flood Risk Assessment (CFRA), phases 1 and 2
- CAP community values and principles

**2014 - 2018**

## SHAPING OPTIONS

- High level technical assessment of alignments and options
- Community engagement

**2019 - 2020**

## MAKING DECISIONS

- Detailed design and phasing
- Community engagement

**2020+**



**We are here**



# Musqueam and City of Vancouver



Letter of Understanding between Musqueam and the City of Vancouver was approved by the Musqueam Inter-Governmental Affairs Committee in January 2018



# Fraser River Foreshore

## WHAT'S AT RISK?

### A MIXED-USE NEIGHBOURHOOD

- 280 commercial and industrial buildings
- 400 +homes
- Rail Corridor
- TransLink Transit Centre
- BC Hydro sub-station
- Transfer Station (waste and recycling)
- Fortis facilities (Fraser Gate)
- Shoreline habitat
- Musqueam Community

Community Workshop

# Workshop Purpose

# Purpose of today



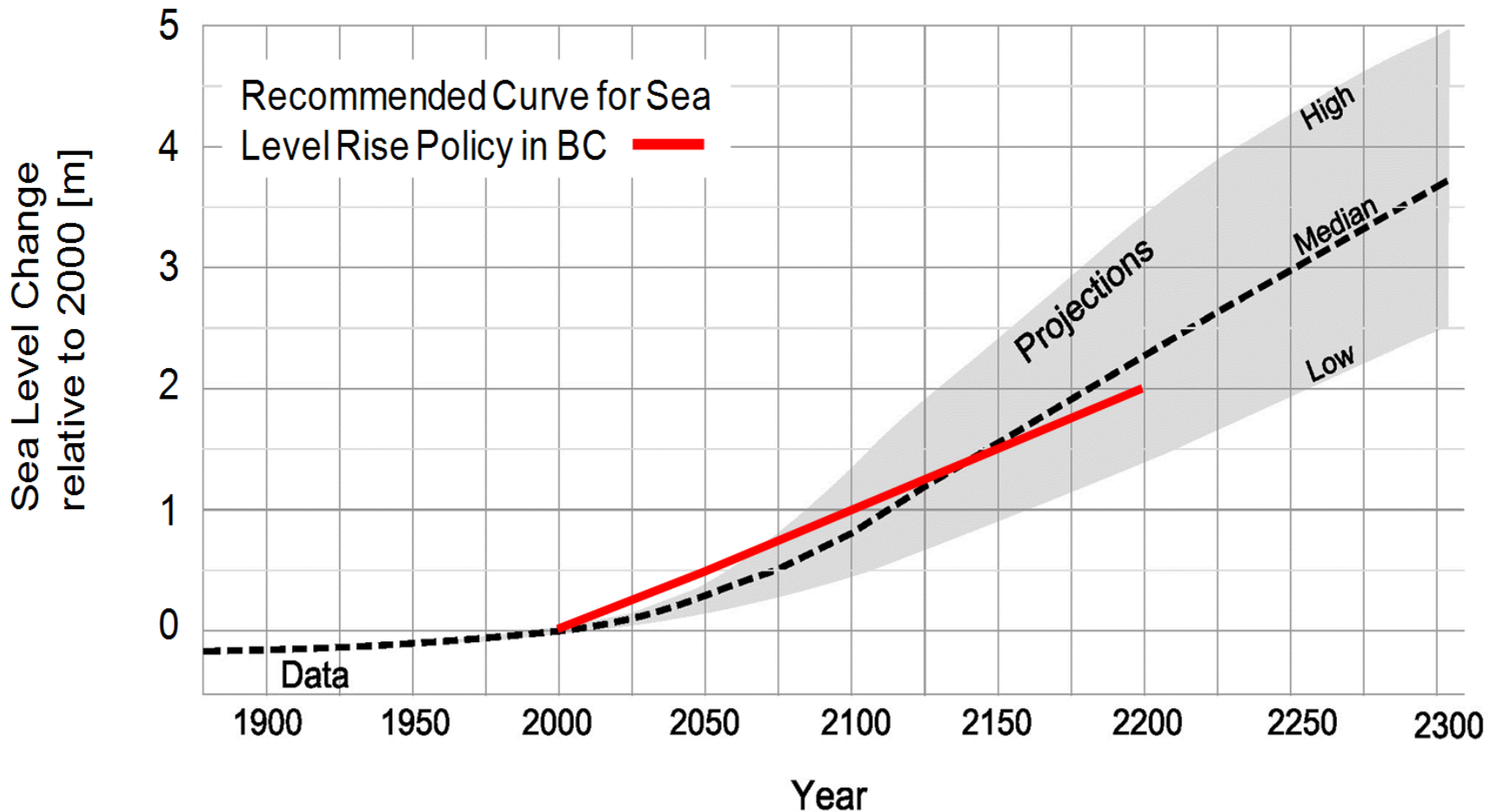
Identification of community values impacted



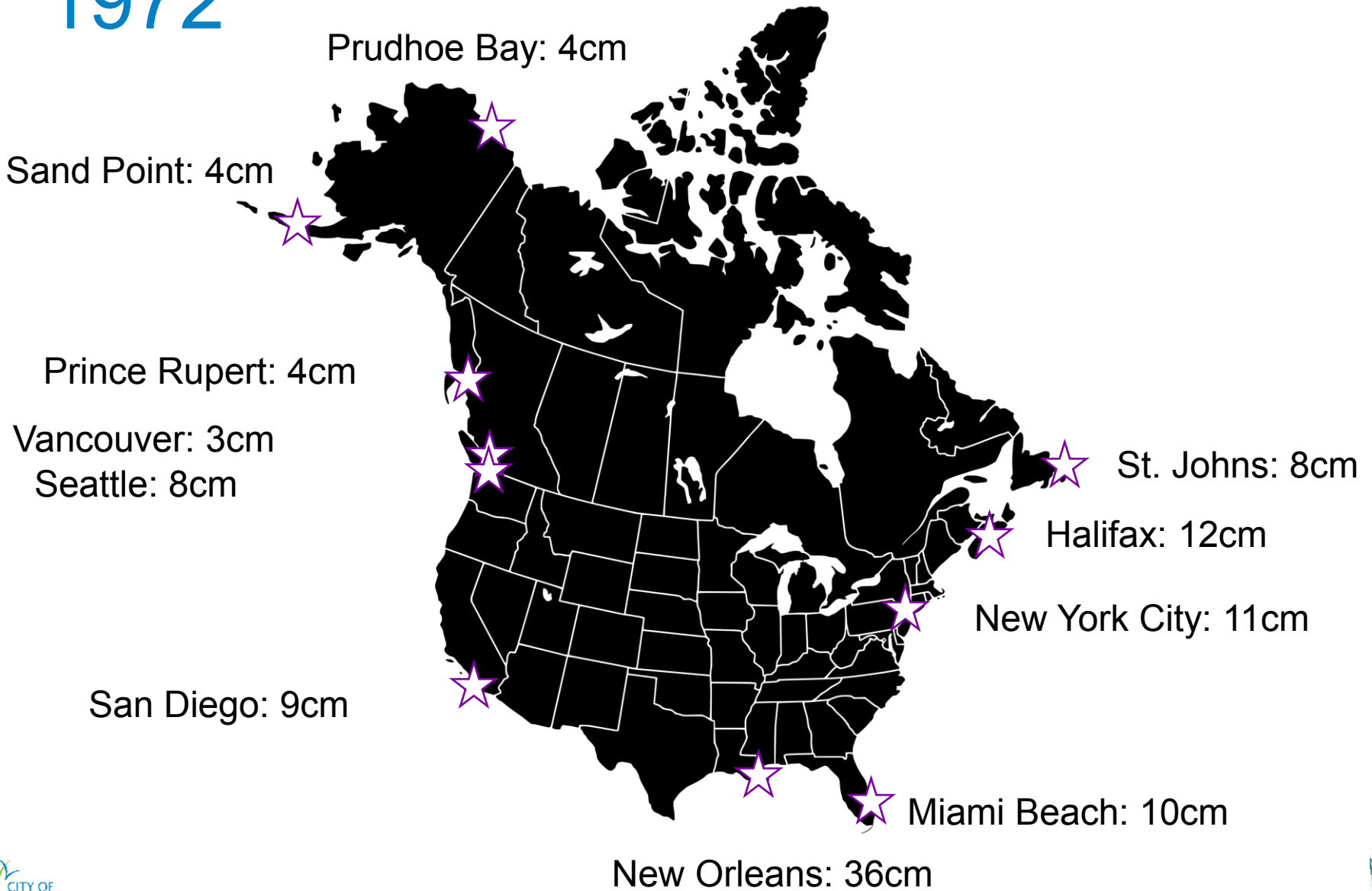
Exploration of adaptation options



# Sea level rise forecast for BC



# Approximate sea level rise since 1972



# Cause of sea level rise

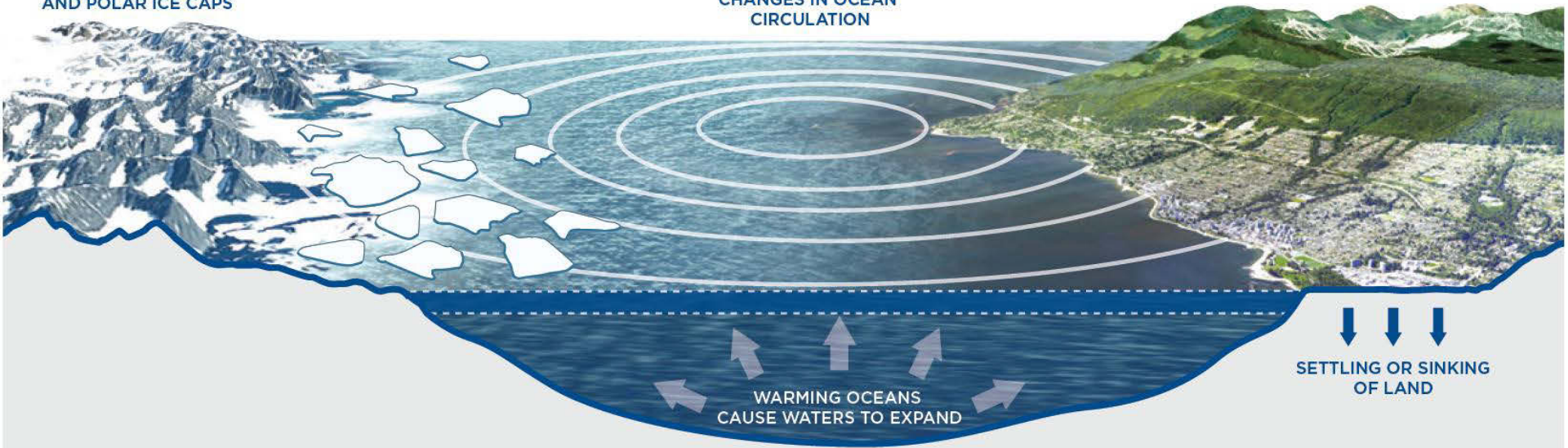
MELTING GLACIERS  
AND POLAR ICE CAPS

CHANGES IN OCEAN  
CIRCULATION

WARMING OCEANS  
CAUSE WATERS TO EXPAND

SETTLING OR SINKING  
OF LAND

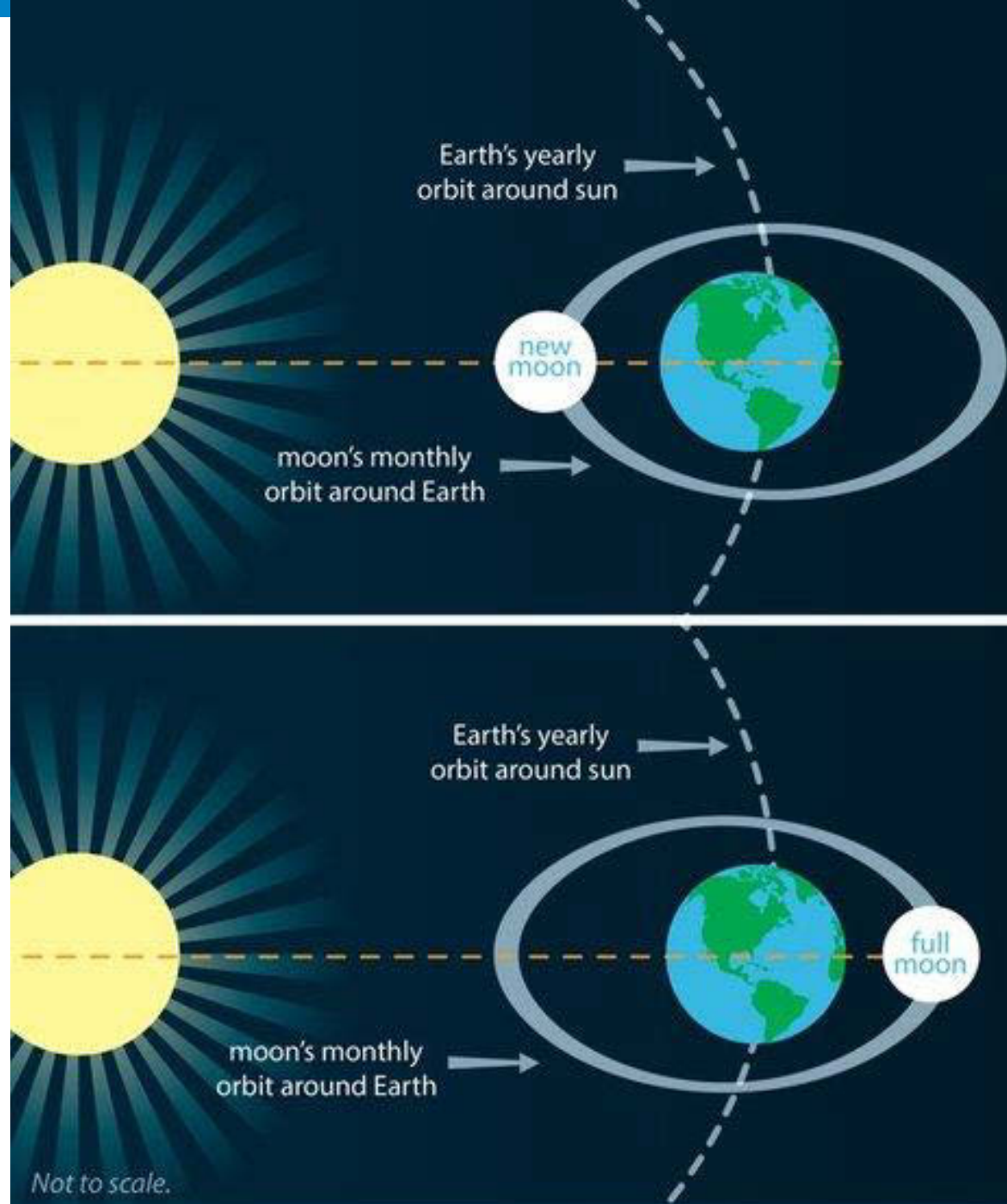
SOME CAUSES OF SEA LEVEL RISE



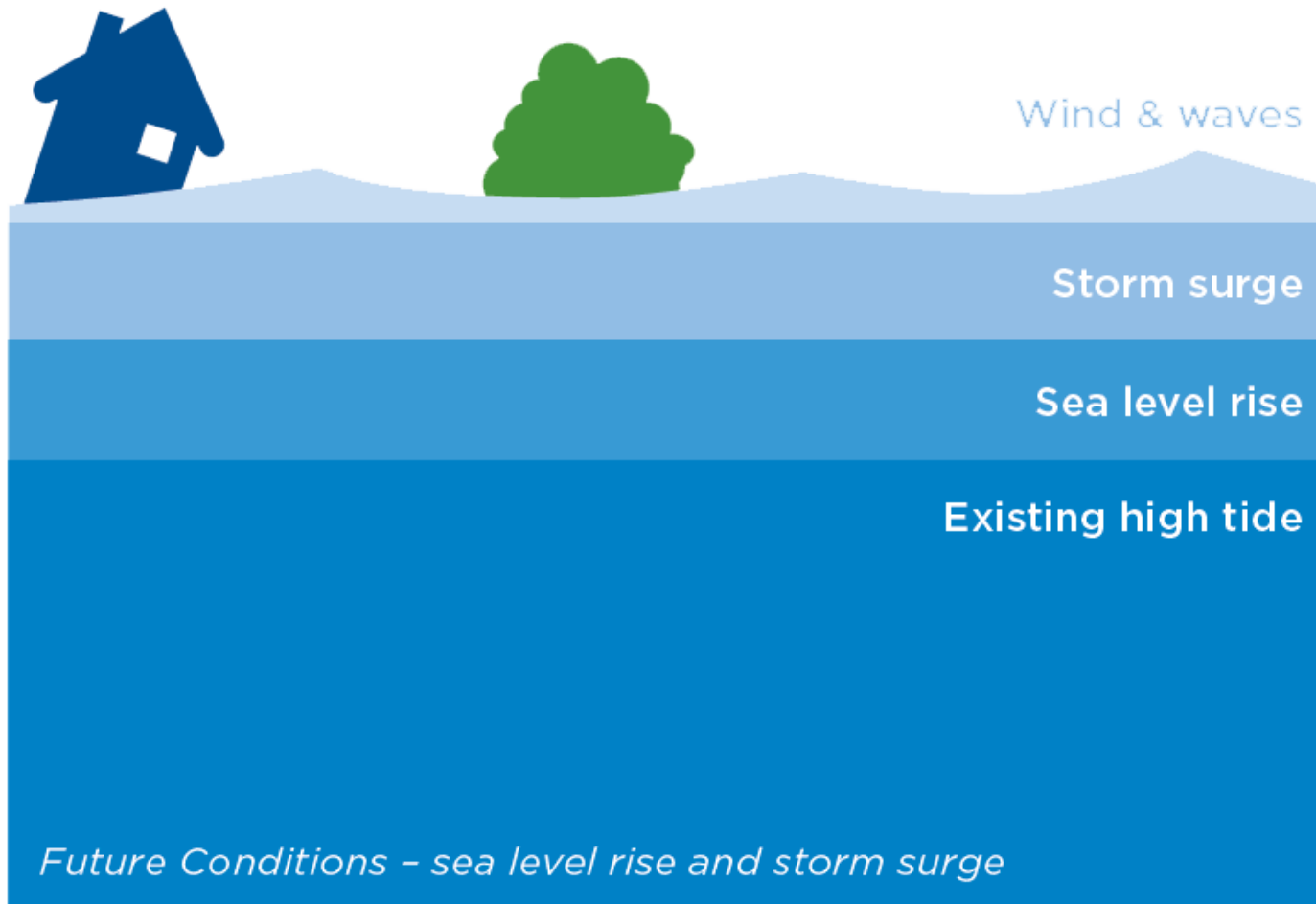


# King Tides

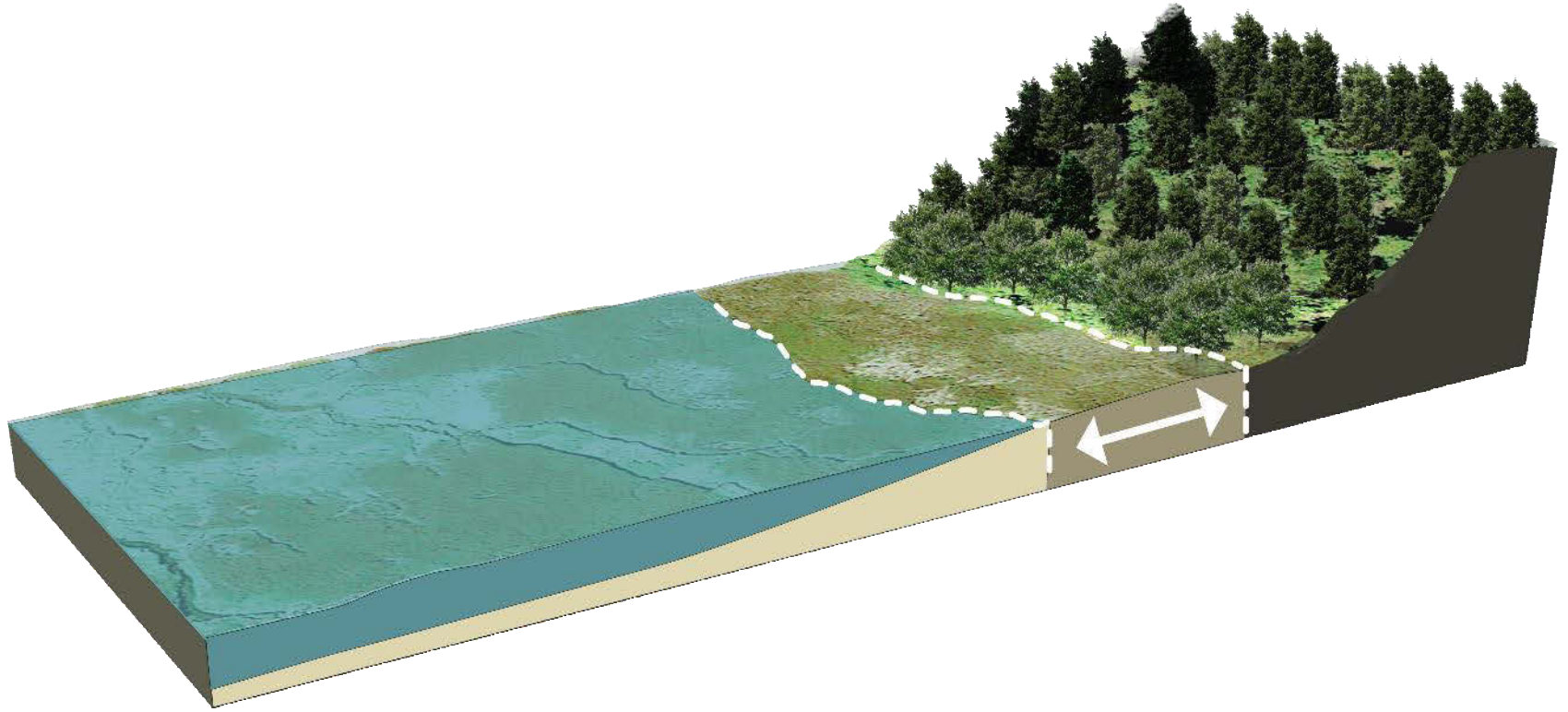
King tide occurs when the moon is either new or full and aligned with the sun



# Storm surges



# Coastal squeeze (maløy' lands)



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# Identifying Concerns

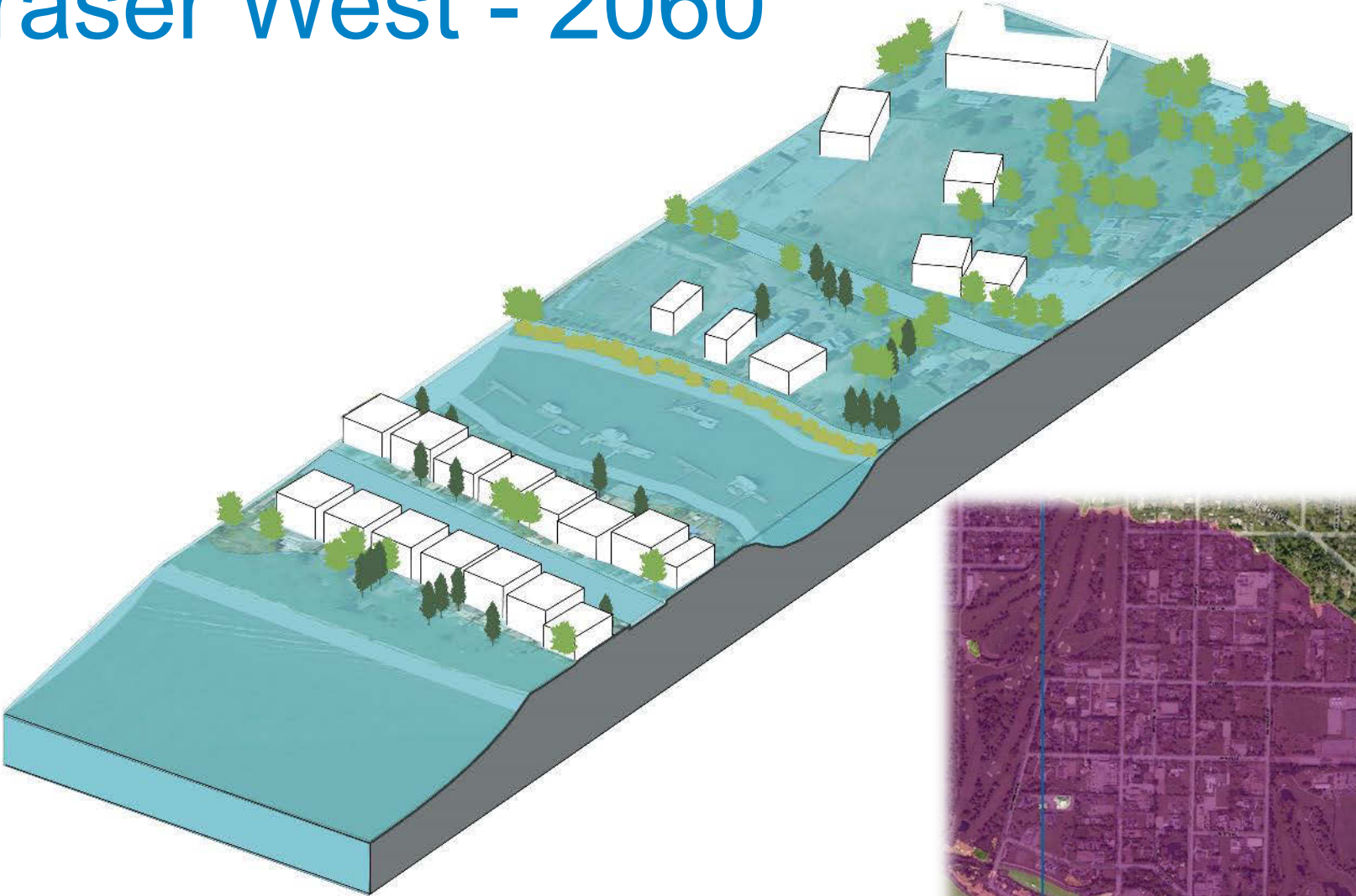
# Fraser West



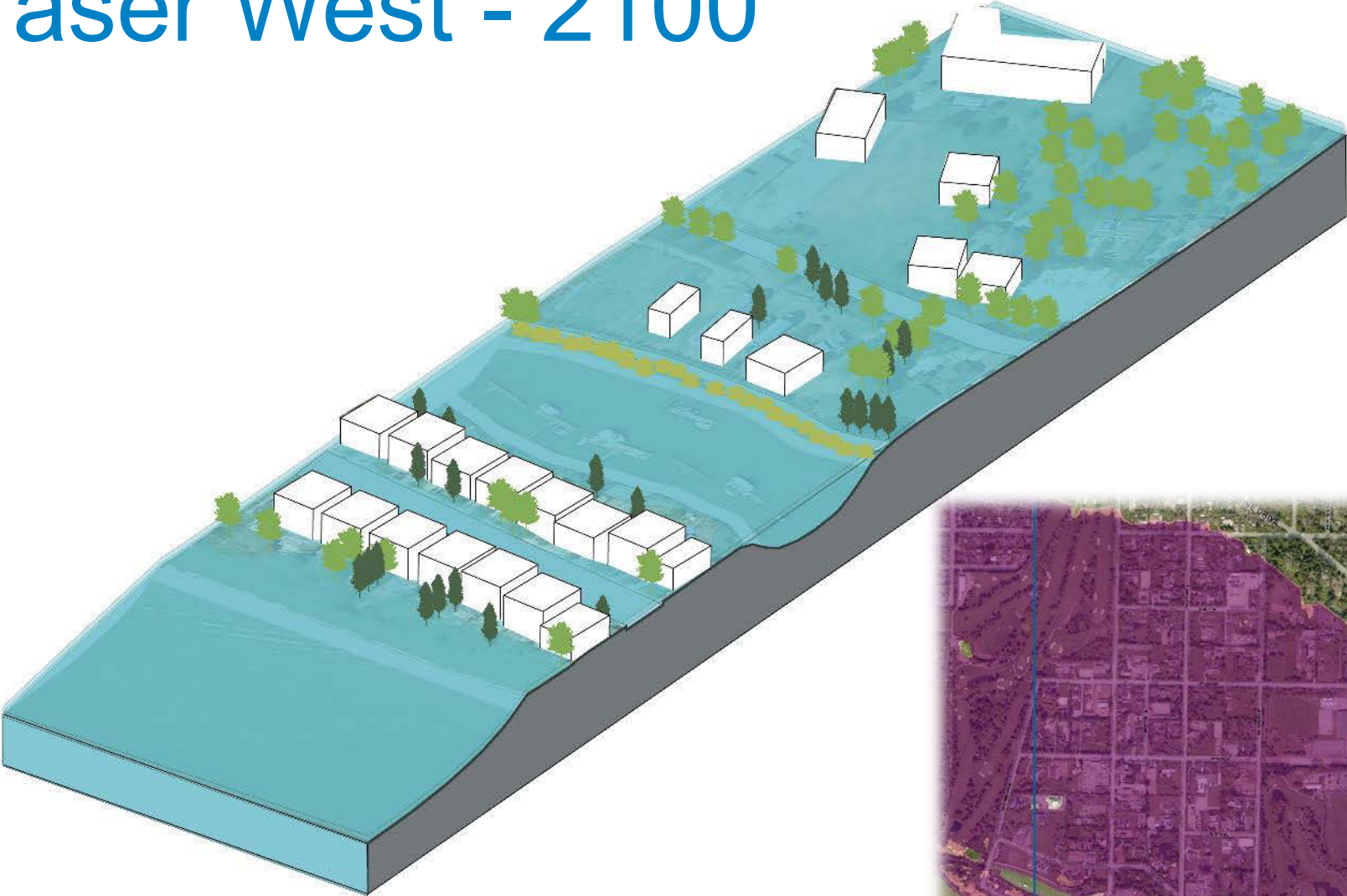
# Fraser West - Today



# Fraser West - 2060



# Fraser West - 2100

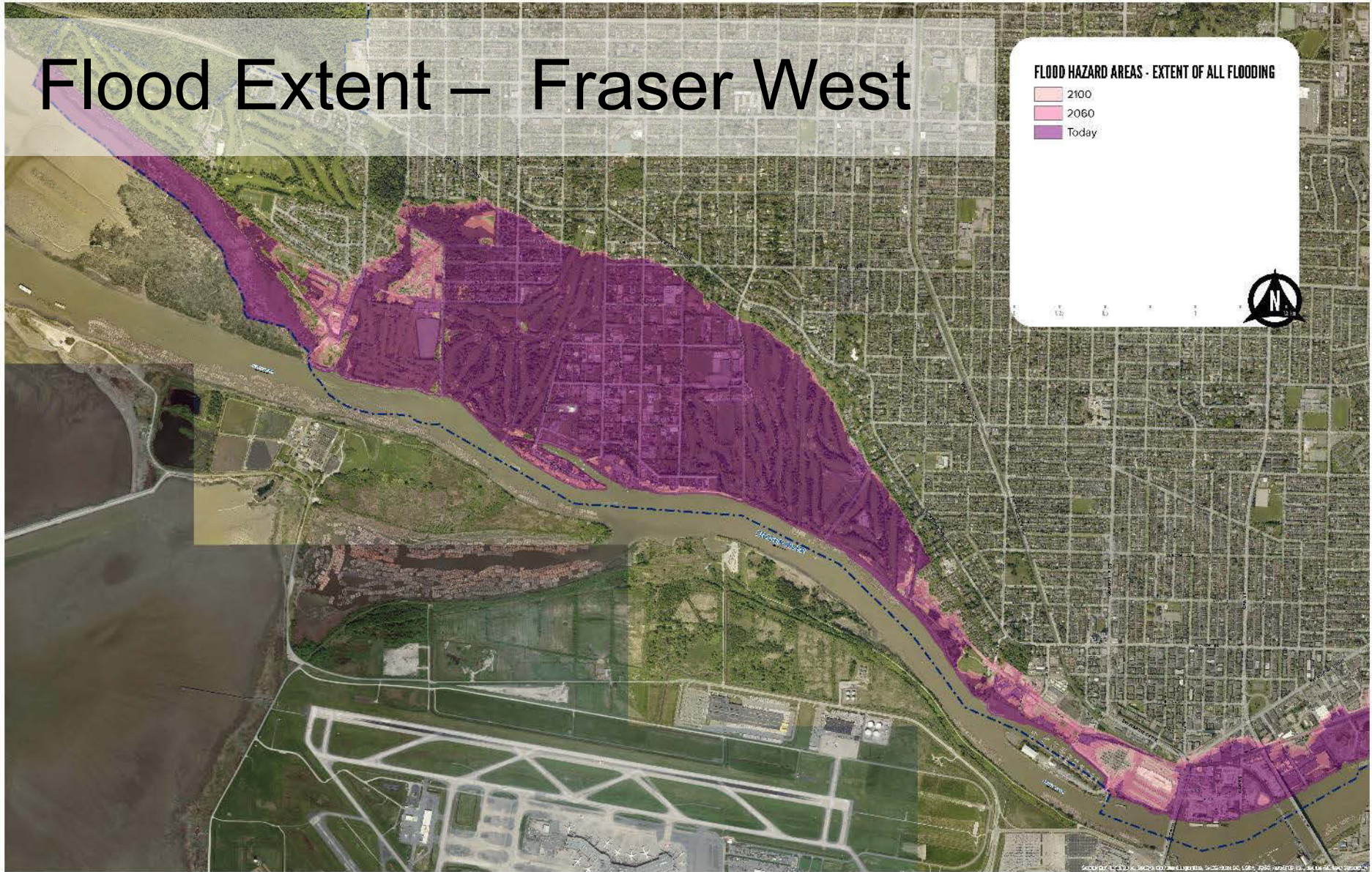




# Flood Extent – Fraser West

## FLOOD HAZARD AREAS - EXTENT OF ALL FLOODING

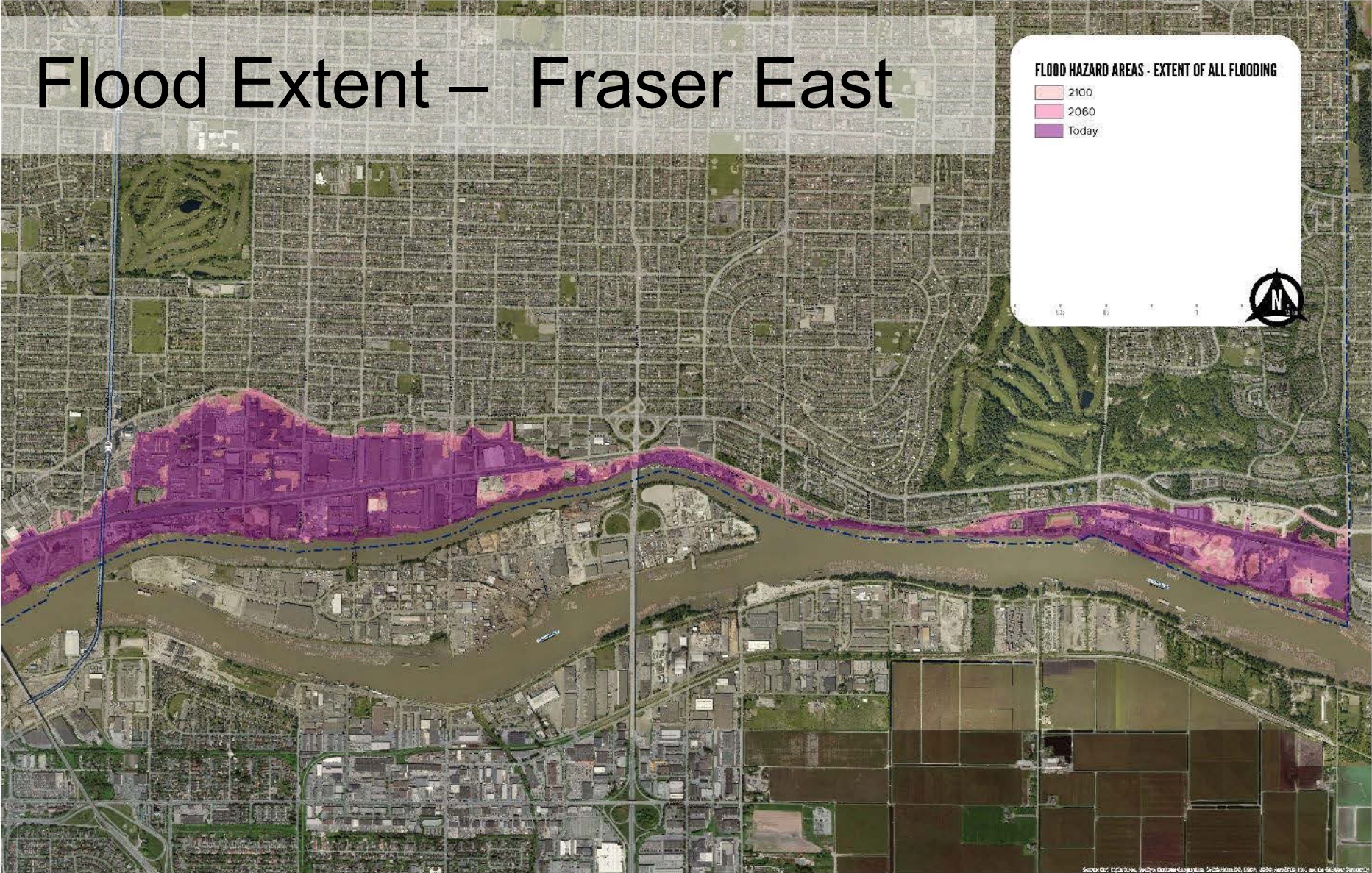
- 2100
- 2060
- Today



# Flood Extent – Fraser East

FLOOD HAZARD AREAS - EXTENT OF ALL FLOODING

- 2100
- 2060
- Today

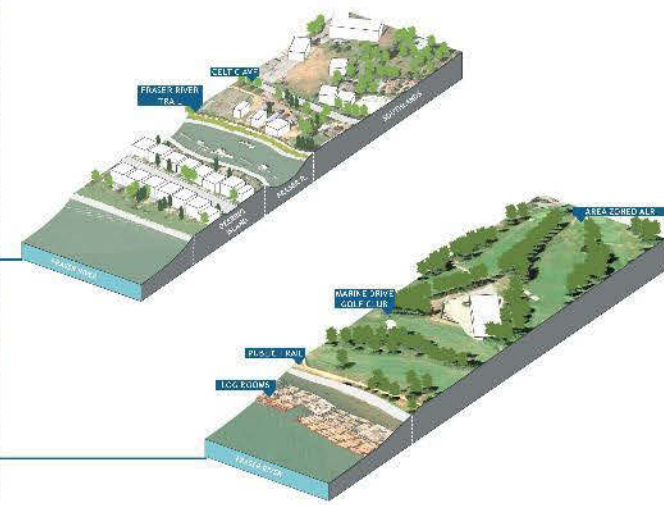


Source: City of Vancouver, British Columbia, Canada. Data provided by the City of Vancouver.

# FRASER RIVER WEST CURRENT CONDITIONS



Existing land uses include residential areas, three golf courses, parks, trails, and a number of equestrian facilities. Musqueam Indian Band's principal reserve is located in the area as well. A large portion of the area is located in the provincial Agricultural Land Reserve.



View west of park development south of Cattle Ave. (S. Forstad, March 2014)



Marine Drive Golf Club course (S. Forstad, March 2014)



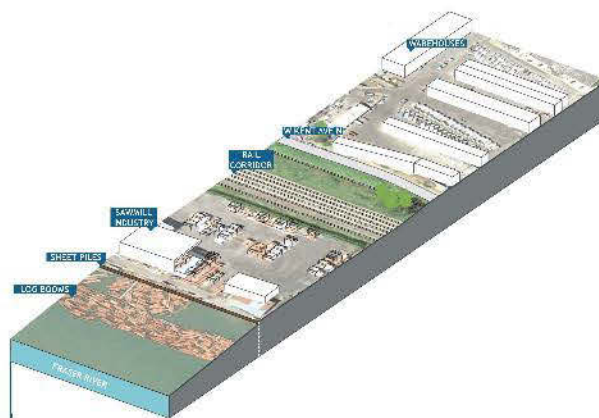
Recent housing constructed above grade along 53 Ave. (S. Forstad, March 2014)



Debris flow from Corrington Street access at west end (S. Forstad, March 2014)

# FRASER RIVER EAST CURRENT CONDITIONS

The eastern portion of Vancouver's Fraser River foreshore is a diverse, mixed use area featuring a range of industrial, commercial, warehousing, manufacturing and office uses. The area is home to the South Vancouver Transfer Station, a City works yard, a large recycling depot, and the Vancouver Transit Centre. Towards Vancouver's eastern boundary, the Fraserlands area is predominantly a multi-family residential neighbourhood with river front parks and a mix of housing types. The area is also home to a major natural gas facility operated by Fortis.



Gradually eroding bankline with lock-block wall about to be underlined (C.F. 2014)



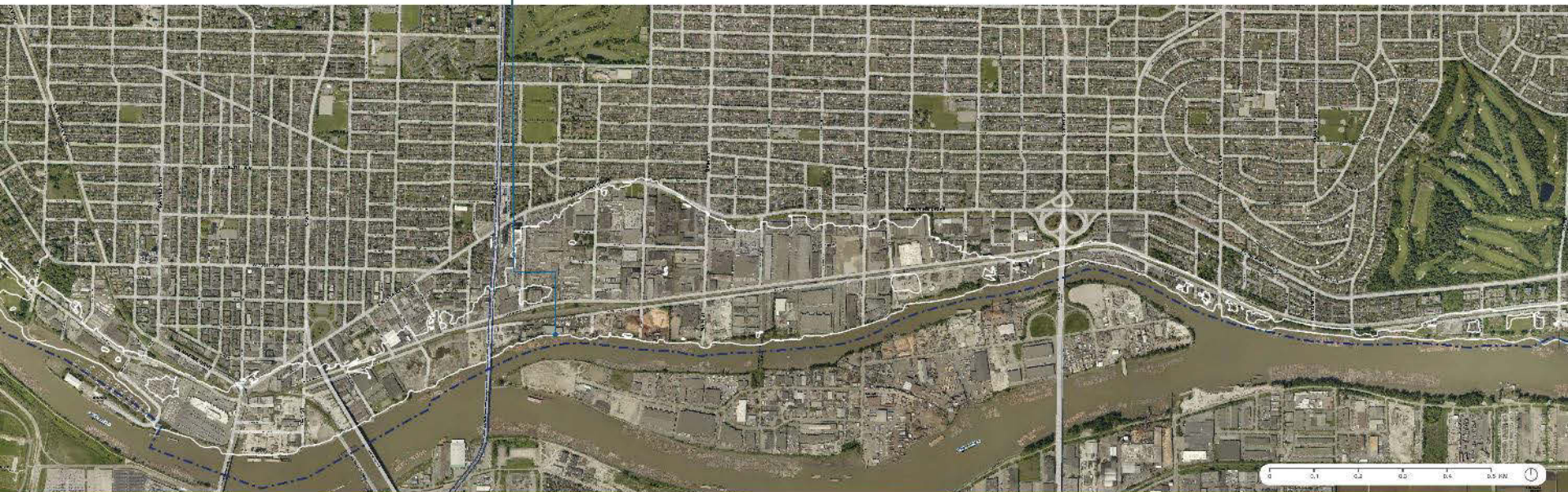
View north along Main Street with floodplain limit in background at Marine Drive (C.F. 2014)



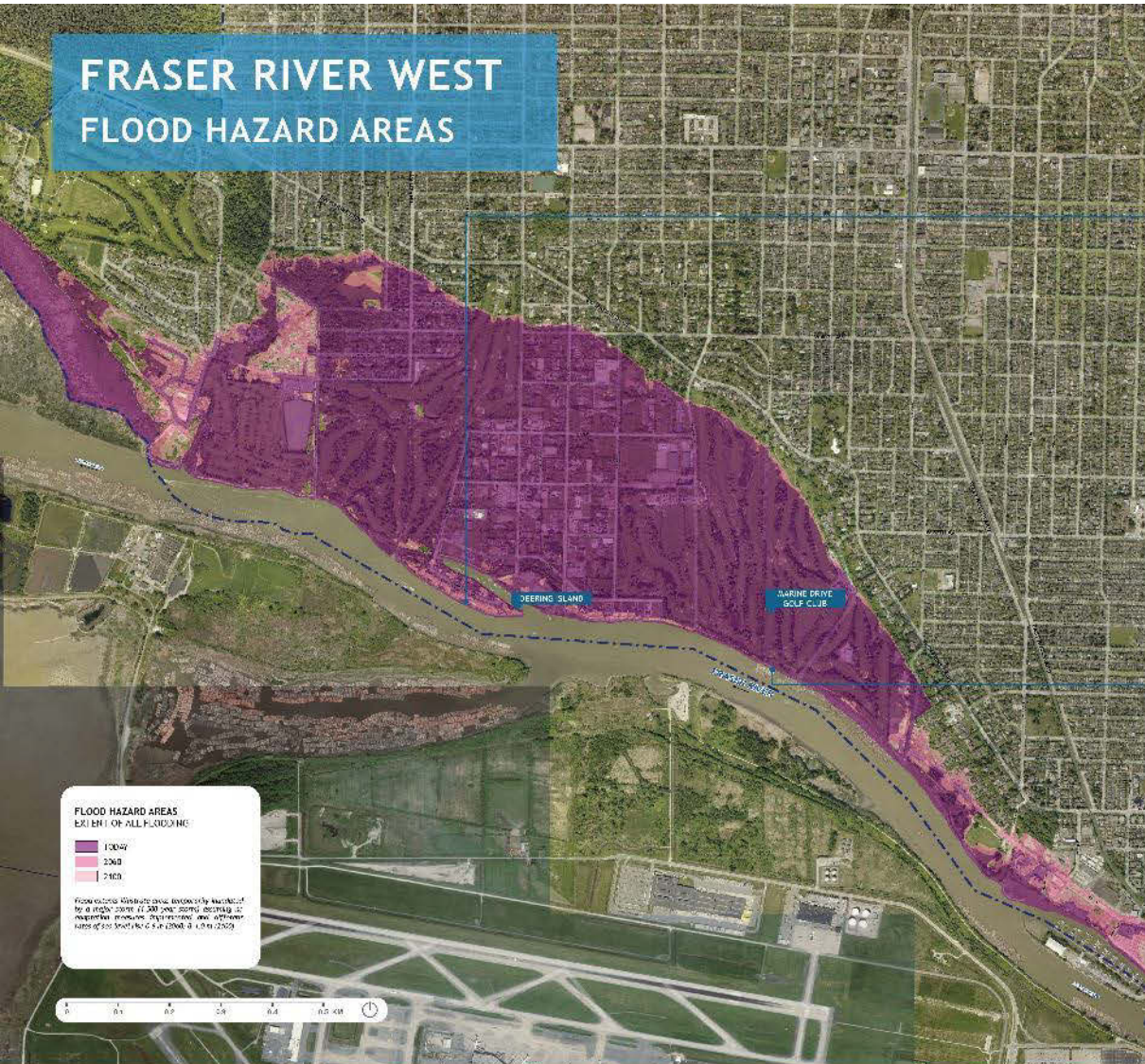
Rock revetment along heavy industrial marine use west of Knight Street bridge (C.F. 2014)



Concrete rubble along marine industrial use east of Fraser Street (C. Farland, March 2014)



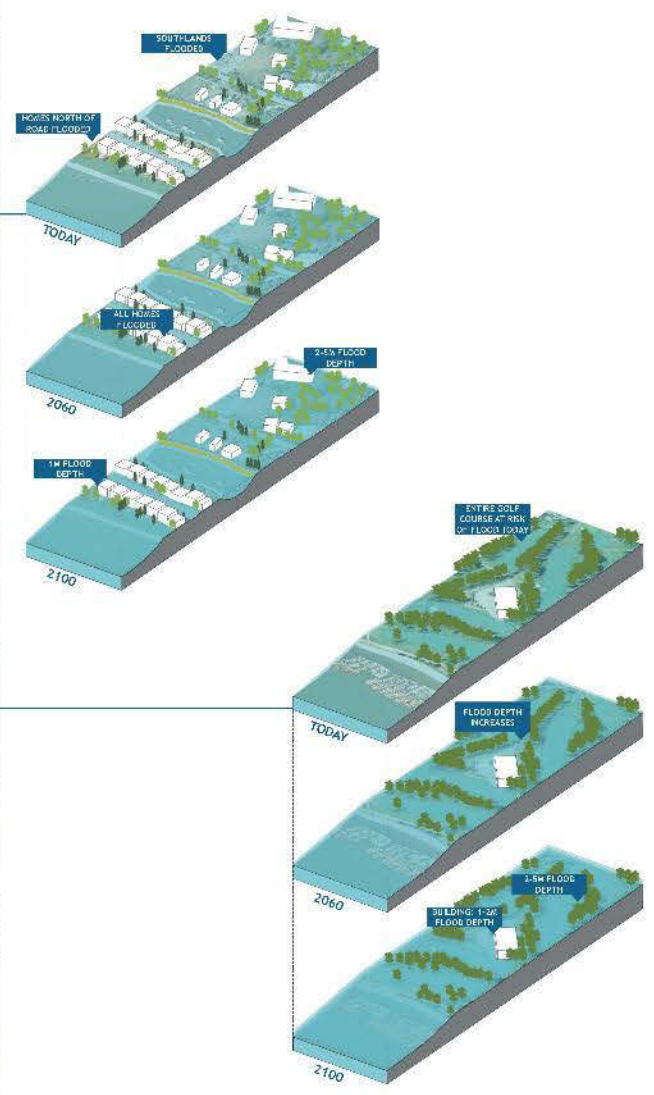
# FRASER RIVER WEST FLOOD HAZARD AREAS



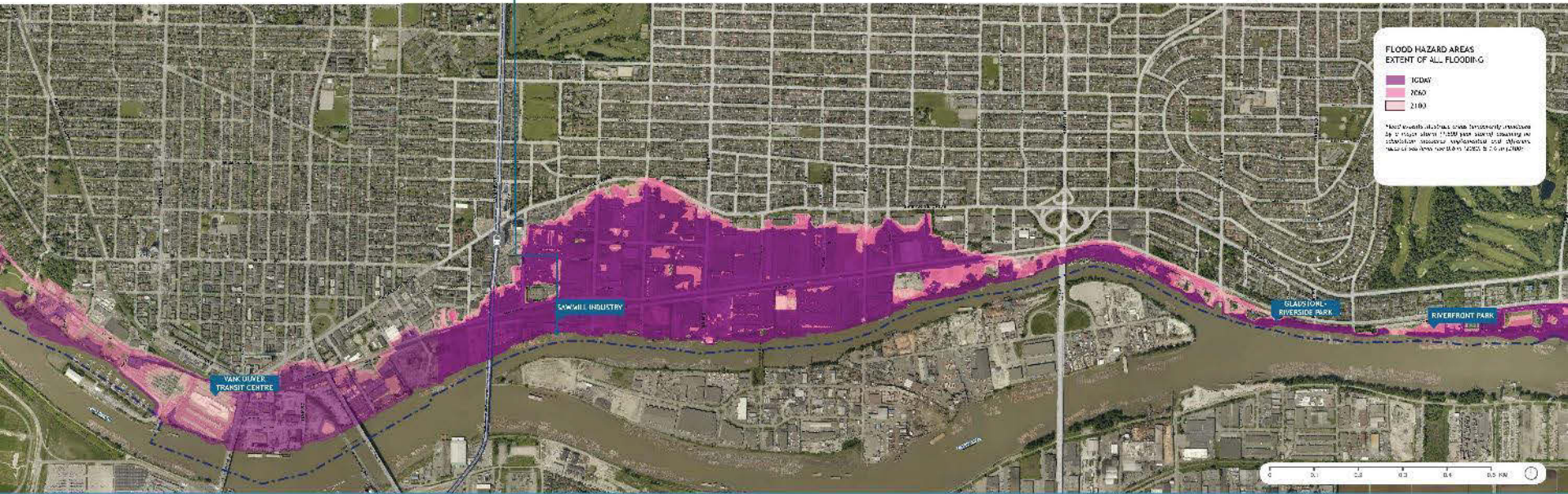
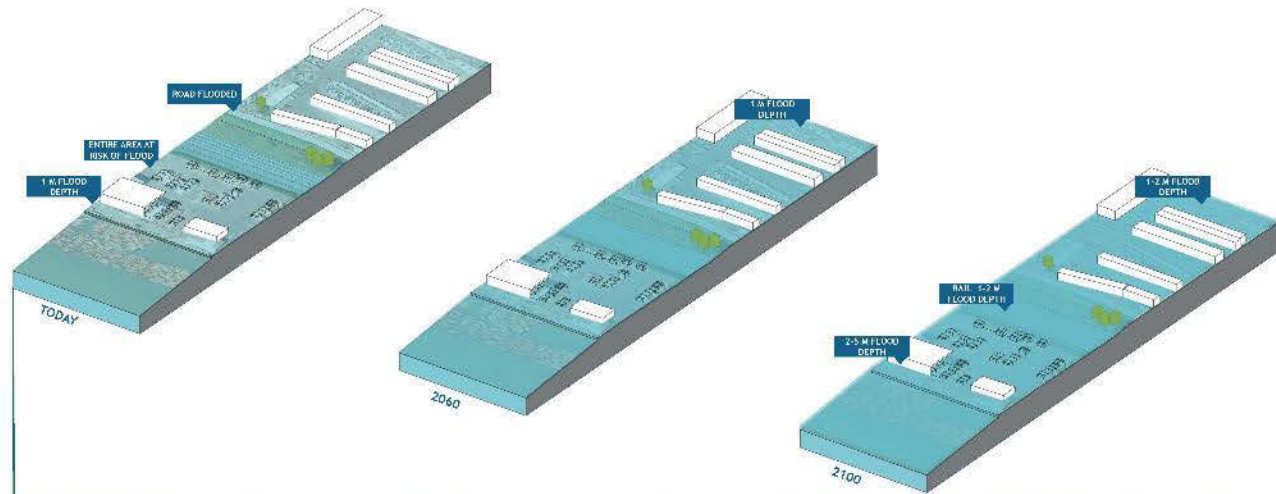
**FLOOD HAZARD AREAS**  
EXTENT OF ALL FLOODING

- 100yr
- 200r
- >10r

From Coastal Adaptation Plan, Version 1.0 by MWH Global for a study done in 2019 and 2020 detailing all important processes, dependencies, and activities based on the best available data as of 2019.



# FRASER RIVER EAST FLOOD HAZARD AREAS



**FLOOD HAZARD AREAS  
EXTENT OF ALL FLOODING**

- TODAY
- 2060
- 2100

\*Note: Levels illustrated are primarily estimates of a flood about 1:200 year return period. Actual conditions may vary depending on other factors such as sea level rise and climate change.

Community Workshop

# Flood Adaptation Approaches

# Flood Adaptation Options

Sketches for the purpose of workshop discussions.  
Not final designs.

**RESIST**



**ACCOMMODATE**



**MOVE**

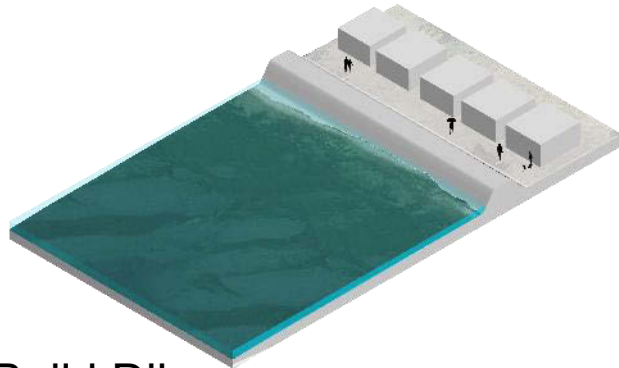




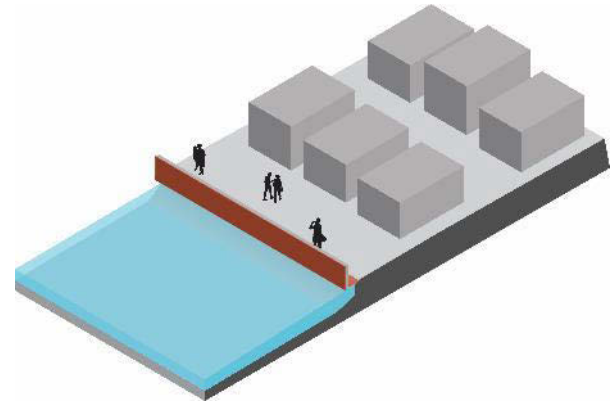
**RESIST**



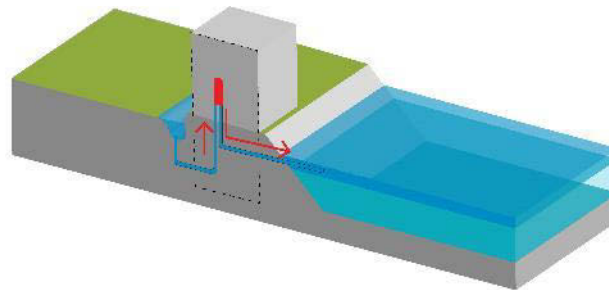
**Sketches for the purpose of workshop discussions.  
Not final designs.**



Build Dikes



Build Walls



Build Pumps

**RESIST**



**Middle Arm Dike, Richmond**

Image Courtesy: a Time With Nature

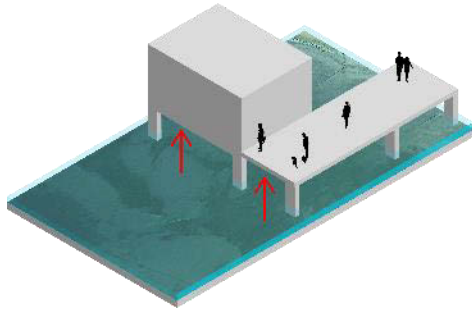


**Jericho Beach Shoreline  
(Green Shores strategies)**

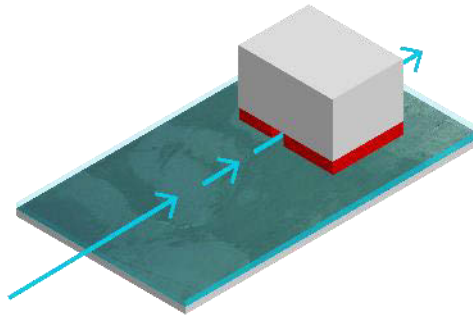
# ACCOMMODATE



Sketches for the purpose of workshop discussions.  
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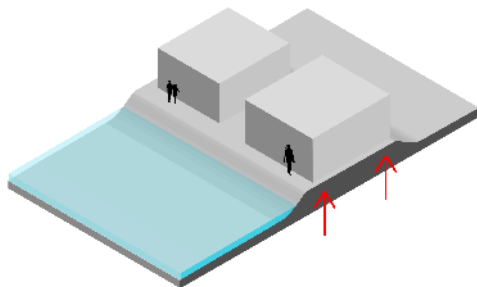
Raised Structures



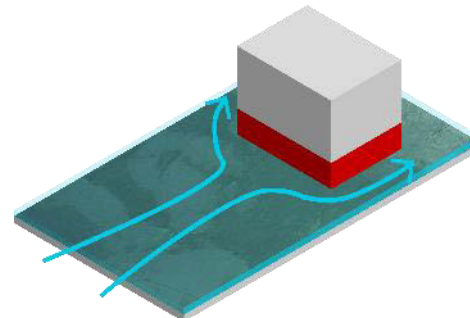
Wet Proofing



Community Preparedness



Build on Fill



Dry Proofing



Early Warning Systems

# ACCOMMODATE



## Parks with Flood Storage

Image Courtesy: Menomonee Floodplain, Wenk Landscape Architecture



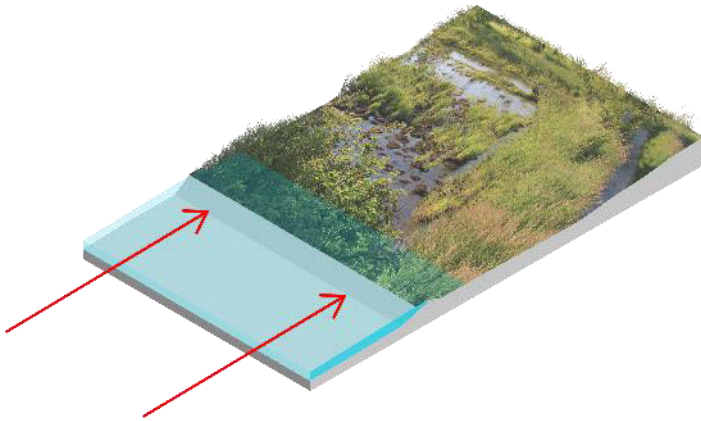
## Raised Home

Image Courtesy: Architecture Plans

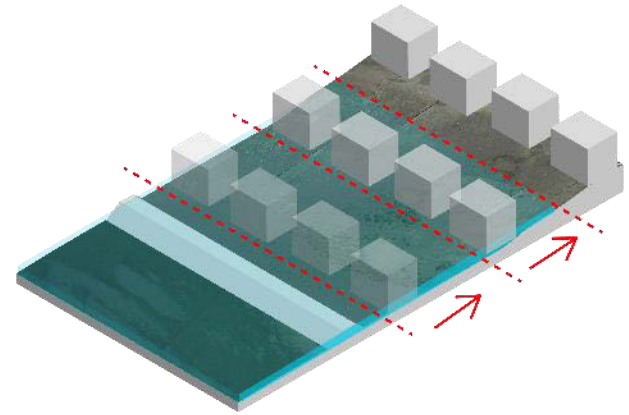
**MOVE**



**Sketches for the purpose of workshop discussions.  
Not final designs.**



Complete Retreat



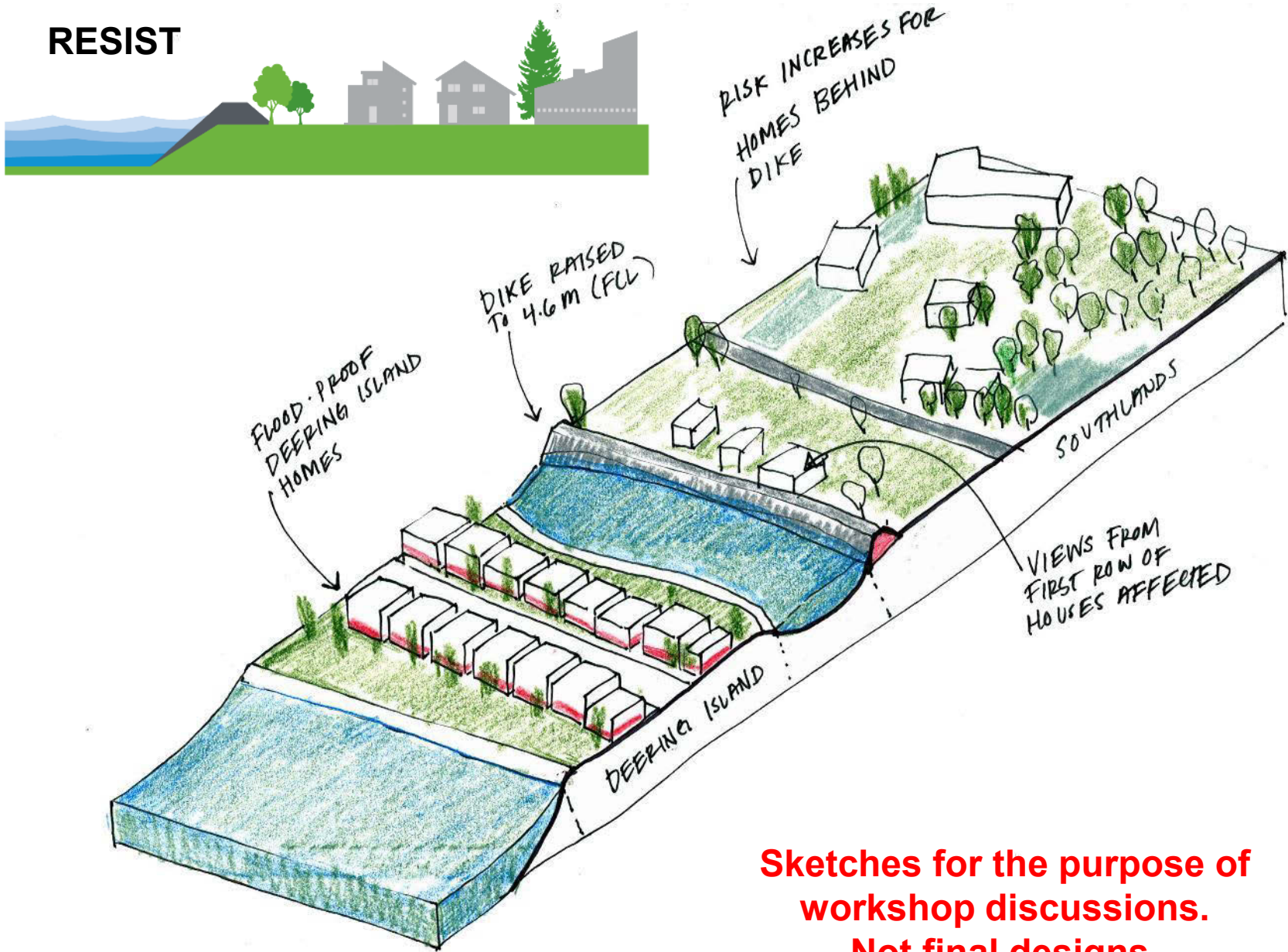
Staged Retreat

**MOVE**



Image: Larry Pynn, Vancouver Sun

# RESIST

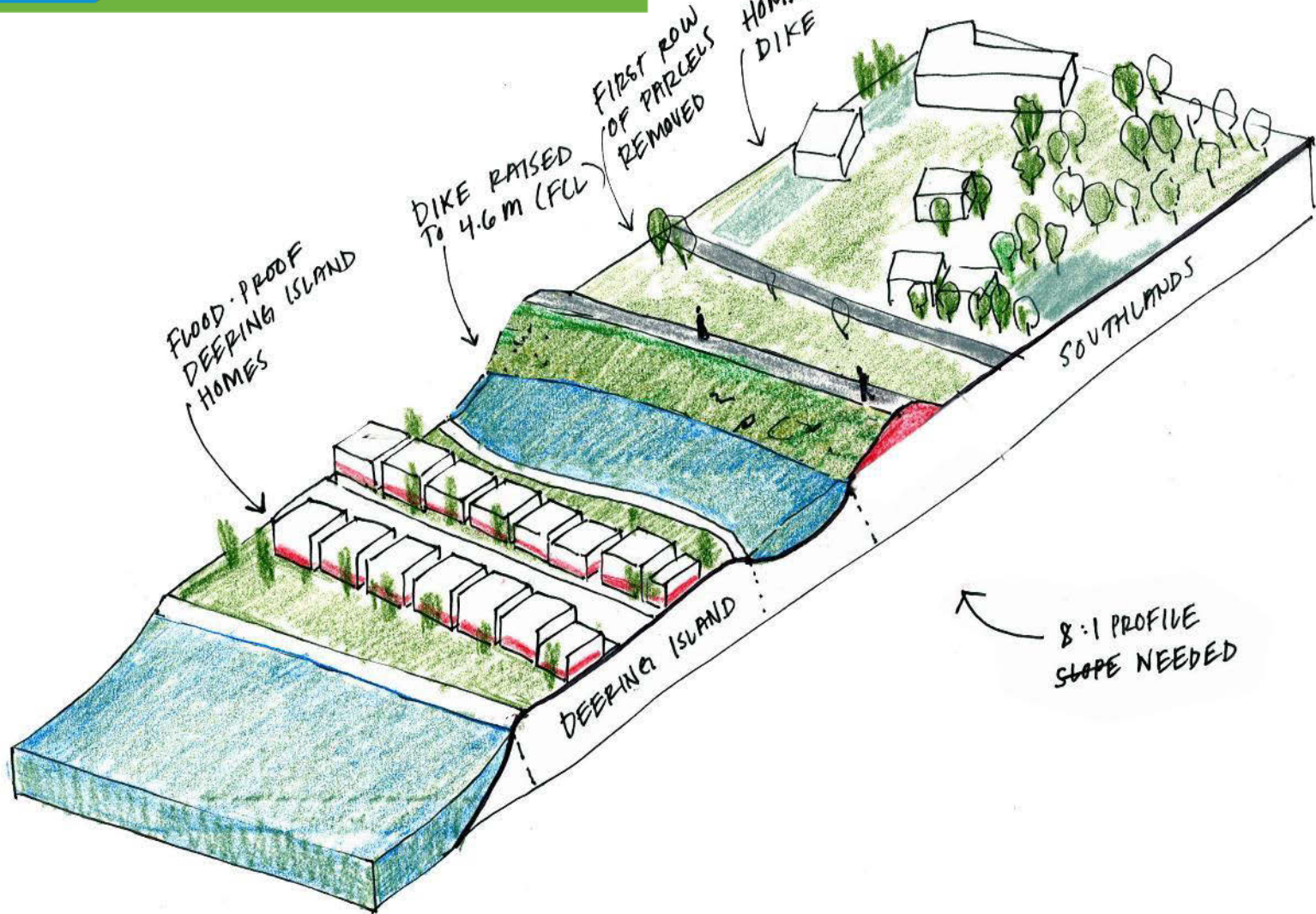


**Sketches for the purpose of workshop discussions.  
Not final designs.**

# RESIST



Sketches for the purpose of workshop discussions.  
Not final designs.

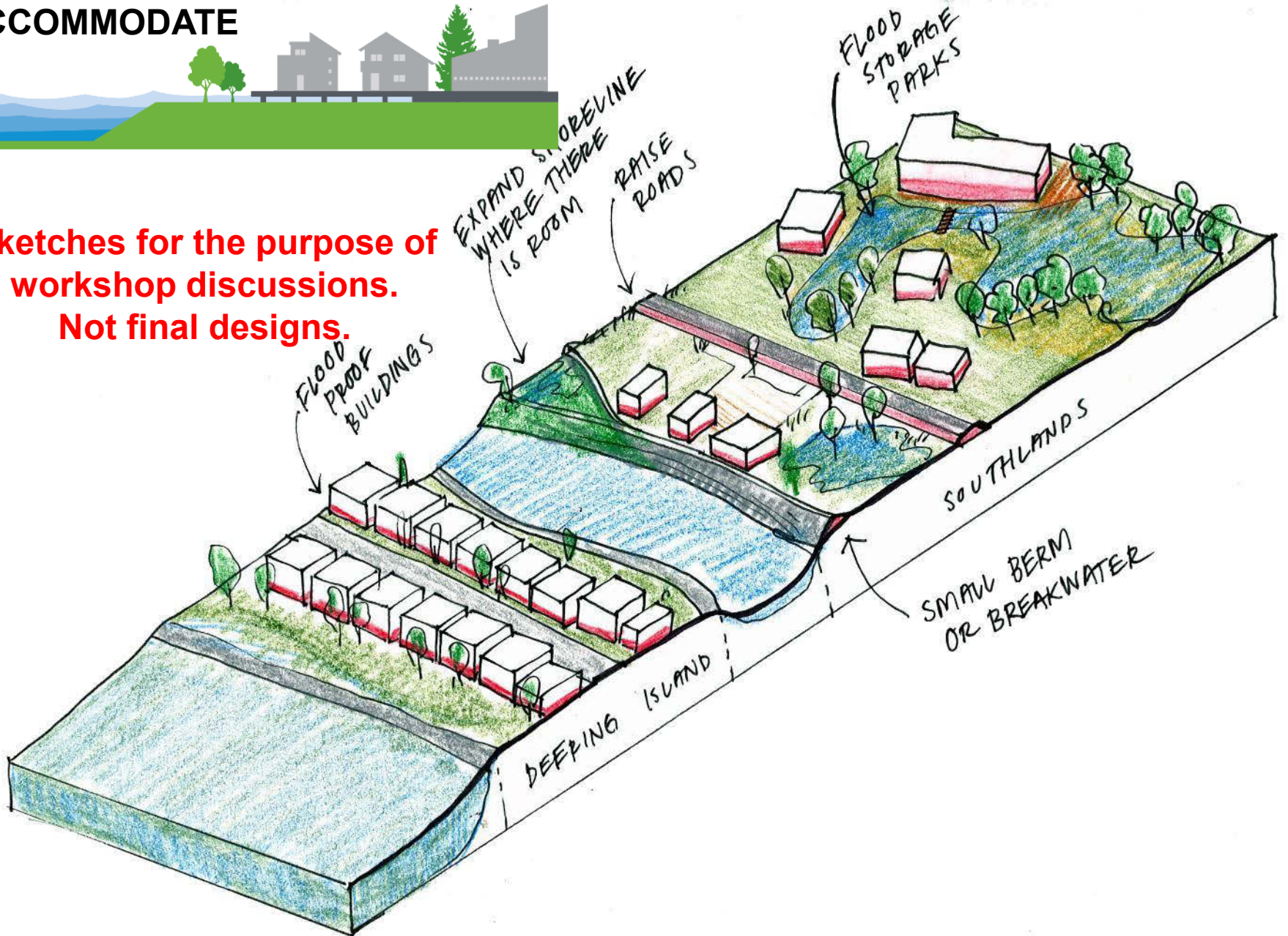




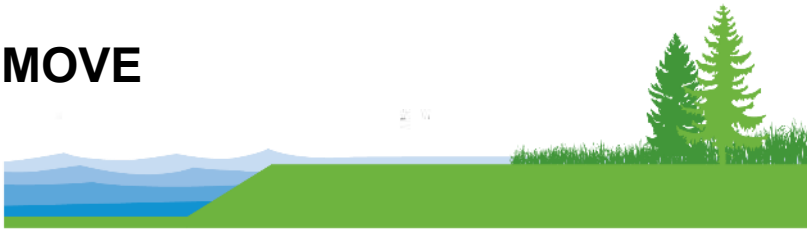
# ACCOMMODATE



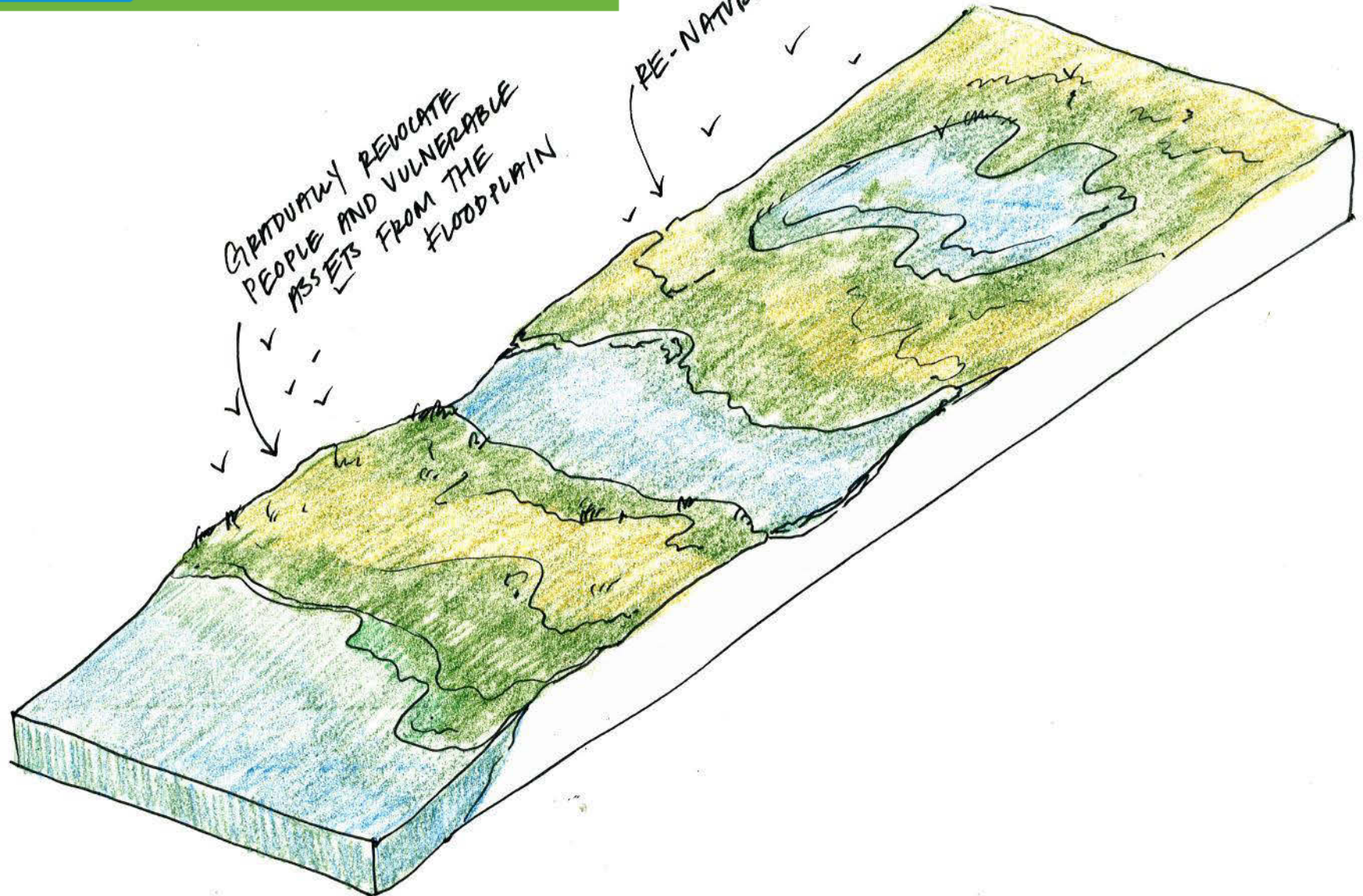
Sketches for the purpose of workshop discussions.  
Not final designs.



# MOVE

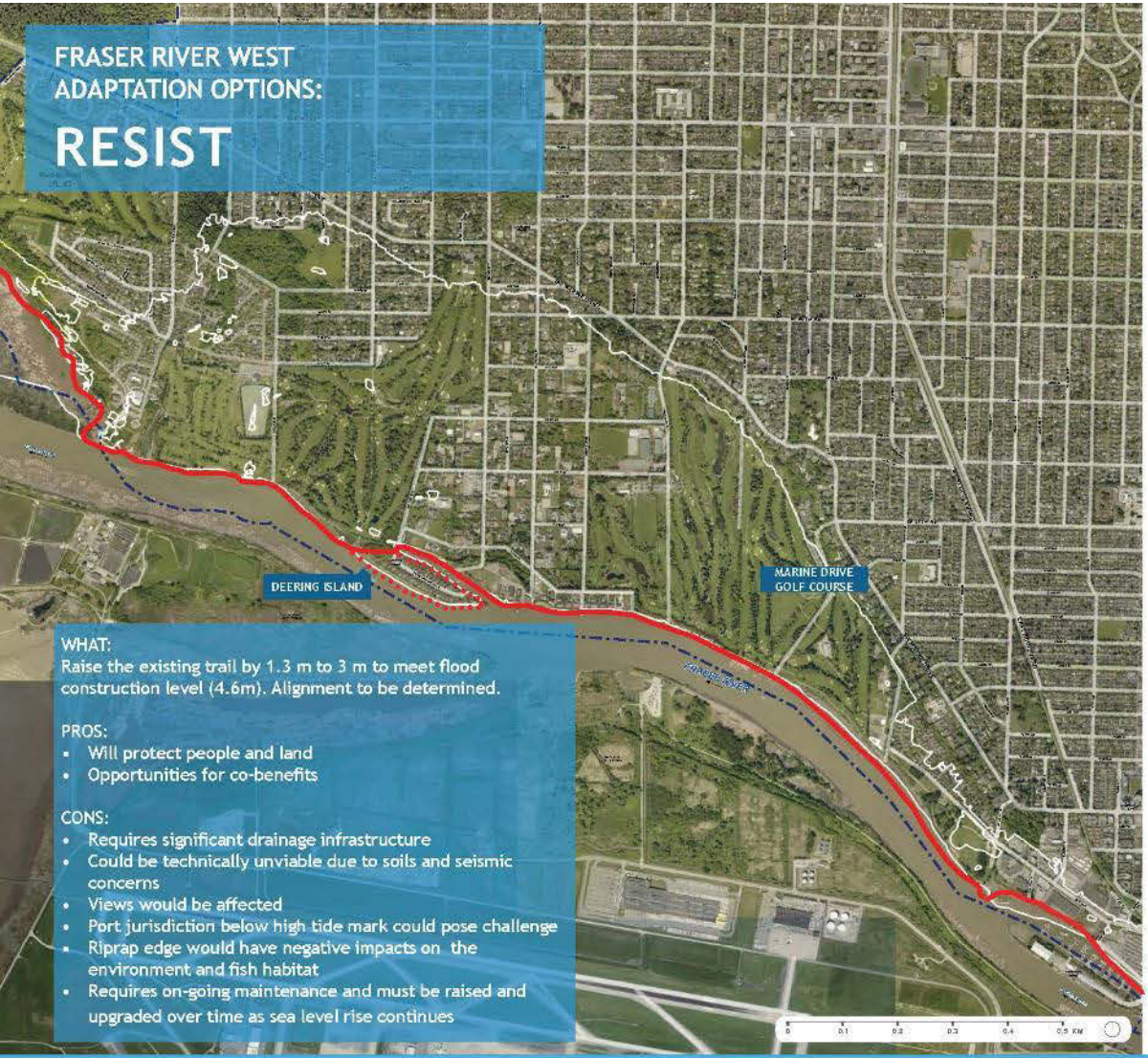


Sketches for the purpose of workshop discussions.  
Not final designs.



FRASER RIVER WEST  
ADAPTATION OPTIONS:

**RESIST**

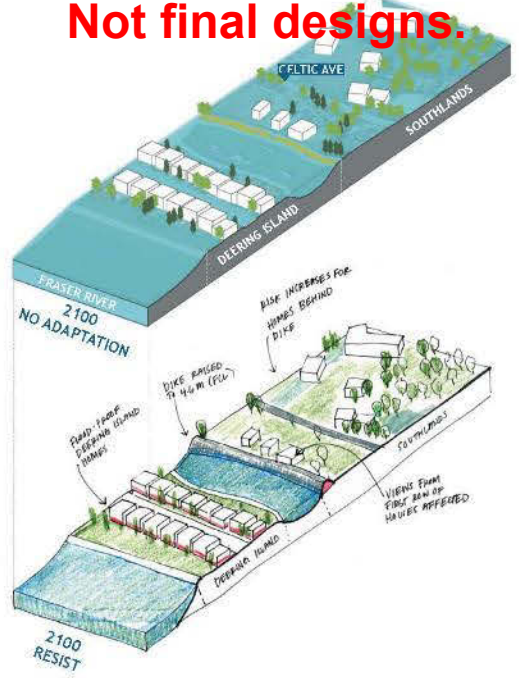


**WHAT:**  
Raise the existing trail by 1.3 m to 3 m to meet flood construction level (4.6m). Alignment to be determined.

- PROS:**
- Will protect people and land
  - Opportunities for co-benefits

- CONS:**
- Requires significant drainage infrastructure
  - Could be technically unviable due to soils and seismic concerns
  - Views would be affected
  - Port jurisdiction below high tide mark could pose challenge
  - Riprap edge would have negative impacts on the environment and fish habitat
  - Requires on-going maintenance and must be raised and upgraded over time as sea level rise continues

**Sketches for the purpose of workshop discussions. Not final designs.**



**WHAT THIS COULD LOOK LIKE**



*Raised Dike in Front of Homes  
Concept Rendering*



*Middle Arm Dike  
"A line with nature"*

**COASTAL ADAPTATION PLAN**  
FRASER RIVER FORESHORE



CITY OF VANCOUVER



# More information?



# COASTAL ADAPTATION PLAN

FRASER RIVER FORESHORE

Thank You!

**nhc**  
northwest  
hydraulic  
consultants



**connect**  
LANDSCAPE ARCHITECTURE



CITY OF  
VANCOUVER