

# City of Vancouver

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## Sea Level Rise Strategy

July 9, 2014



**GREENEST CITY 2020**





# Outline

Preparing for Climate Change

Impacts to Our Coastline

Sea Level Rise Strategy

Implications

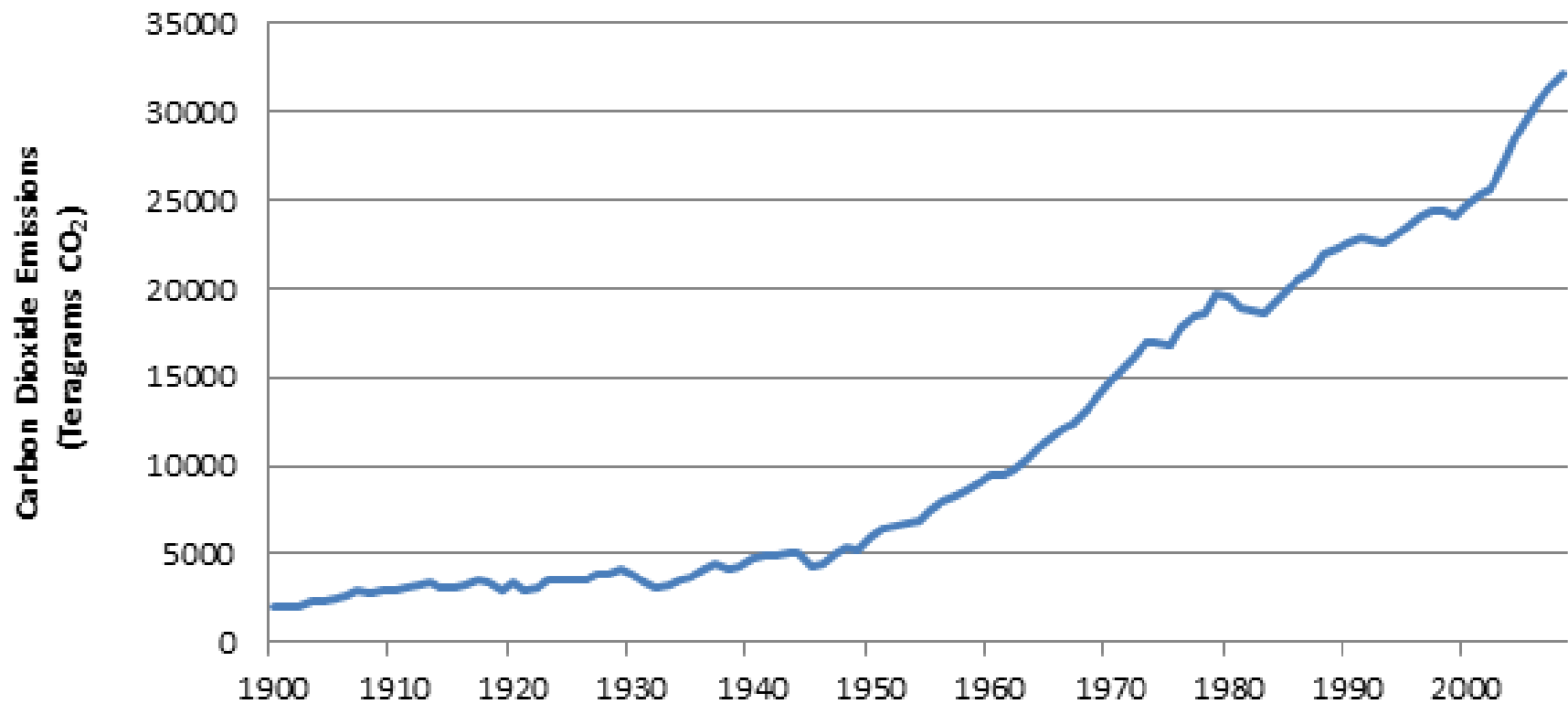
Summary, Recommendation, and Next Steps

# Preparing for Climate Change



Despite local efforts

Global green house gas emissions keep growing





As do the impacts of climate change

Extreme weather events cost Canadian insurers \$3.2B in 2013



Calgary Flood 2013

Climate change is creating  
unprecedented impacts globally ...



UK Floods 2014



... and locally, as sea level rise causes ocean and river flooding



Kits Pool: King Tide 2012

As well as increases in heavy rain events and hotter drier summers.





# To ensure Vancouver is ready, Council adopted an Adaptation Strategy with 9 Priority Actions and 46 supporting actions



1. Coastal Flood Risk Assessment
2. Amend minimum building elevations



3. Continue sewer separation
4. Citywide Stormwater Management Plan



5. Continue water conservation actions
6. Extreme Heat Planning



7. Complete an Urban Forest Strategy
8. Incorporate climate change in building code
9. Complete a back-up power plan

# Priority Actions are underway, including recommendations to address sea level rise



1. Coastal Flood Risk Assessment
2. Amend minimum building elevations

3. Continue sewer separation
4. Citywide Stormwater Management Plan

5. Continue water conservation actions
6. Extreme Heat Planning

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## Impacts to our Coastline







We rely heavily on our coastline

For Working

- ~135 Million Tonnes of cargo a year
- 98,800 jobs
- \$9.7 billion in Gross Domestic Product (GDP)
- \$20.3 billion in economic output
- \$1.3 billion per year in tax revenues

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For Playing

- 17 ha of natural shoreline habitat
- Almost 18 km of beaches surround Vancouver, including ten ocean-side locations and one fresh water lake.



An aerial photograph of a coastal city at sunset. The sky is filled with dramatic, golden-hued clouds. In the foreground, there are modern residential buildings with blue and white facades. A large marina is filled with numerous white sailboats and motorboats. In the background, a city skyline with tall buildings is visible, along with a bridge and mountains in the distance.

## For Living

- 25,000 people living within 300m of shoreline
- 16 million sq ft of residential space

Photo by Kenny Louie: Flickr

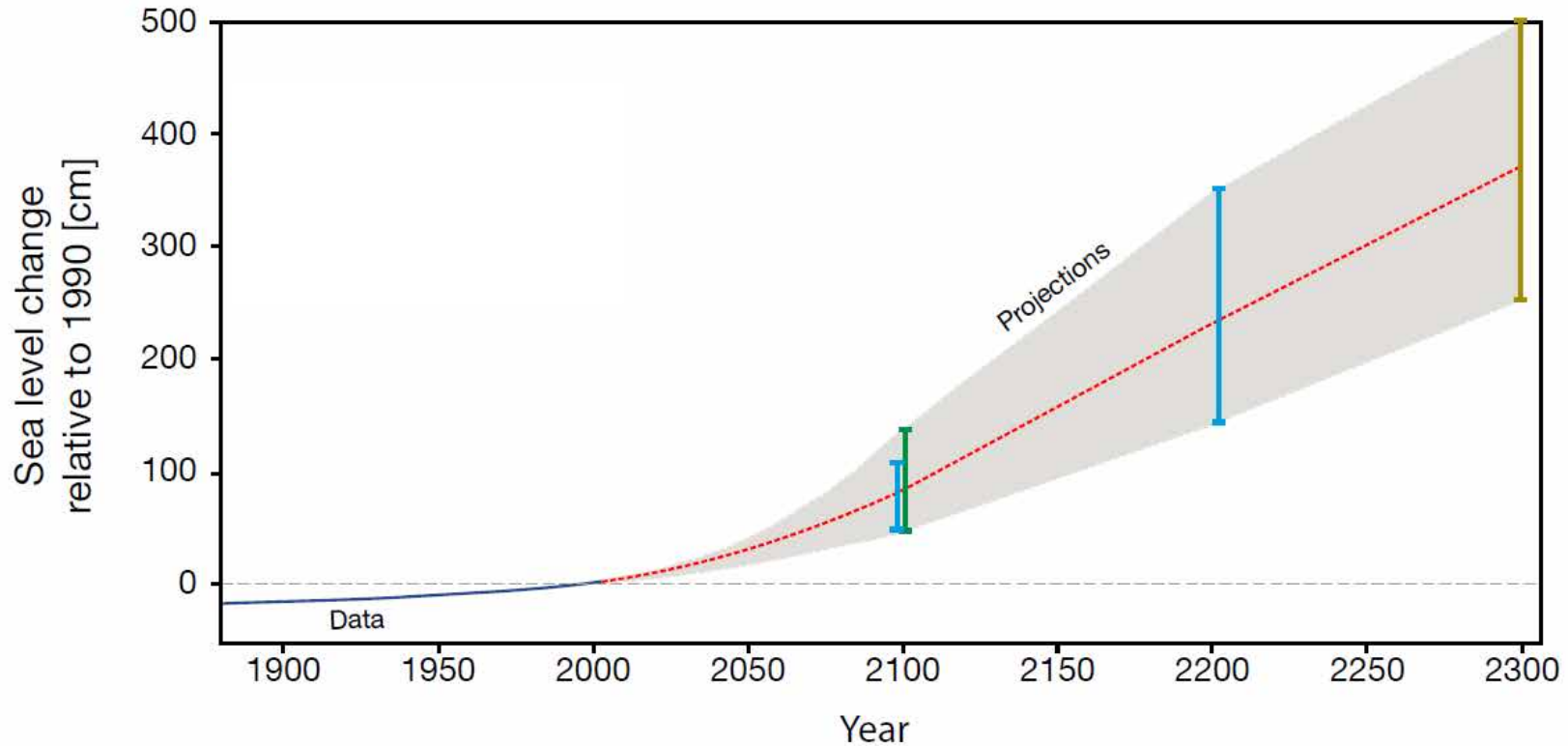




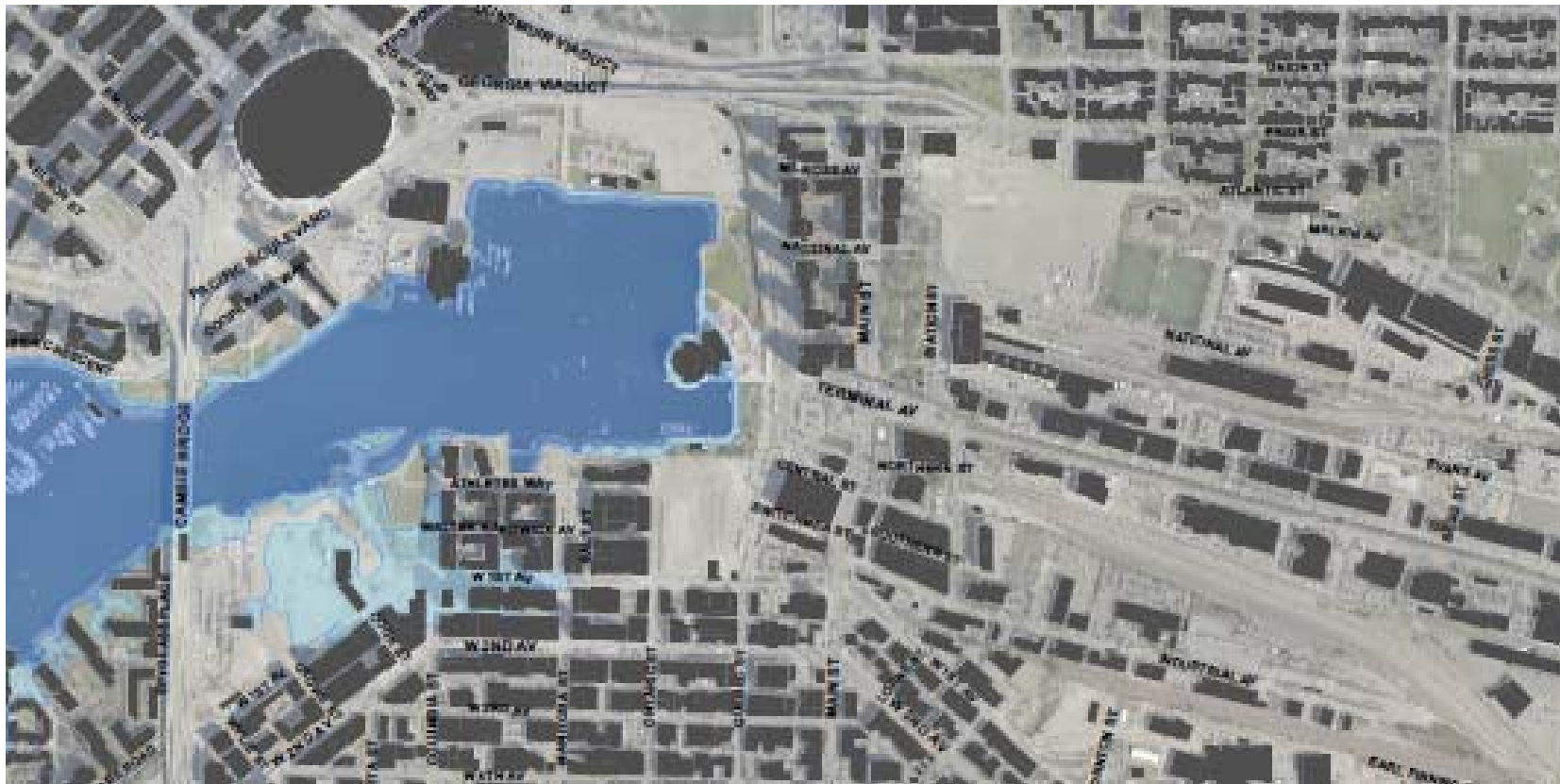
## For Tourism

- In 2012, the tourism industry generated \$3.6 billion in revenue
- Over 666,000 cruise ship passengers visited contributing \$167M to the economy

Our coastal areas will be impacted by ongoing sea level rise, unlike areas that will also be impacted by more intense storms



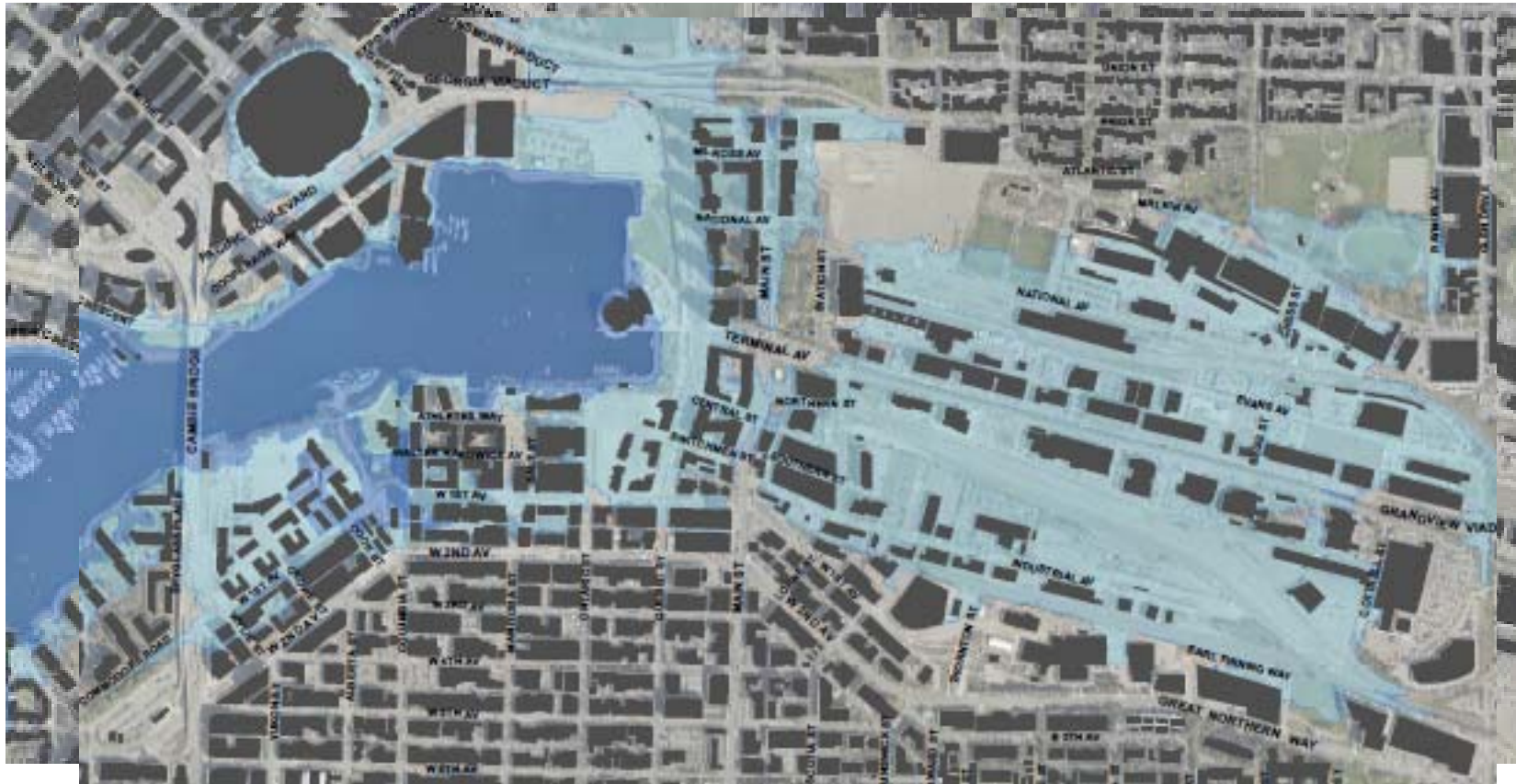
And with increasing sea level, our risk grows



Huge storm, high tide 2020

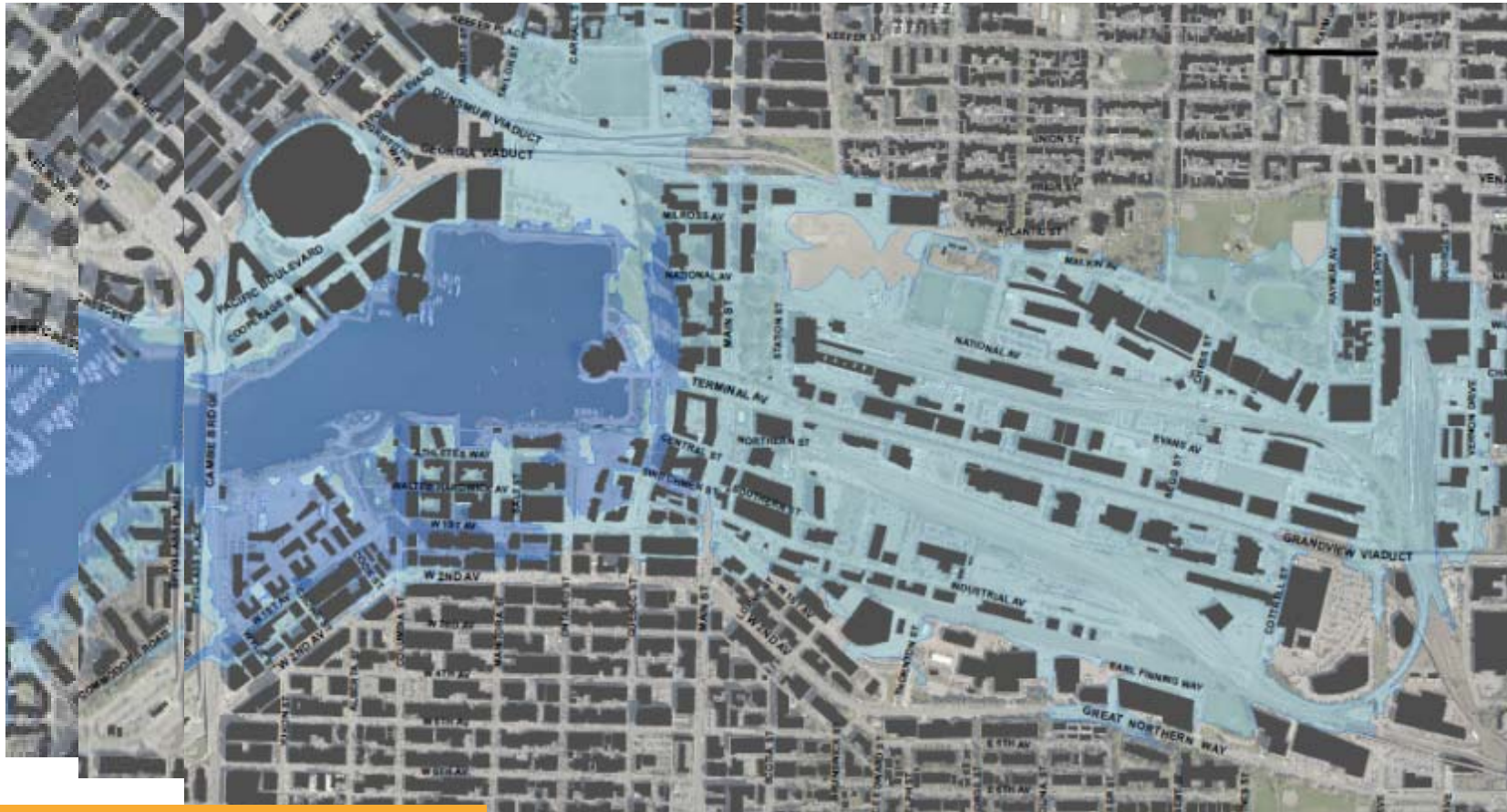


And with increasing sea level, our risk grows



~ year 2100

And with increasing sea level, our risk grows



~ year 2200





We're not alone, we can learn from others

## Big U project - Manhattan

- \$383 M project
- Protection that provides public space
- Increase flood construction levels

# City of Vancouver Sea Level Rise Strategy





# Sea Level Rise Strategy Principles

- Use best science and learn from others
- Pragmatic balance of cost and risk
- Be opportunistic and proactive
- Take a phased approach, distribute cost of adaptation across time

# Sea Level Rise Strategy

1. City-wide coastal flood response actions
2. Location-based responses
3. Leverage large-site redevelopments
4. Immediate actions in impacted areas

City-wide / Location-based / Large Site Redevelopment/ Immediate actions



# 1. City-wide Coastal Response

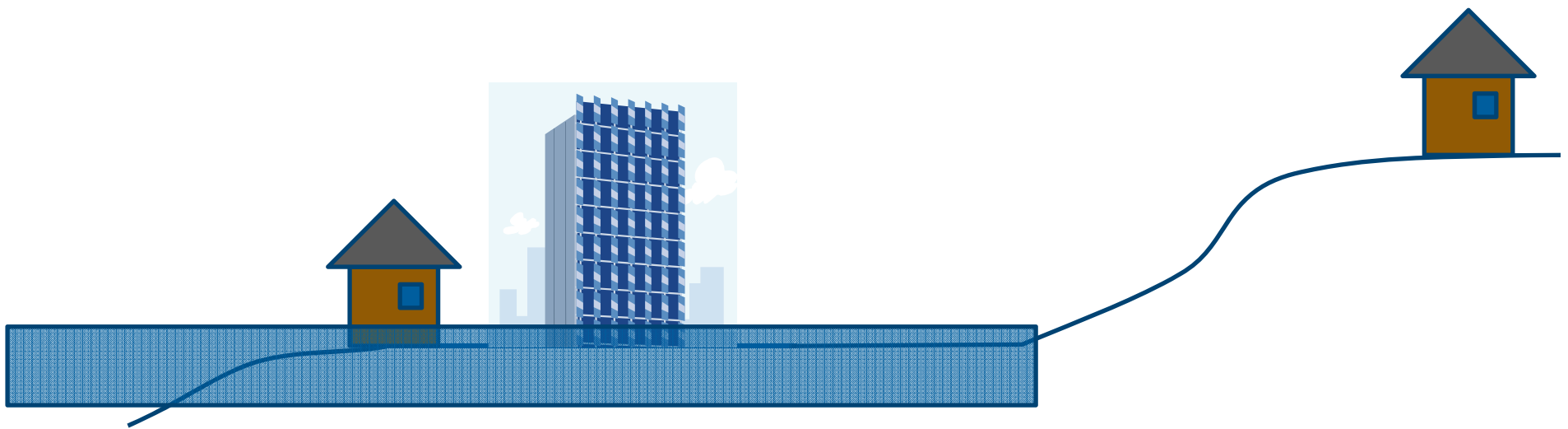


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City-wide / Location-based / Large Site Redevelopment / Immediate actions

Flood Construction Levels (FCL) ensure the ground floor of occupied space is protected from flood risks for the life of new buildings in designated flood plains

- FCL has been 3.5m since 1972
- Interim FCL of 4.5m has been in place since Jan. 2012 in response to Provincial warnings of projected sea-level rise



Recommend Flood Construction Level be raised to at 4.6 m

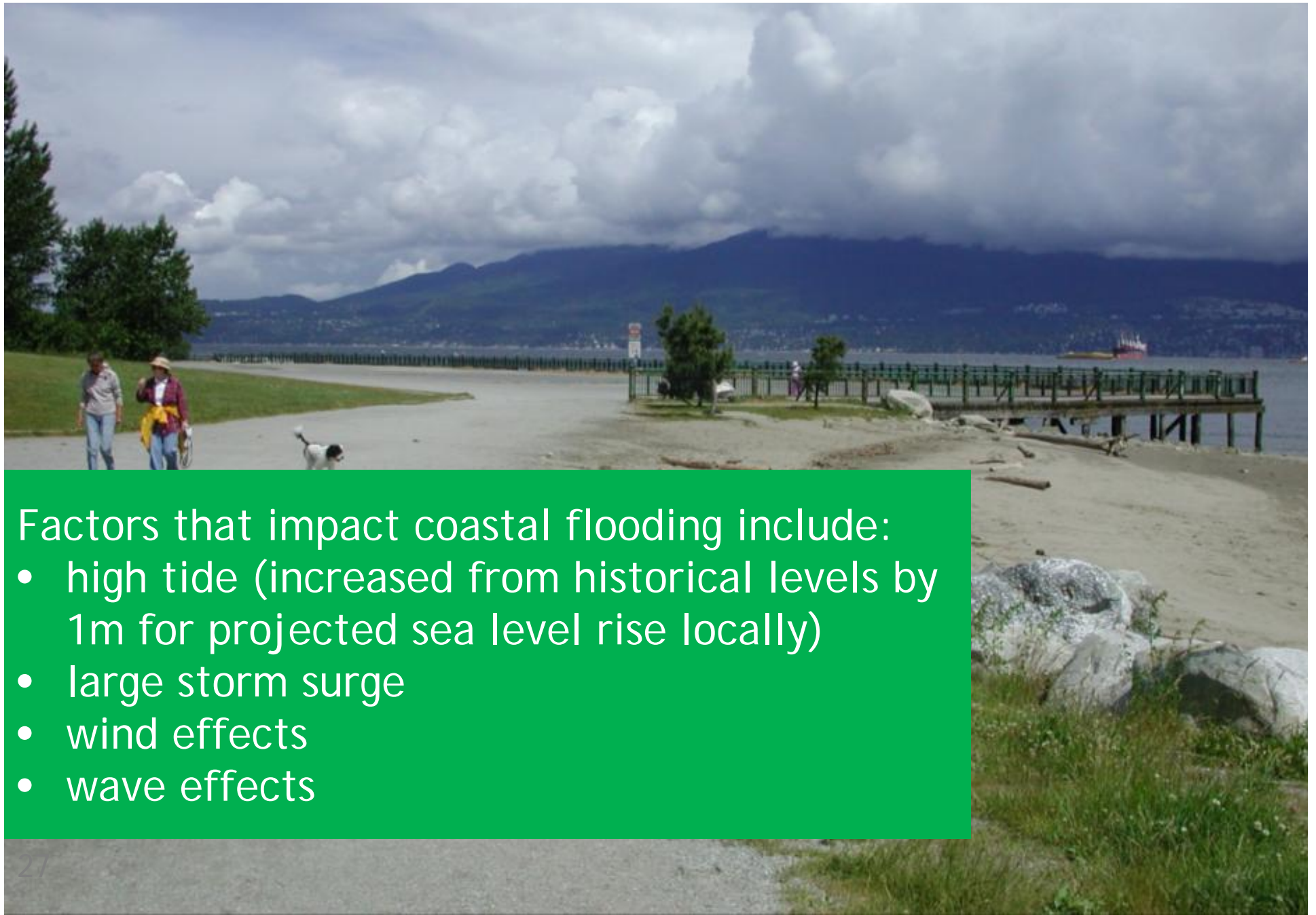
- Sophisticated modelling of coastal flooding factors following the Provincial methodology indicated that the FCL should be set at 4.6m



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City-wide / Location-based / Large Site Redevelopment / Immediate actions



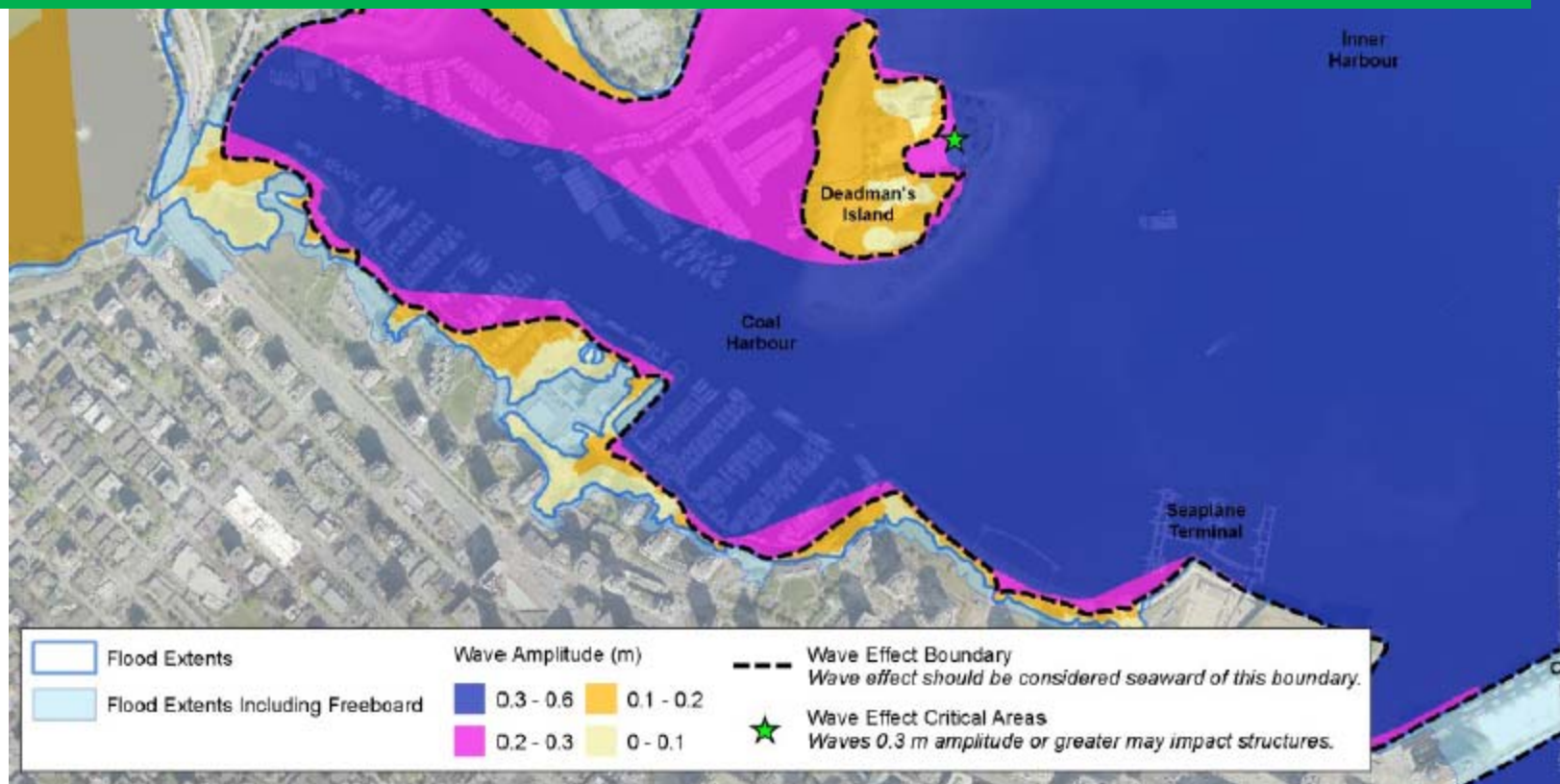


Factors that impact coastal flooding include:

- high tide (increased from historical levels by 1m for projected sea level rise locally)
- large storm surge
- wind effects
- wave effects

City-wide / Location-based / Large Site Redevelopment / Immediate actions

Statistical and coastal flood modelling assessed the probability of extremes of these factors occurring simultaneously and the impact they would have on Vancouver's shoreline.

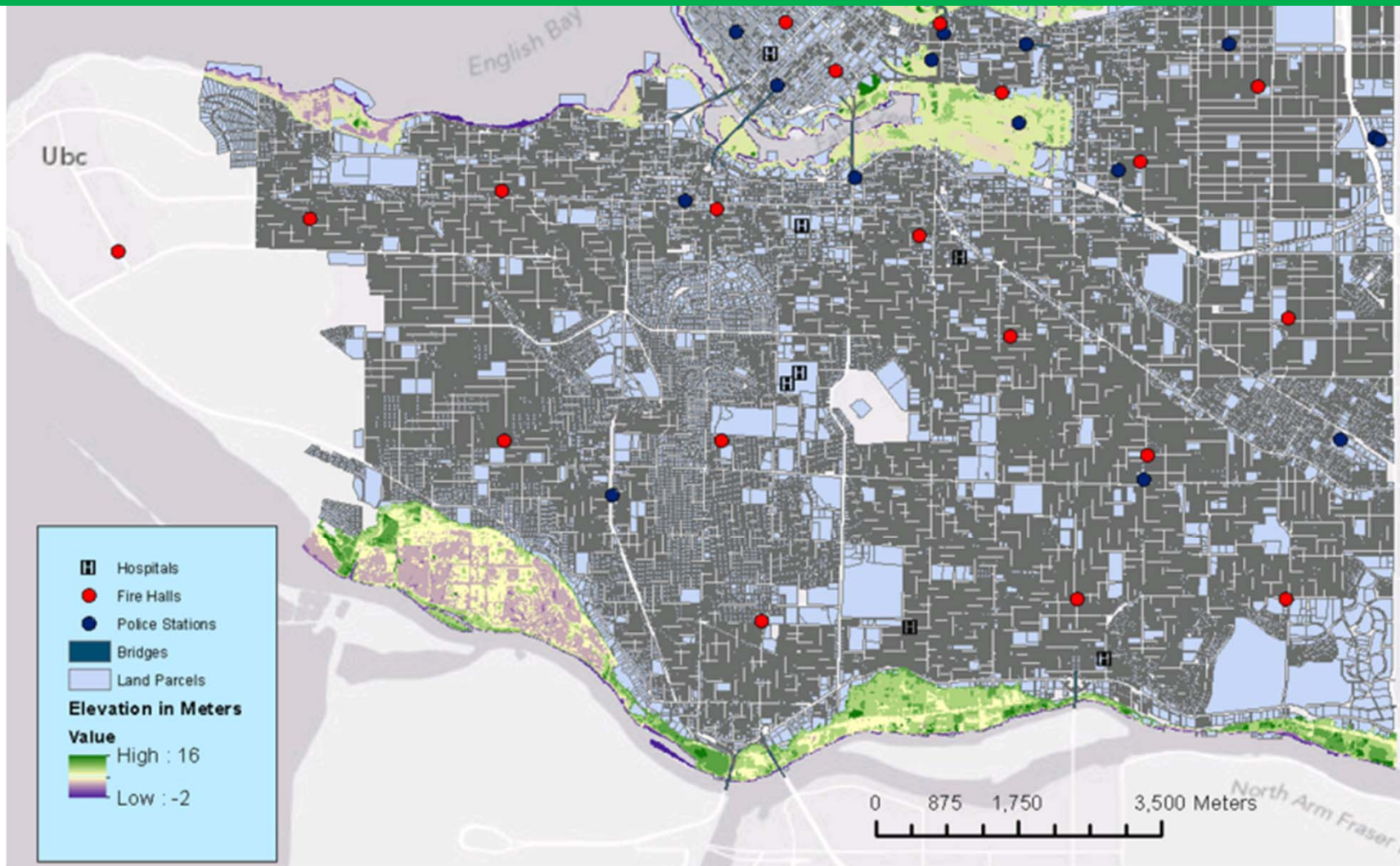


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City-wide / Location-based / Large Site Redevelopment / Immediate actions



The models were used to map coastal flood plains and depth of flooding to the year 2100 and establish the FCL recommendation.



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City-wide / Location-based / Large Site Redevelopment / Immediate actions



Raising FCLs provides an immediate level of protection for at-risk areas while location-based responses are developed

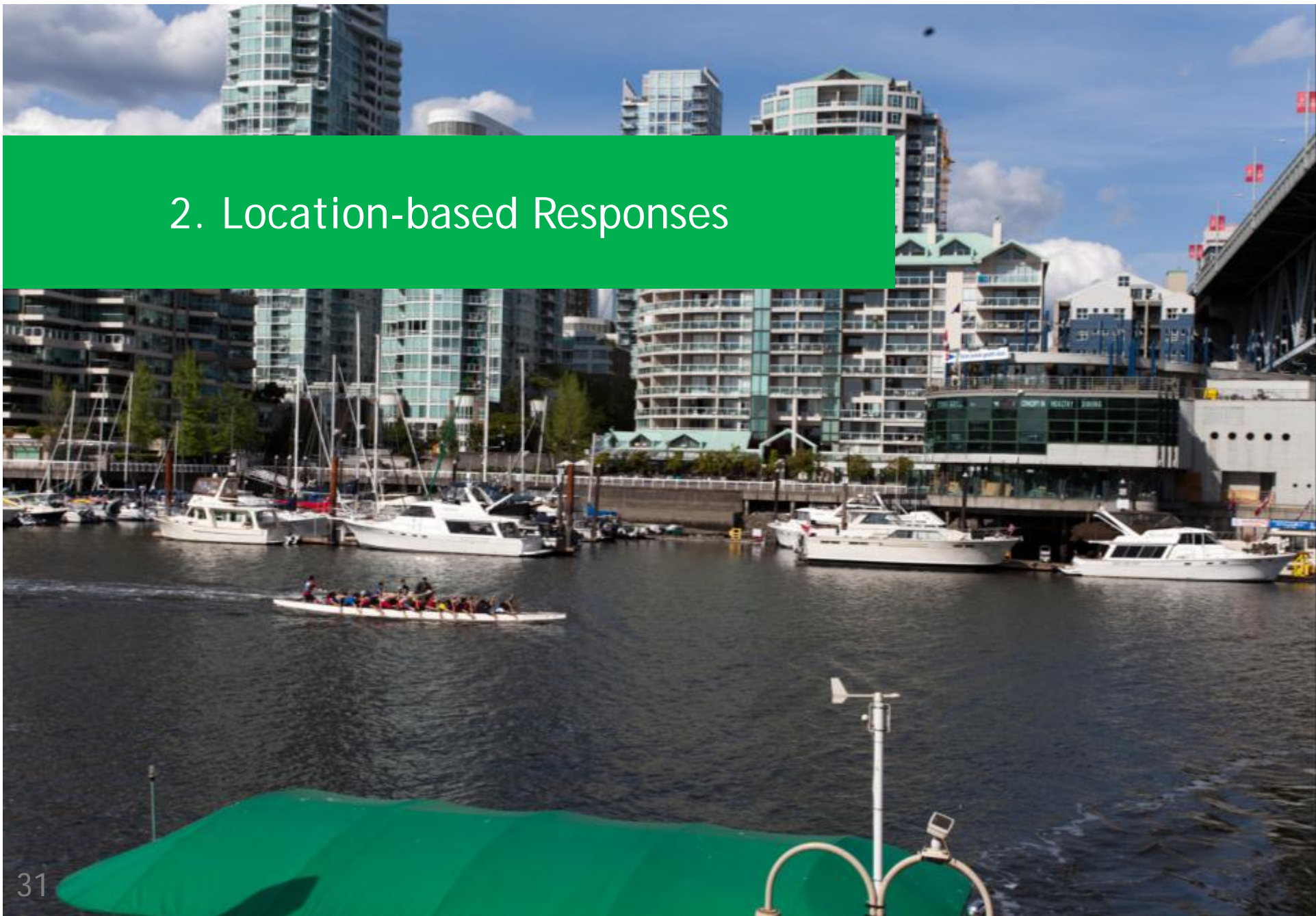


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City-wide / Location-based / Large Site Redevelopment / Immediate actions



## 2. Location-based Responses



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City-wide / Location-based / Large Site Redevelopment / Immediate actions



Modelling indicated future flood prone locations include:

Coal Harbour

Port

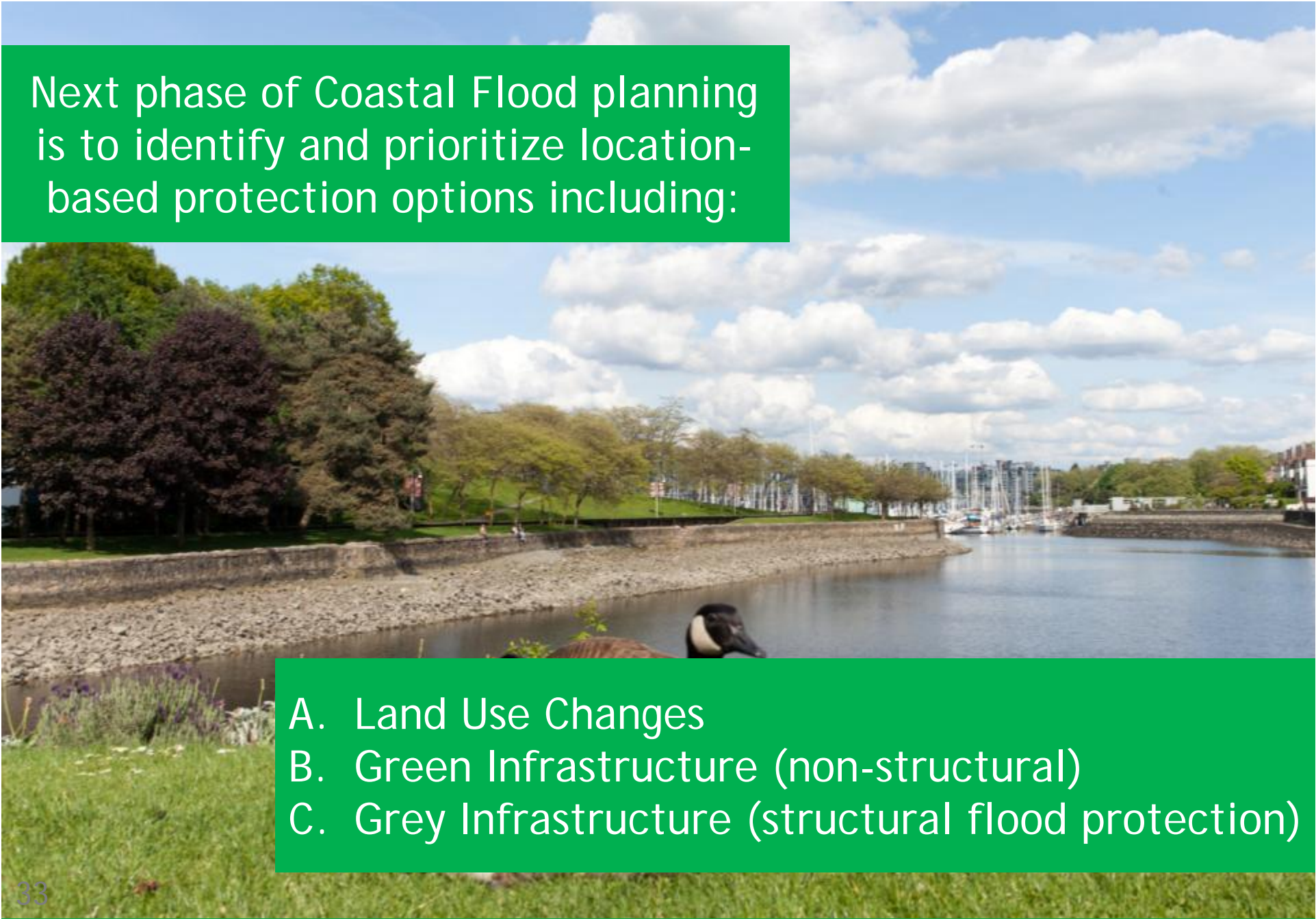
Kits Point

False Creek

Southlands

River District





Next phase of Coastal Flood planning is to identify and prioritize location-based protection options including:

- A. Land Use Changes
- B. Green Infrastructure (non-structural)
- C. Grey Infrastructure (structural flood protection)



## A. Land use changes

- Restrict permitted uses in flood plain
- Create flood management buffers, including existing or new parks
- Regulate building design and equipment placement to minimize flood damage and disruption



## B. Green Infrastructure (non-structural)



- Creation or restoration of wetlands
- Sand dune building
- Beach enhancements to disrupt wave effects
- Etc.



## C. Grey Infrastructure (structural flood protection)



- Dykes and berms
- Increased road elevations
- Flood gates
- Over time, new buildings developed at higher FCLs can also form part of a neighbourhood protection plan



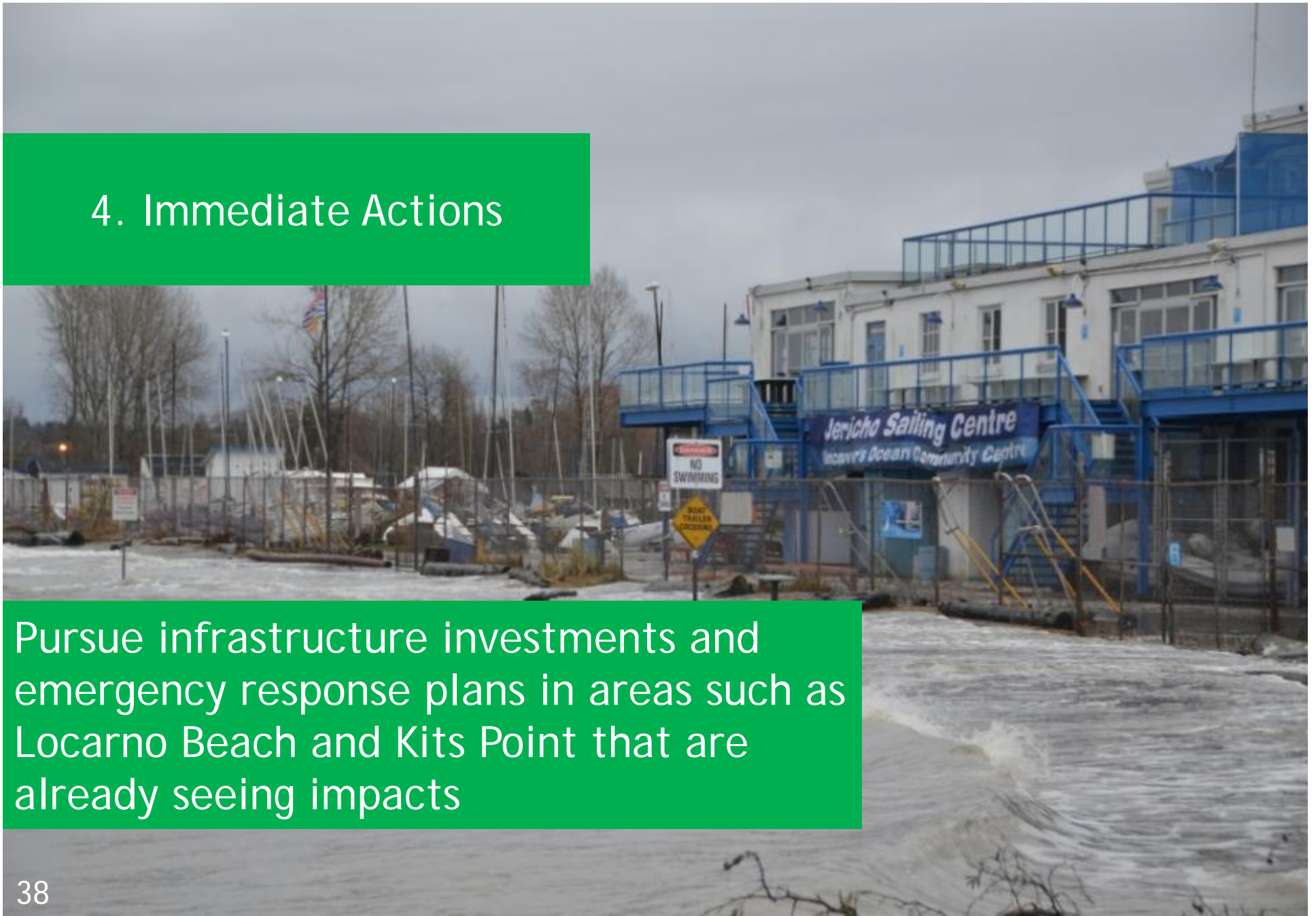
### 3. Leverage Large Site Redevelopment

Explore opportunities to leverage large scale developments and infrastructure projects to provide flood protection beyond 2100 and/or for entire areas:

- Increased FCL (eg. River District)
- Viaducts removal *may* create opportunity to build elevated road surface to act as a berm

## 4. Immediate Actions

Pursue infrastructure investments and emergency response plans in areas such as Locarno Beach and Kits Point that are already seeing impacts





## Summary

- Best science was used to set recommended flood construction levels

The Sea Level Rise Strategy includes:

1. City-wide coastal flood response actions
2. Location-based response planning
3. Leveraging large-site redevelopments
4. Immediate actions in impacted areas

## Recommendation

- Approve immediate Vancouver Building Bylaw amendment to increase flood construction levels in designated flood plains and update associated bylaws

## Next Steps

- Identify and prioritize location-based responses
- Explore large site redevelopments and infrastructure projects for flood protection opportunities
- Develop protection and response plans for areas already being impacted