



# SURREY COASTAL FLOOD ADAPTATION STRATEGY (CFAS)

General Phase 1 Workshop Presentation  
(February 3 through March 8, 2017)

# Agenda

- Introductions and Overview
- Project Overview
- Activity 1 – Hazards
- BREAK
- Activity 2 – Issues and concerns
- BREAK
- Activity 3 – Options identification – concerns (if time permits)
- Next Steps

CFAS Focus Group

# INTRODUCTIONS

# Our objectives for the day

- Get a better understanding of:
  - Sea level rise and its impacts on coastal flooding in Surrey,
  - Coastal flooding hazards it presents (short-, medium- and long-term)
  - The Coastal Flood Adaptation Strategy (CFAS) project
- Identify your issues and concerns around coastal flooding
- Explore some preliminary options for addressing coastal flood hazards
- Discuss how best to keep you engaged in the CFAS project

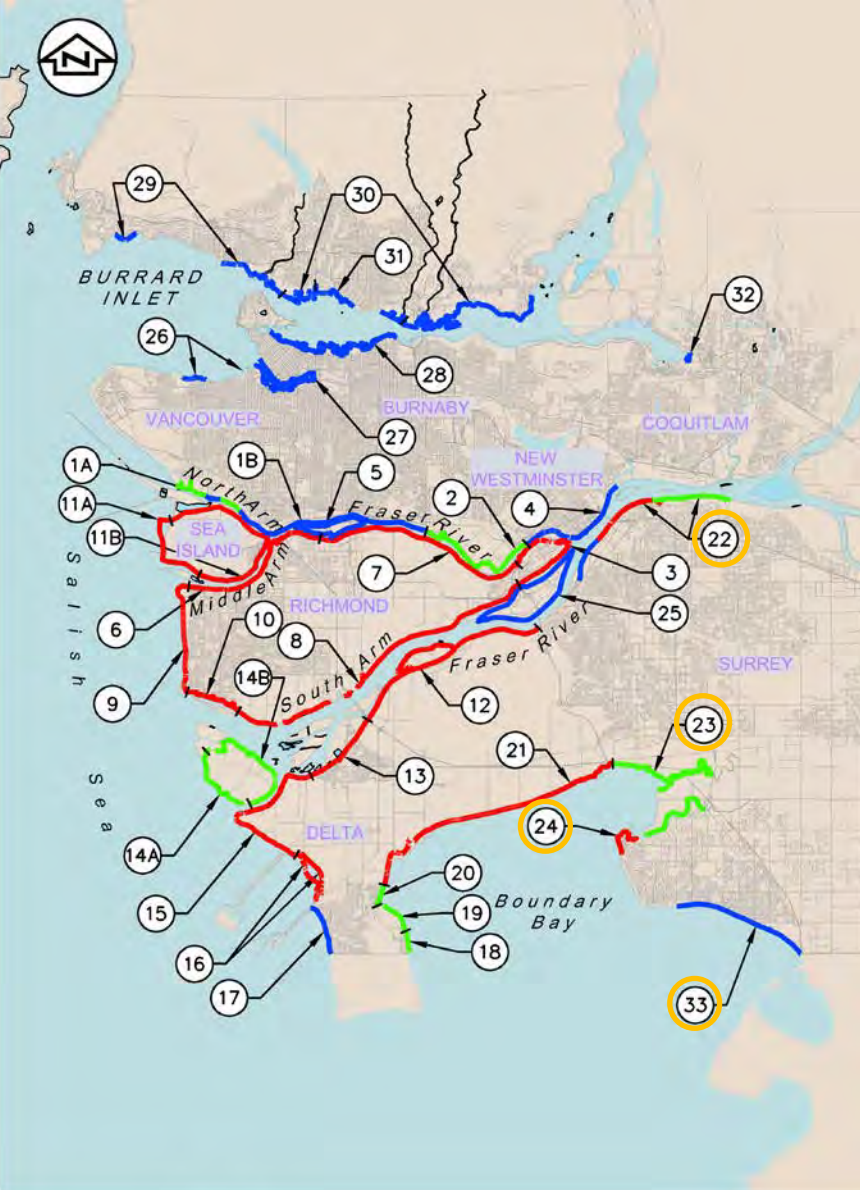


CFAS Focus Group

# PROJECT OVERVIEW

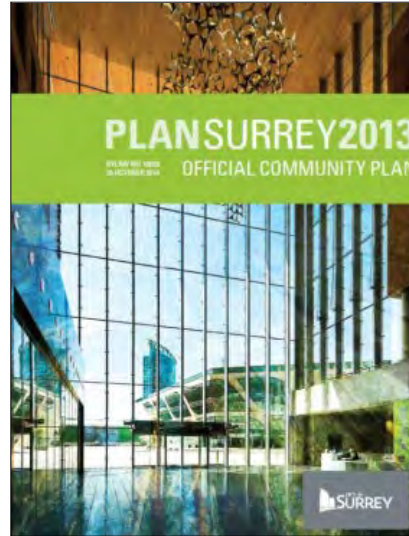
# Introduction & Summary

- 2011 Provincial Guidelines on sea level rise published
- Outlined expected sea level rise and flood protection requirements
- 2012 report estimated the cost to adapt flood protection to meet the rise in sea level predicted by 2100
- \$9.5 Billion estimate for Lower Mainland
  - Estimate of works in Surrey, \$1.5B



# Introduction & Summary

- Multiple Surrey plans and initiatives recognize challenge
- CFAS a product of this work and the next step





# Introduction & Summary

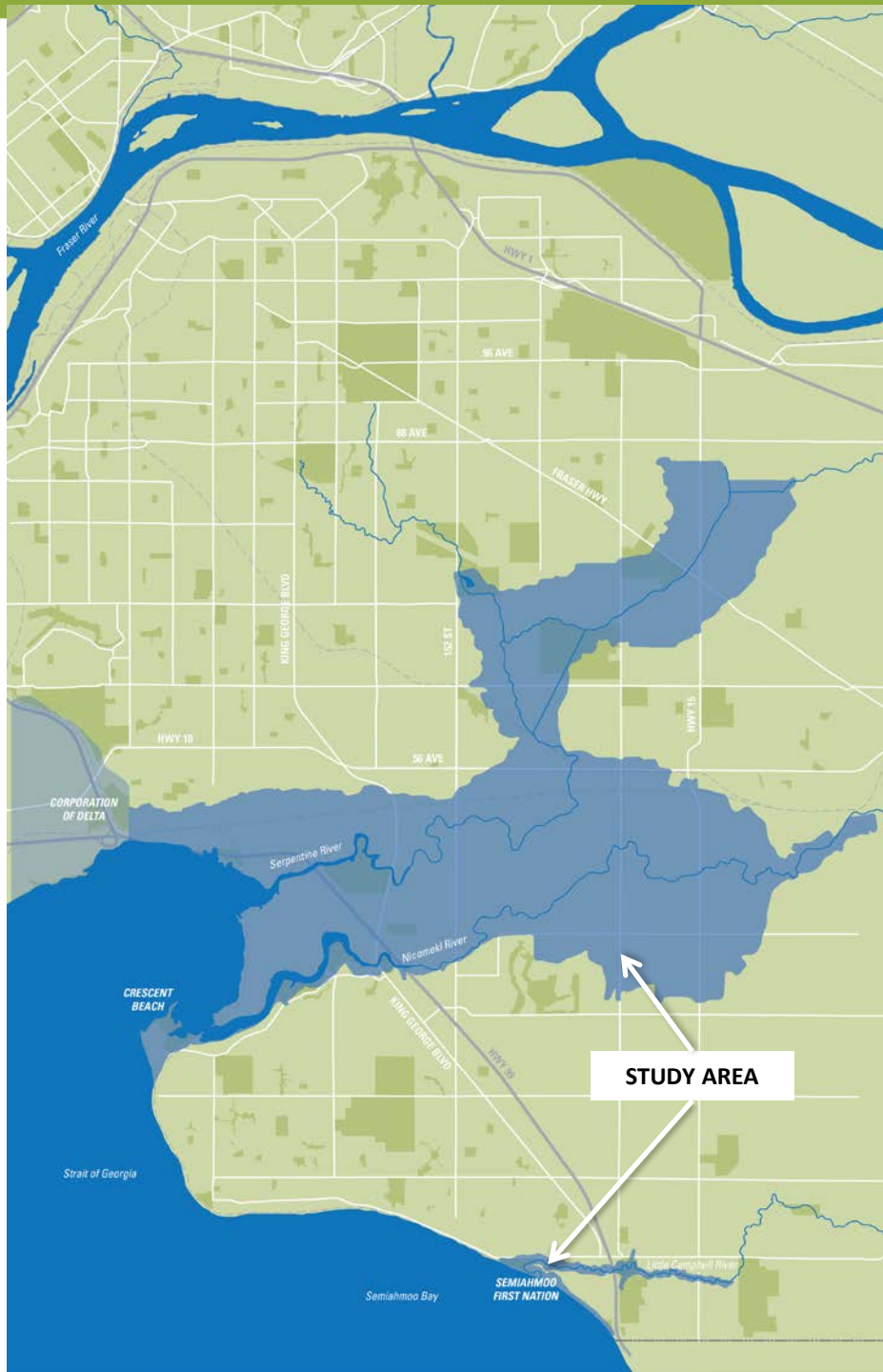
- CFAS is also continuing Surrey's commitment to community-driven, participatory planning





# CFAS

- Meeting an identified challenge
- Building on past work
- Linked to current work
- Continuing commitment to participatory planning
- Launched in fall 2016
- 3-year timeline
- Large study area with many communities, stakeholders and partners



# Study area @ a glance

## COMMUNITIES AND PEOPLE



Many residential areas and neighbourhoods  
Semiahmoo First Nation  
1,500+ residents  
Approximately 20% of Surrey's land area

## PARKS AND ENVIRONMENT



Destination regional and City parks  
Beaches and recreation areas  
Critical foreshore, coastal, and riparian areas

## LOCAL AND REGIONAL ECONOMY



700+ jobs  
Over \$100M in annual farm gate revenue  
Over \$1B in assessed property value  
Almost \$25B annual truck and rail freight traffic

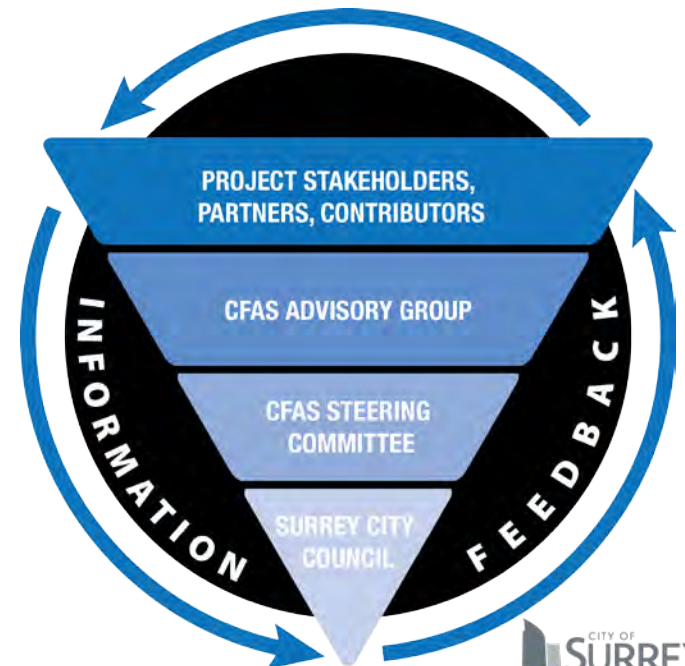
## INFRASTRUCTURE



Over 10km of Provincial Highways  
Over 200,000 vehicle trips a day  
Over 30km of railway (freight, passenger)

# Surrey CFAS Process

- Many stakeholders
  - Farmers and agricultural community
  - Residents, businesses, community groups
  - Environmental and recreational groups
  - Infrastructure operators and owners
  - Semiahmoo First Nation





# Surrey CFAS Process



CFAS Focus Group

# COASTAL FLOODING & SEA LEVEL RISE

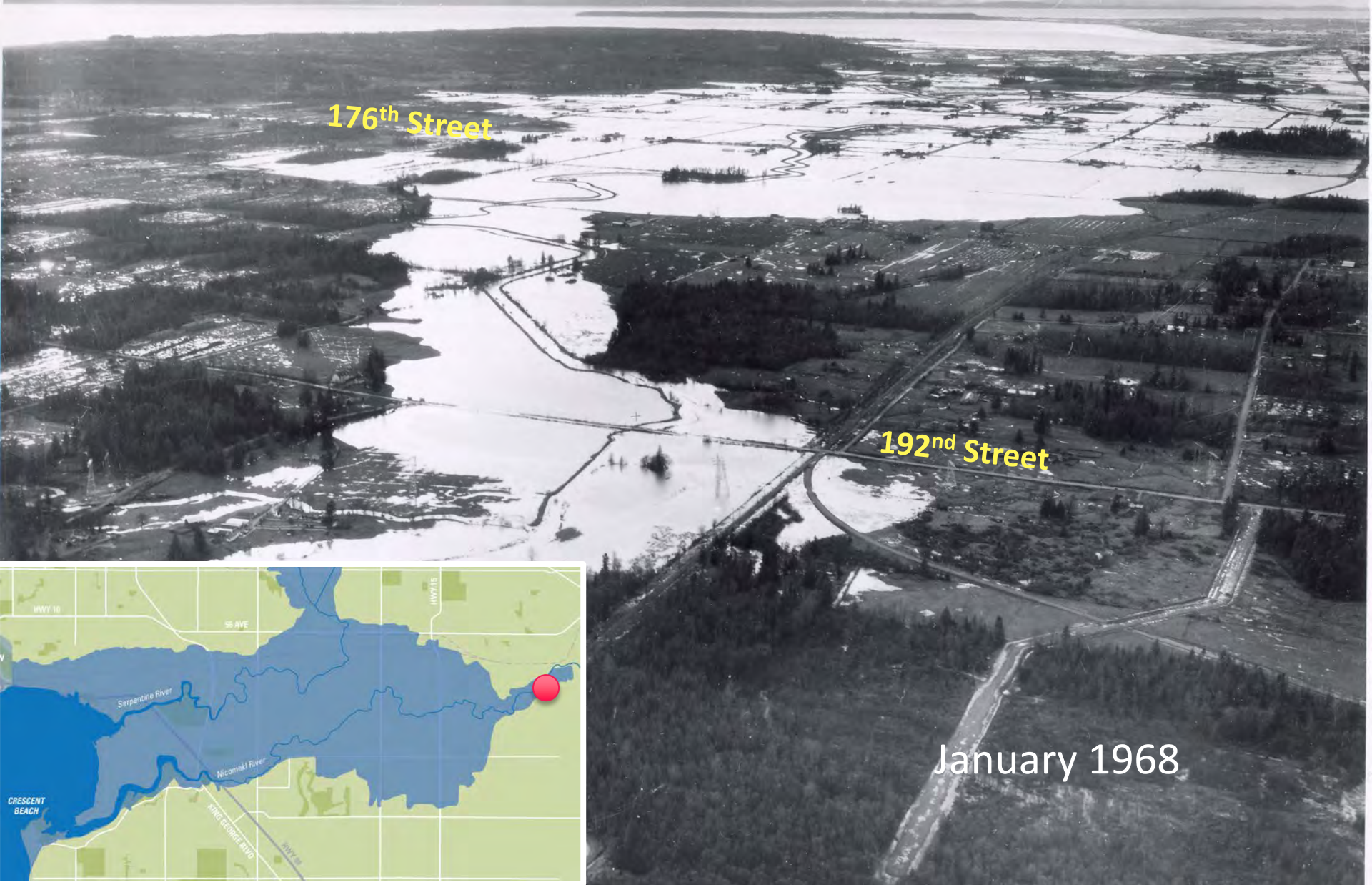
# Surrey's Coastal Floodplain



- A natural floodplain
- Regularly experiences coastal flooding
- Ocean-driven flooding (storm surges, king tides)
- River-driven flooding (rain storms, rapid snow melt)



# Coastal Flooding in Surrey



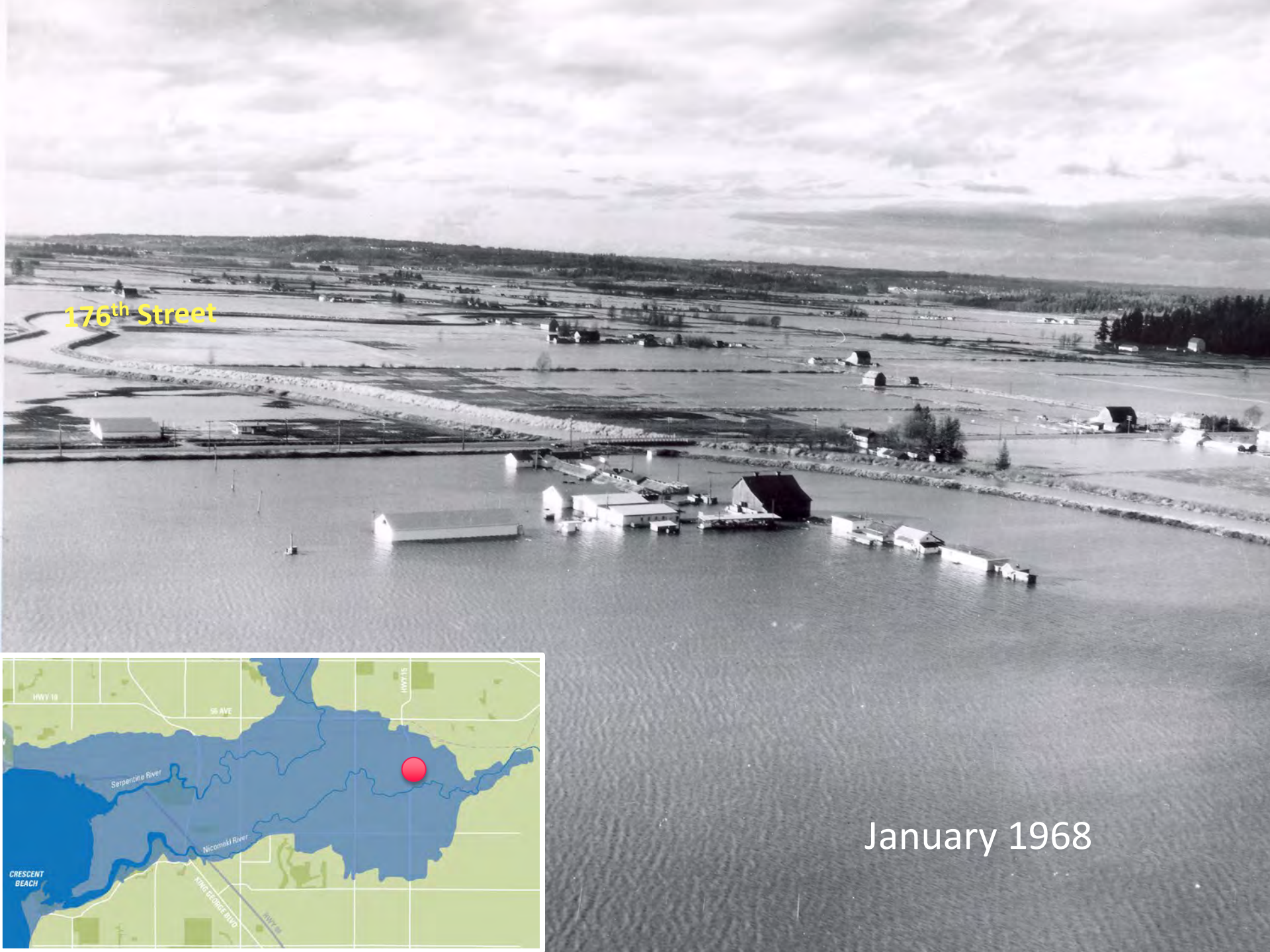
176<sup>th</sup> Street

192<sup>nd</sup> Street

January 1968

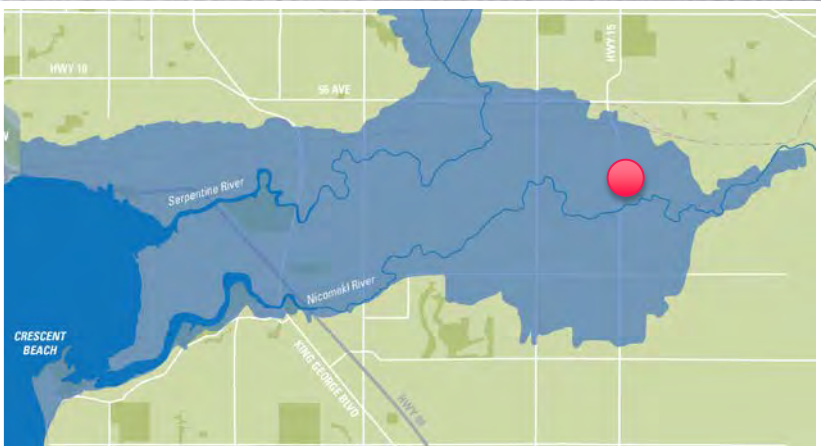






176<sup>th</sup> Street

January 1968





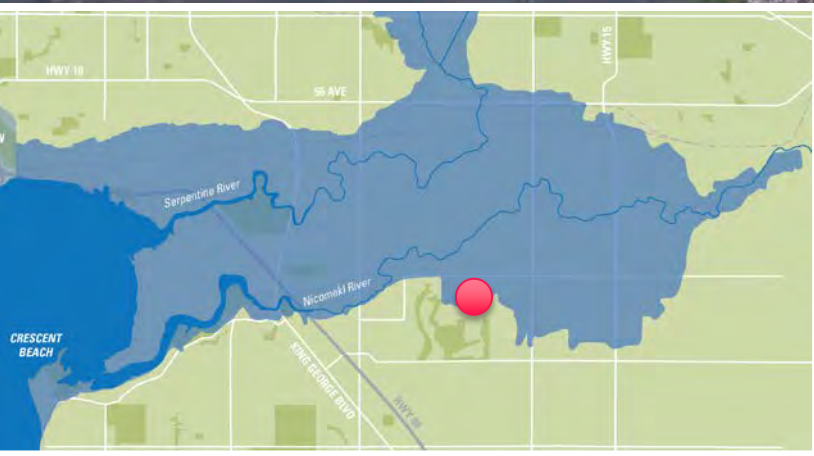


Hwy 10

168th Street

40th Avenue

January 2009







Colebrook Park

Serpentine WMA

January 2009







Winter 2016



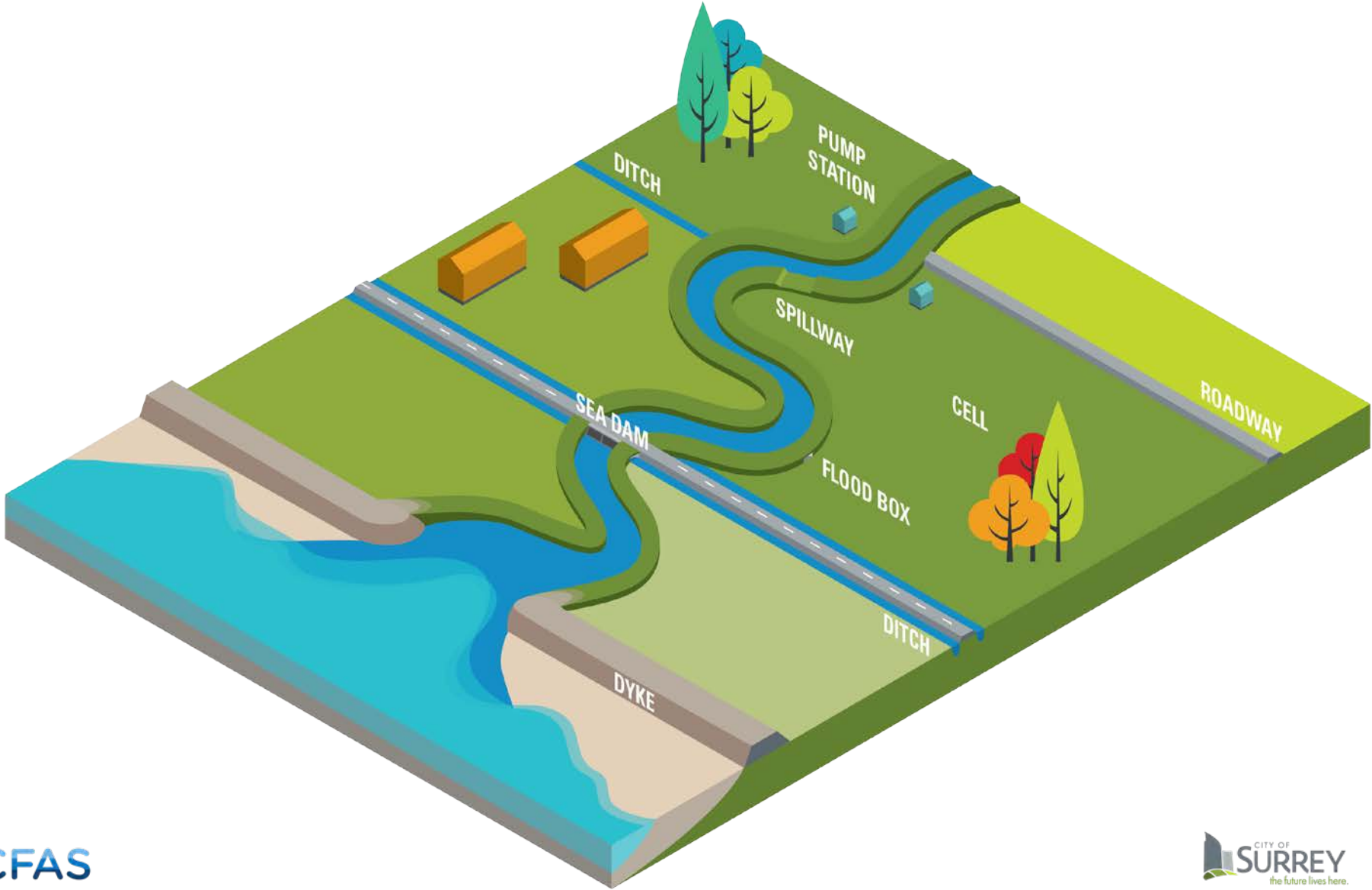
# Flood Management

- A long history of work
- 1890's first dykes





# Flood management



# COASTAL AND RIVER FLOODING

1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100 2100

## Major Coastal and River Flood Events



## A Changing Shoreline

In 1890, dyking of Mud Bay begins. Shortly afterwards, dyking and damming of the Serpentine and Nicomekl Rivers begins. By 1953, a timber sea wall at Crescent Beach is constructed.

Since then, residents of Surrey's Coastal Floodplain have relied on a system of dykes and sea dams to protect themselves from ocean and river flooding.



Sea Level Rise

TODAY

## An Evolving Future

As our climate continues to change and sea levels continue to rise over the coming years, it is anticipated that the frequency and intensity of major coastal and river floods will also increase.

The Province has directed municipalities to plan for at least 1m sea level rise by 2100. In Surrey, and elsewhere in the Lower Mainland, most drainage systems are not designed for projected changes.

1  
Metre

100 cm  
80 cm  
60 cm  
40 cm  
20 cm  
0 cm

Photos credit: City of Surrey Archives and Museum

# Approximate sea level rise since 1972





# Climate Change and Coastal Floods

- Coastal cities around the world are facing same challenges
- Province directed municipalities to plan for at least 1 m sea level rise by 2100
- In Surrey and elsewhere most drainage systems not designed for projected changes

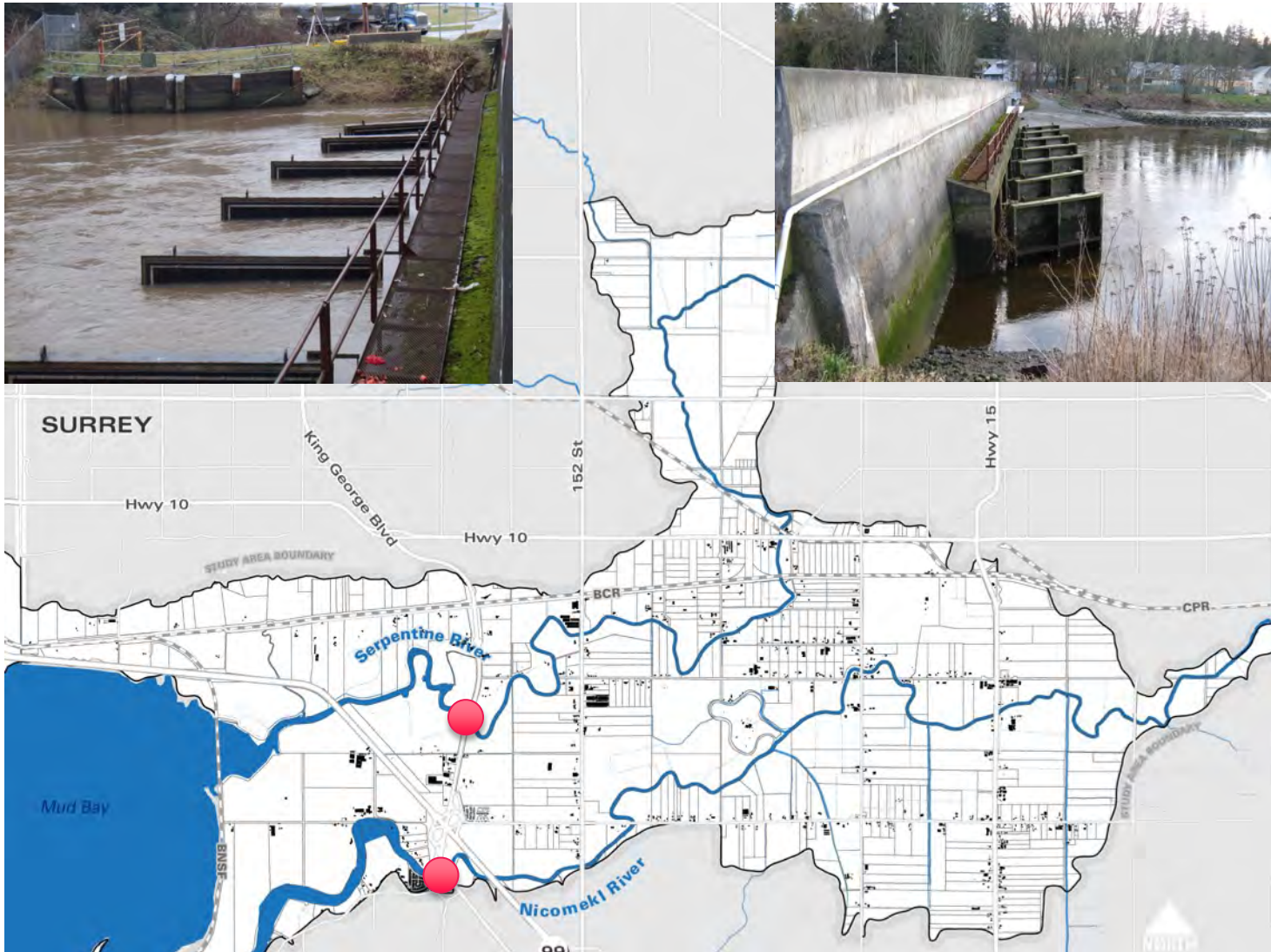
**100cm** 

THE EXPECTED SEA LEVEL RISE  
OVER THE NEXT 100 YEARS IN  
SURREY IMPACTING ABOUT  
20% OF SURREY'S LAND AREA



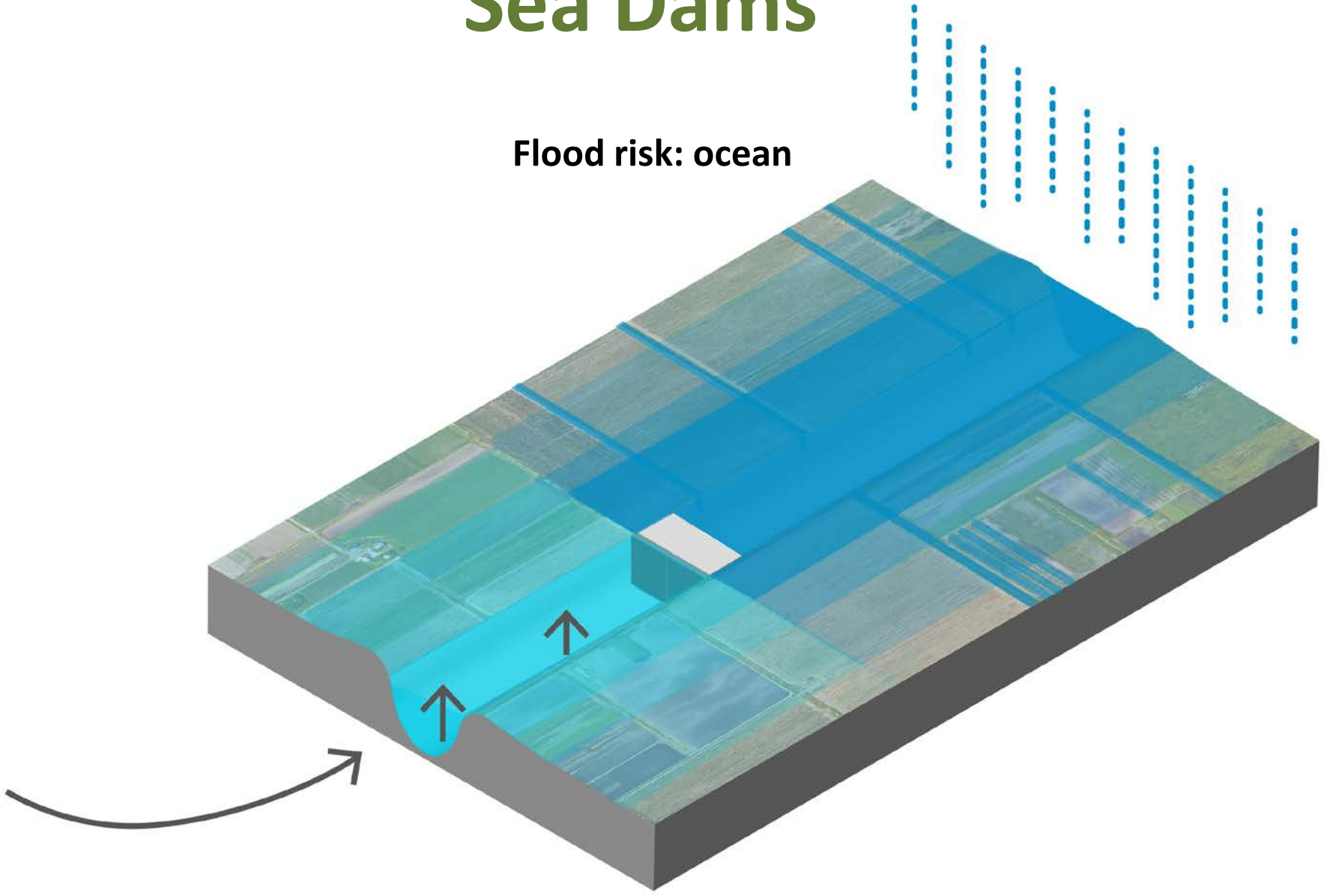


# Sea dams



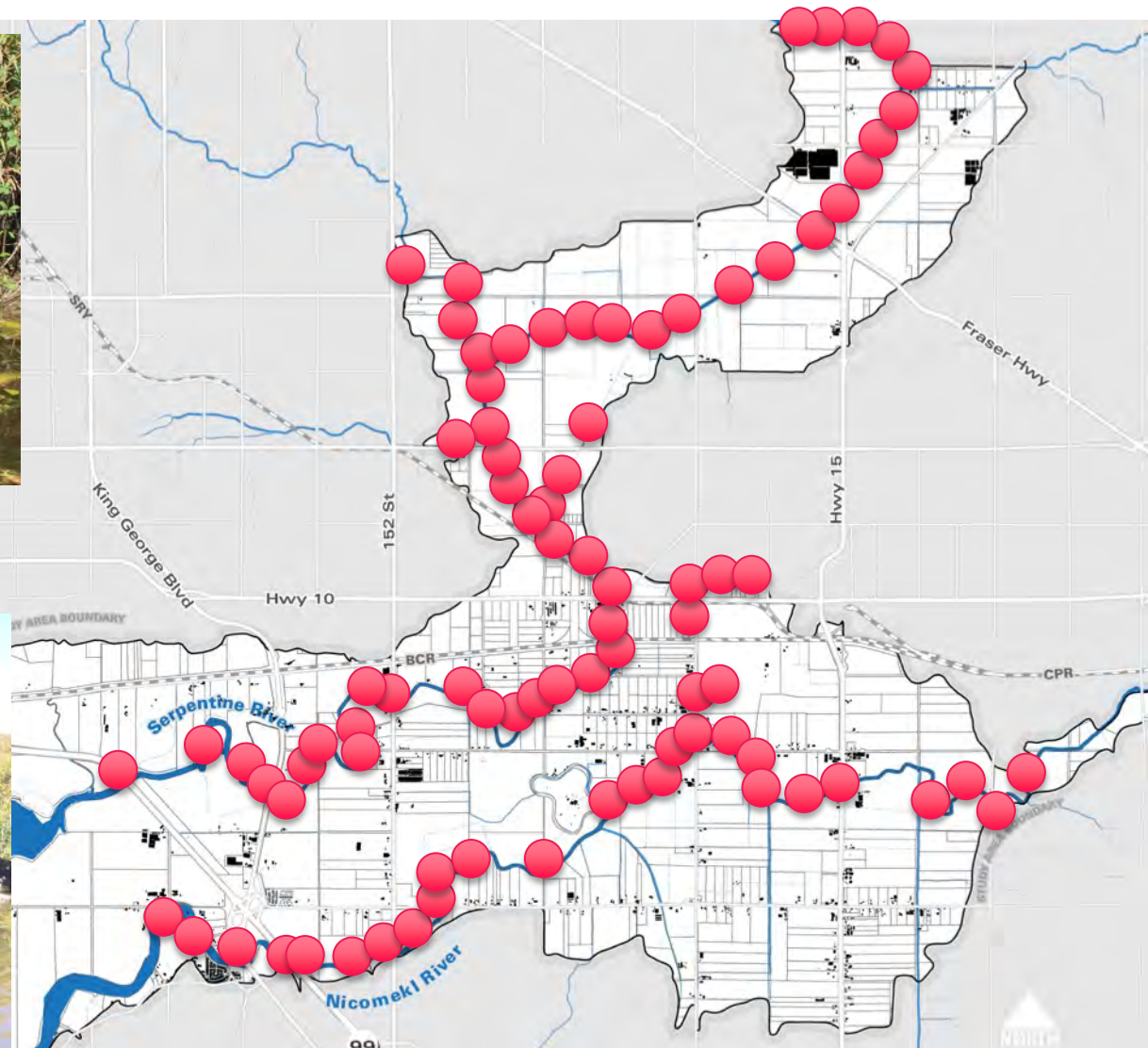
# Sea Dams

Flood risk: ocean



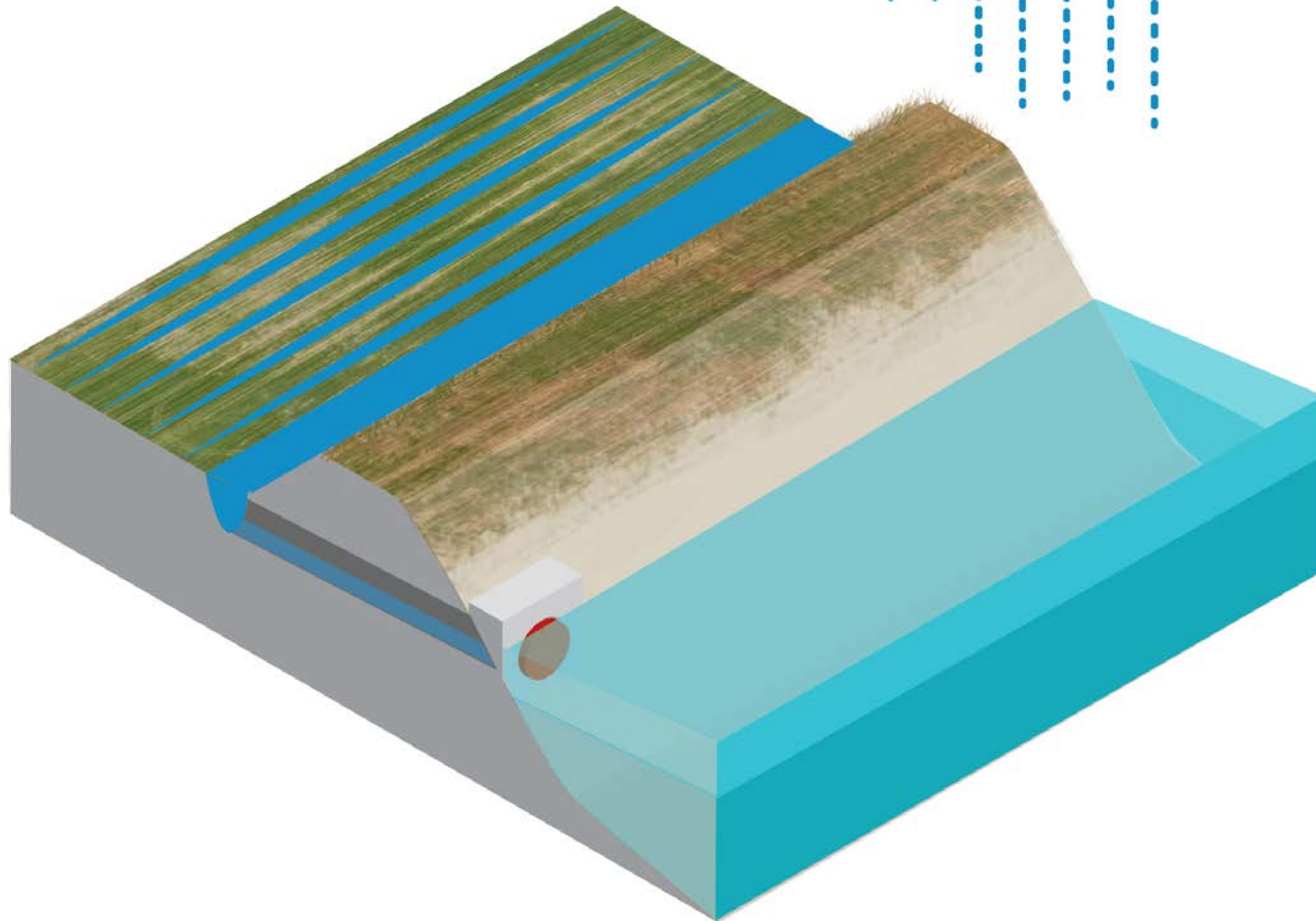


# Floodboxes

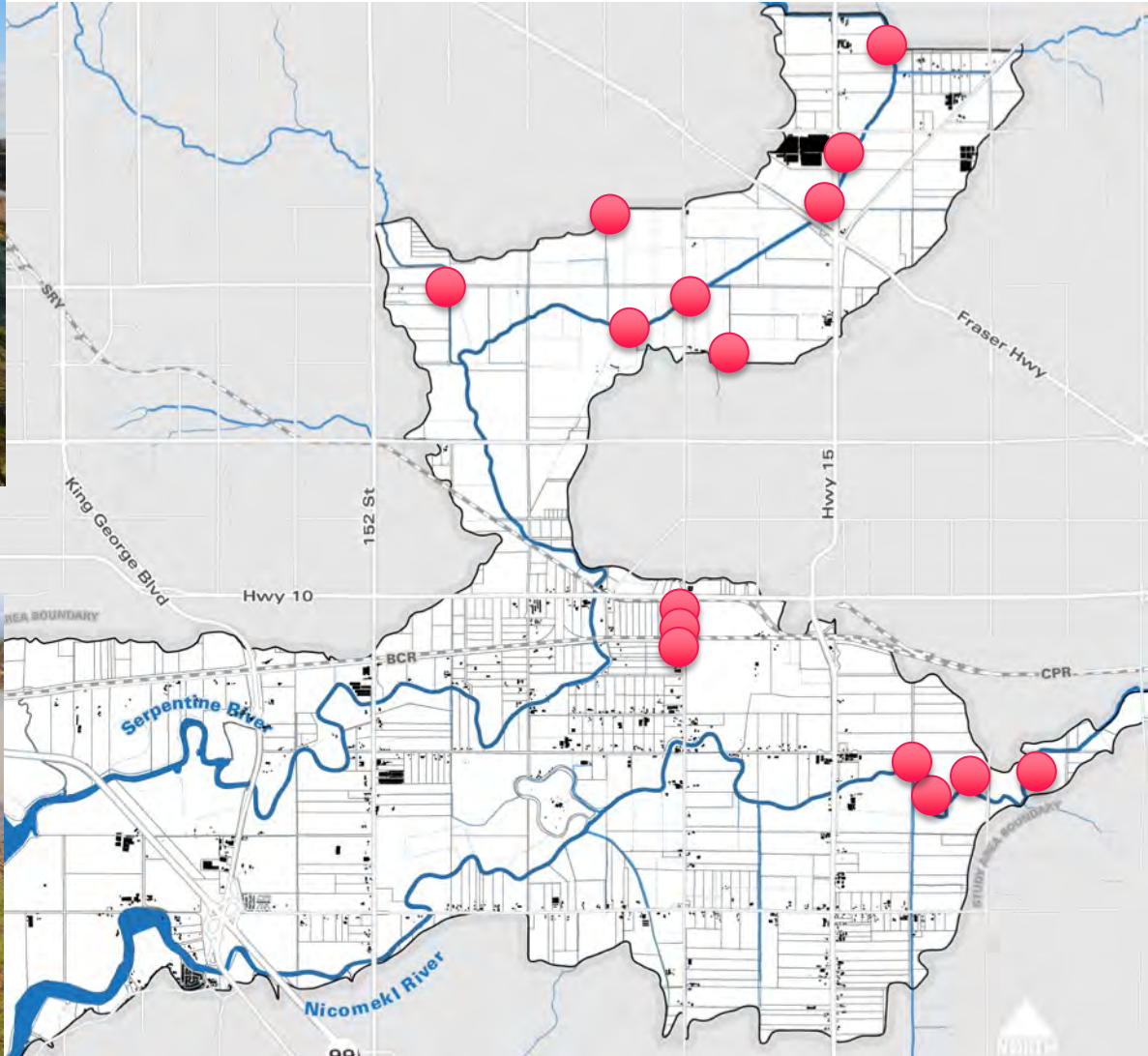




# Floodboxes

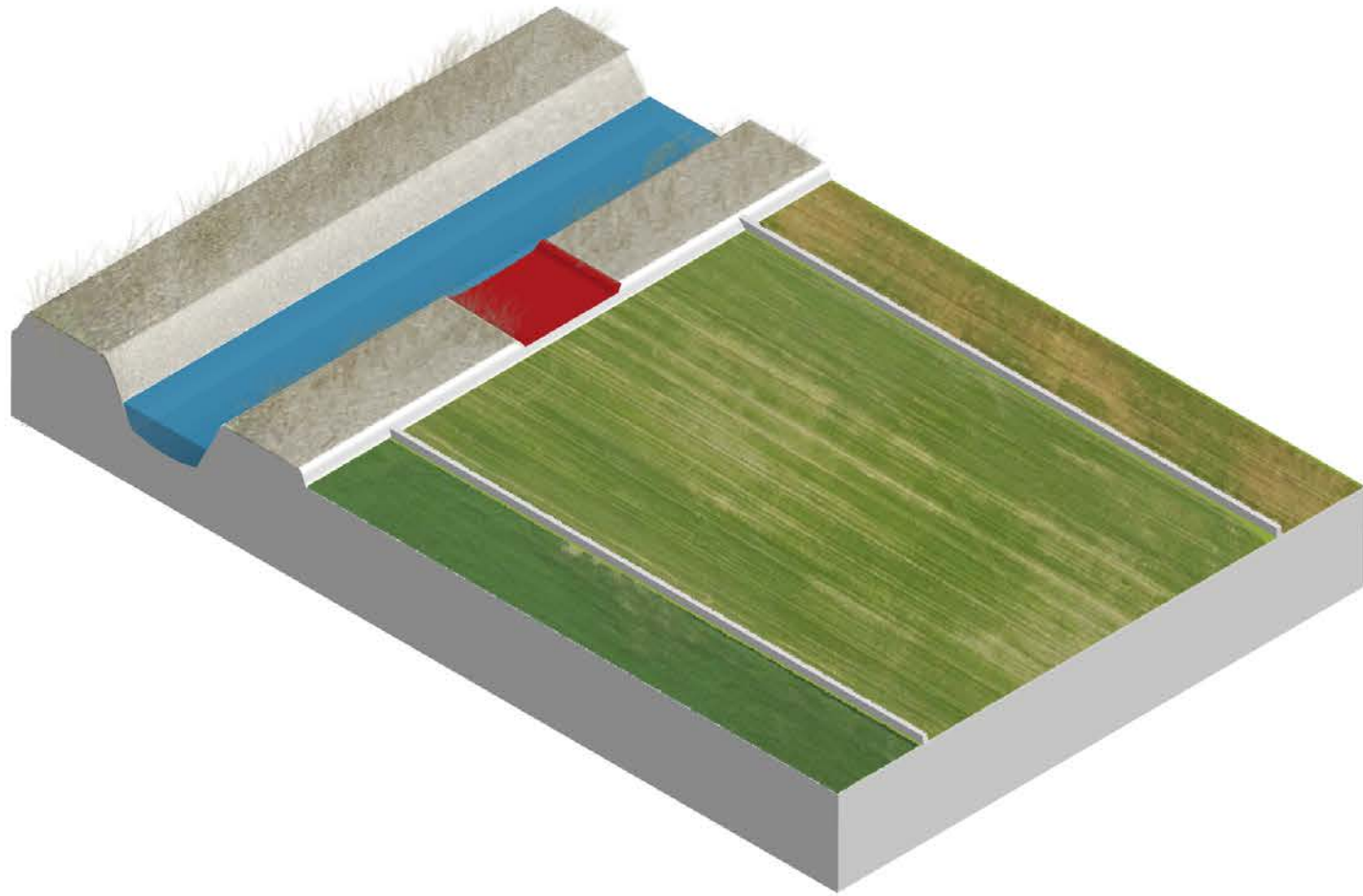


# Spillways

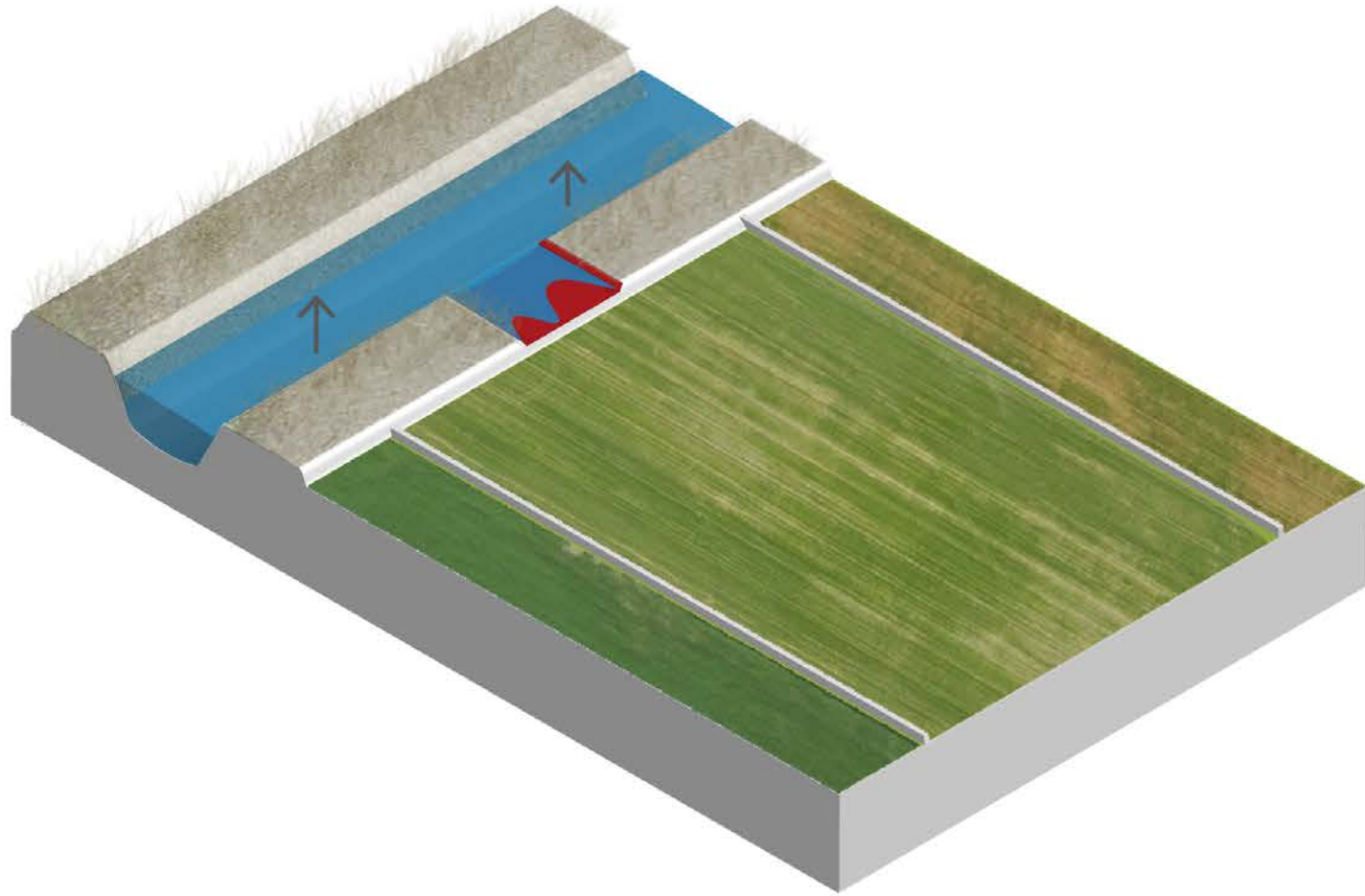




# Spillways

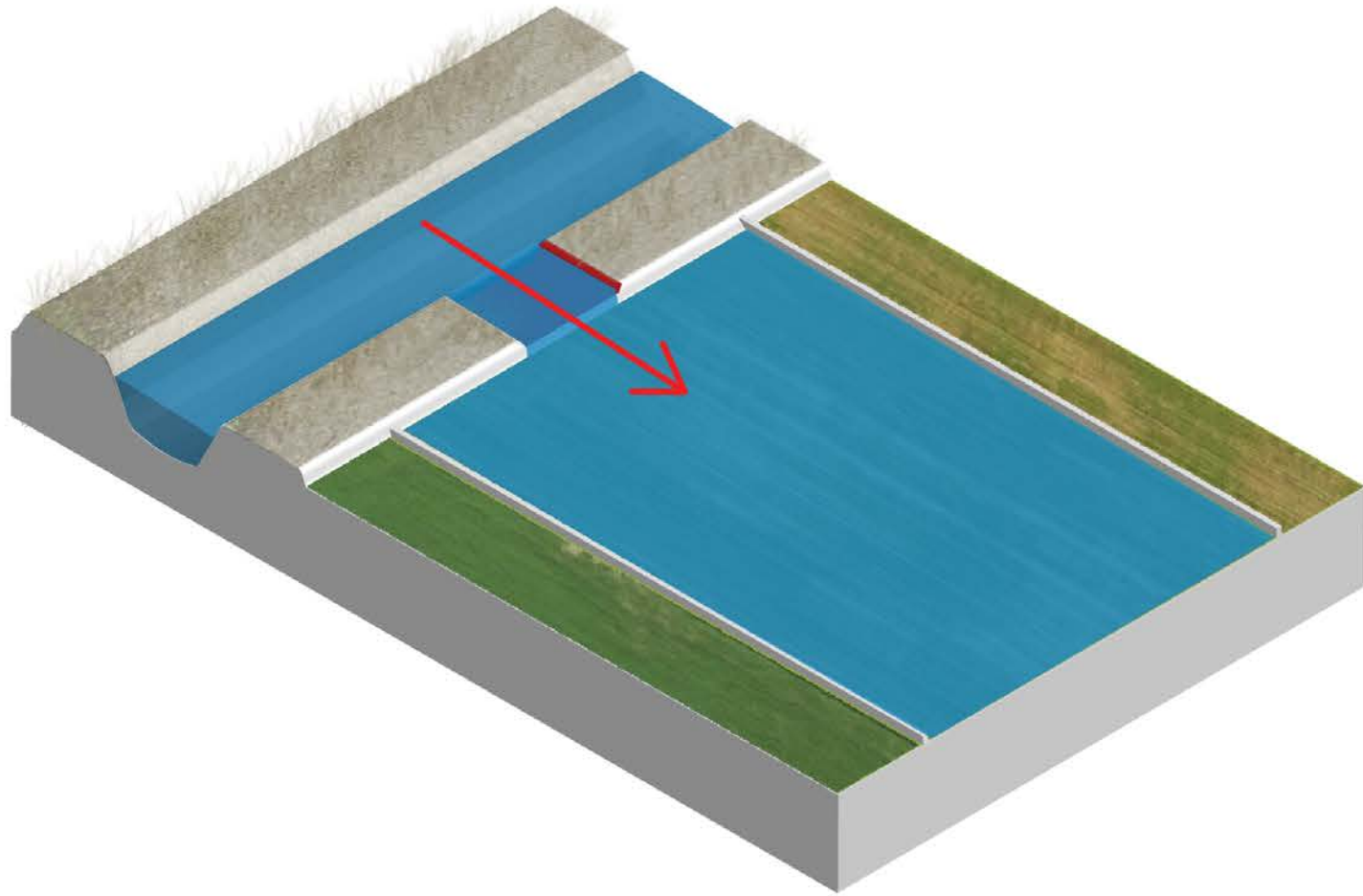


# Spillways

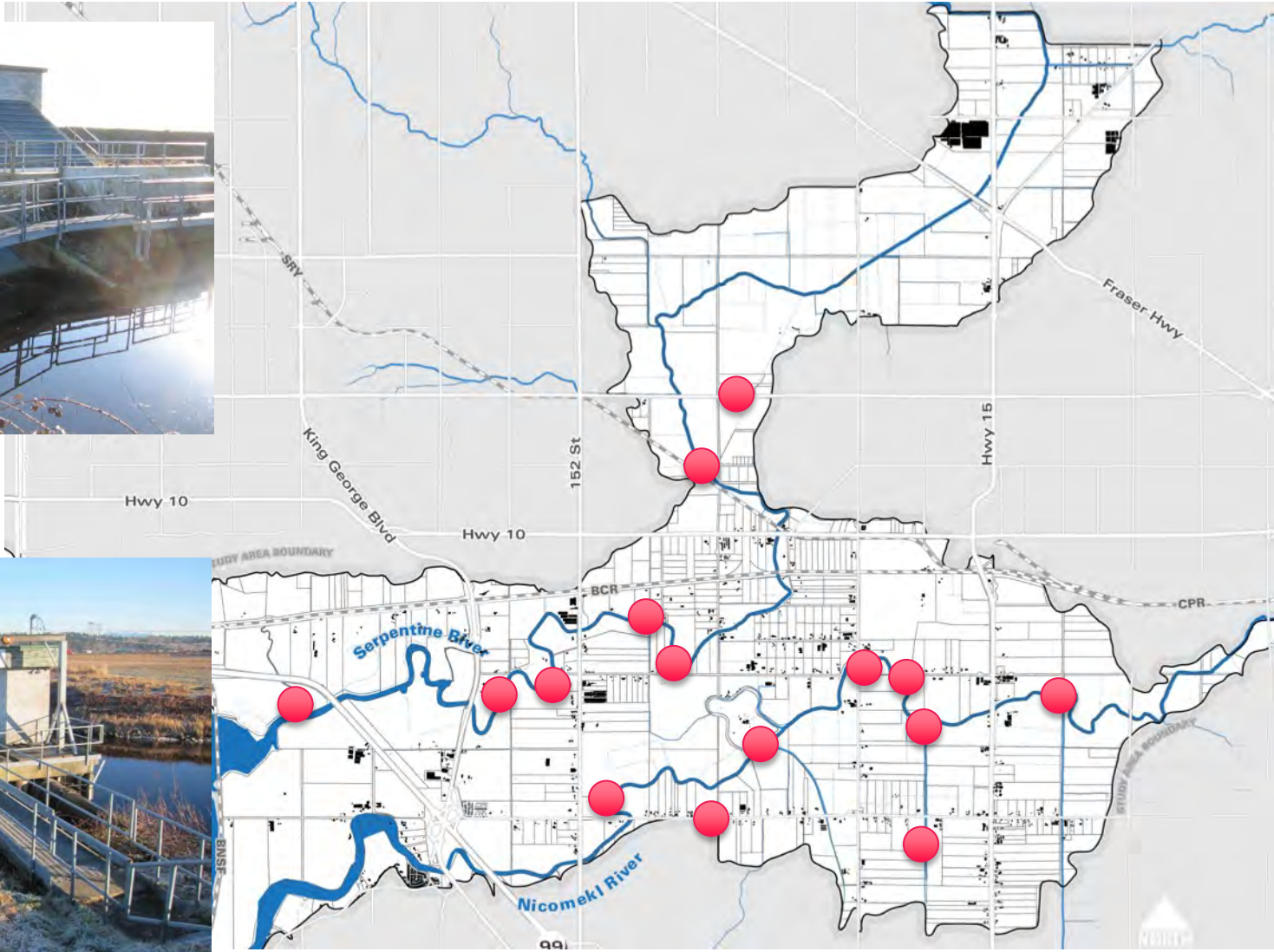




# Spillways

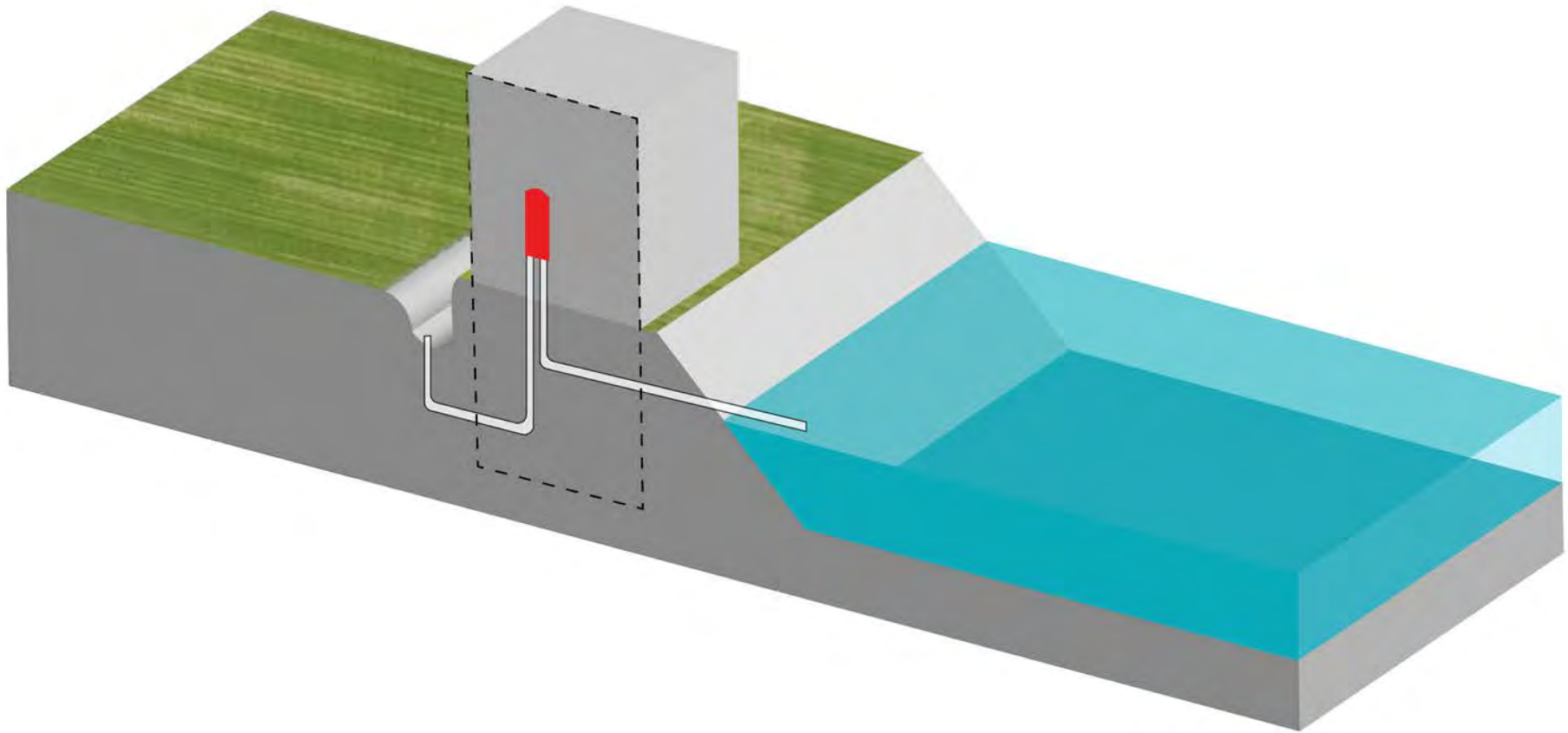


# Pumps

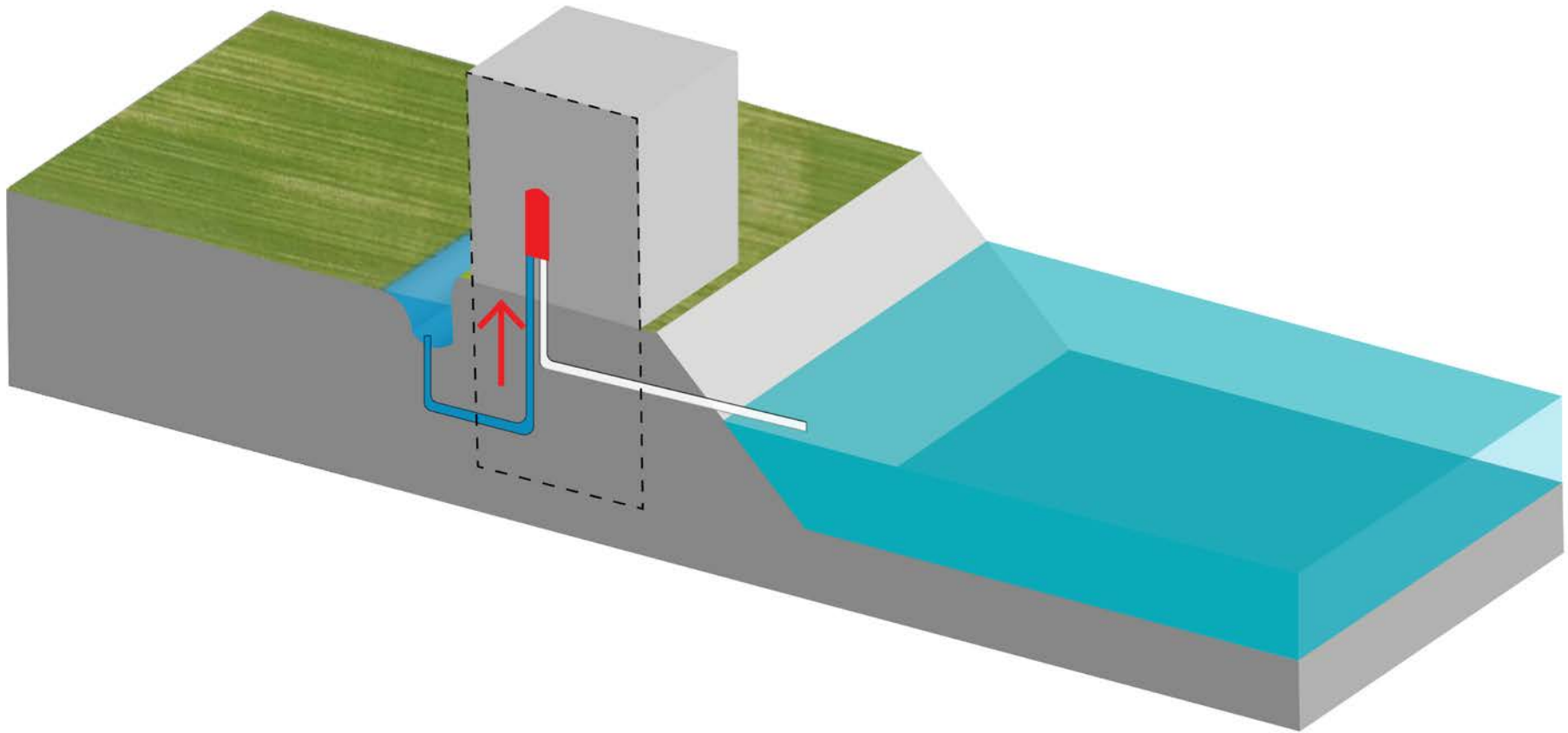




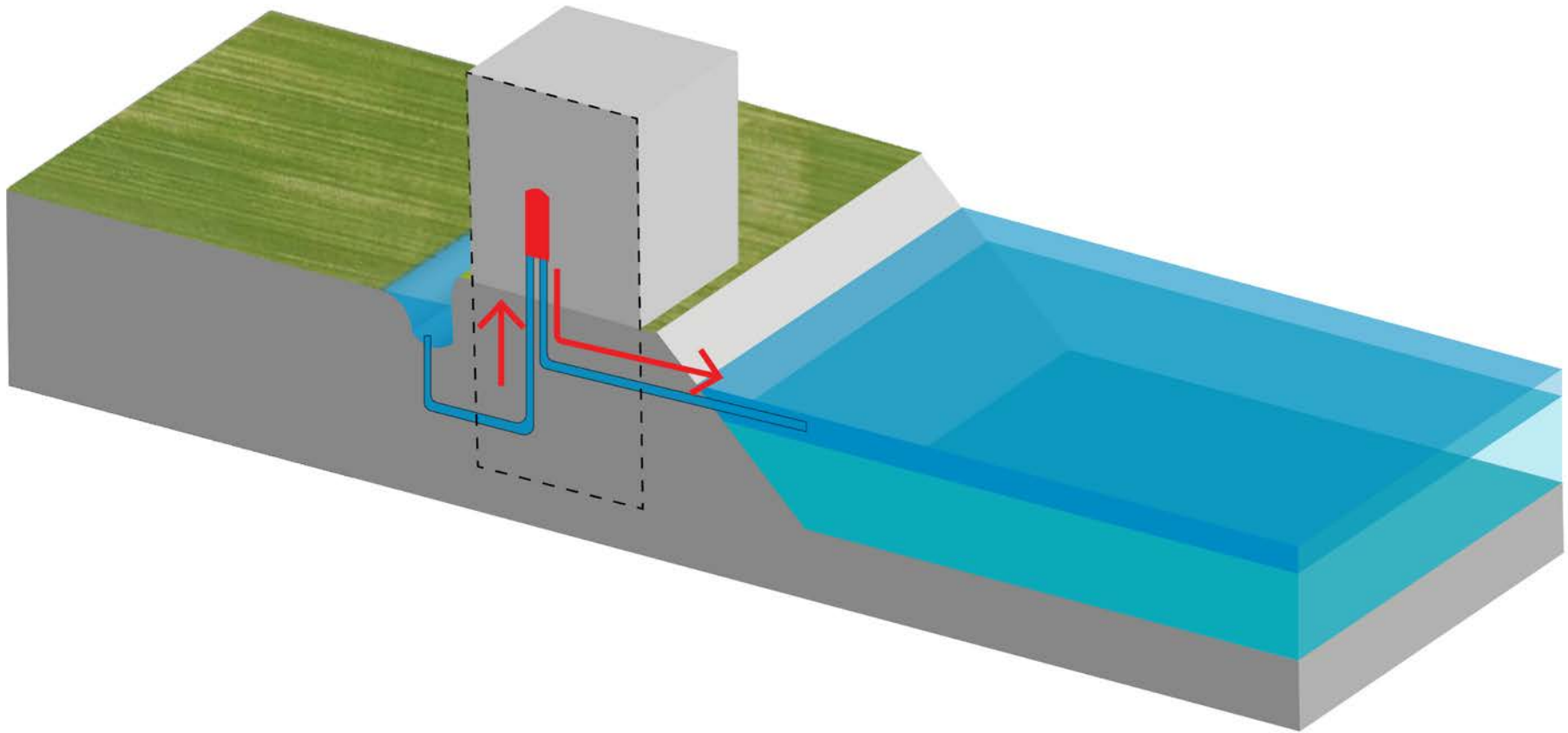
# Pumps



# Pumps

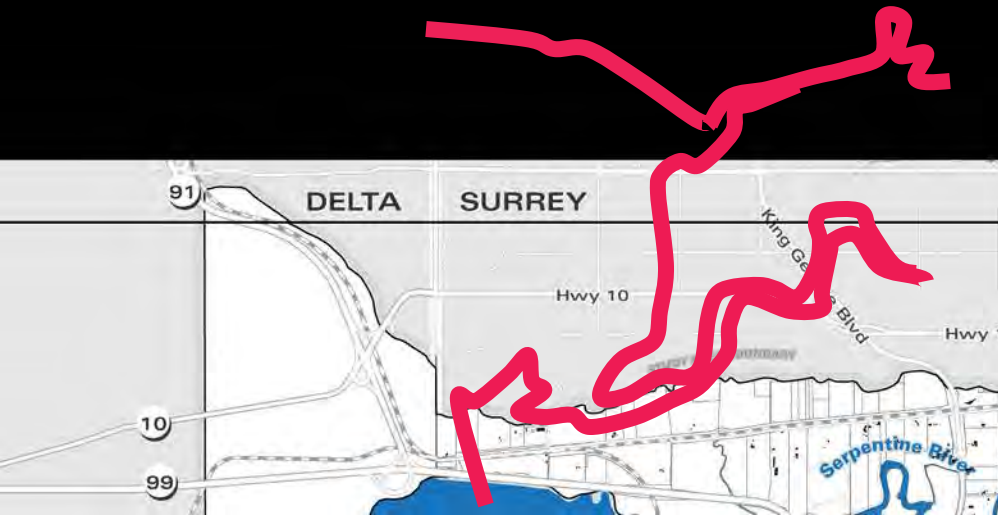


# Pumps

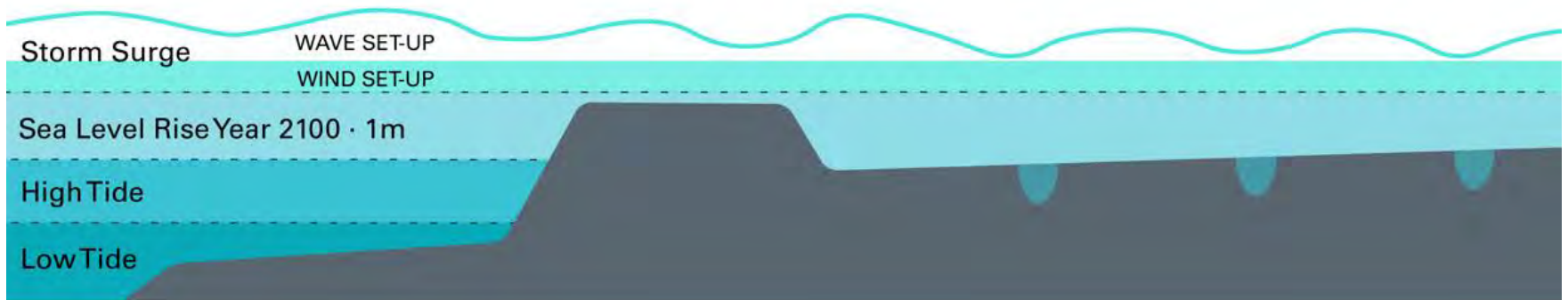




# Ocean Dykes



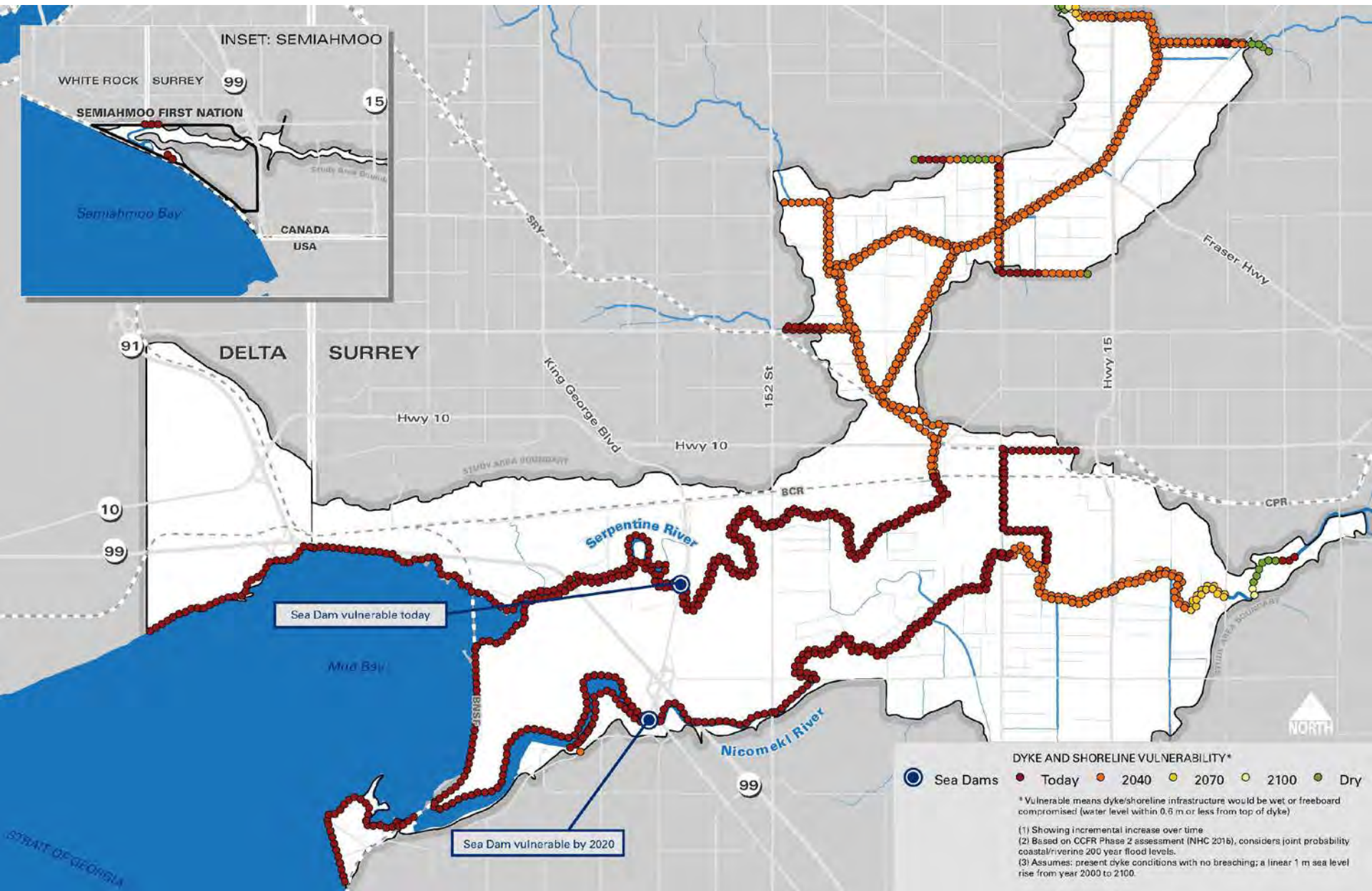
# Ocean Dykes



# Coastal Flooding and Sea Level Rise









# Extreme Floods

- Climate change is affecting intensity and frequency of storms and flood events
- Extreme floods of today become more frequent in the future



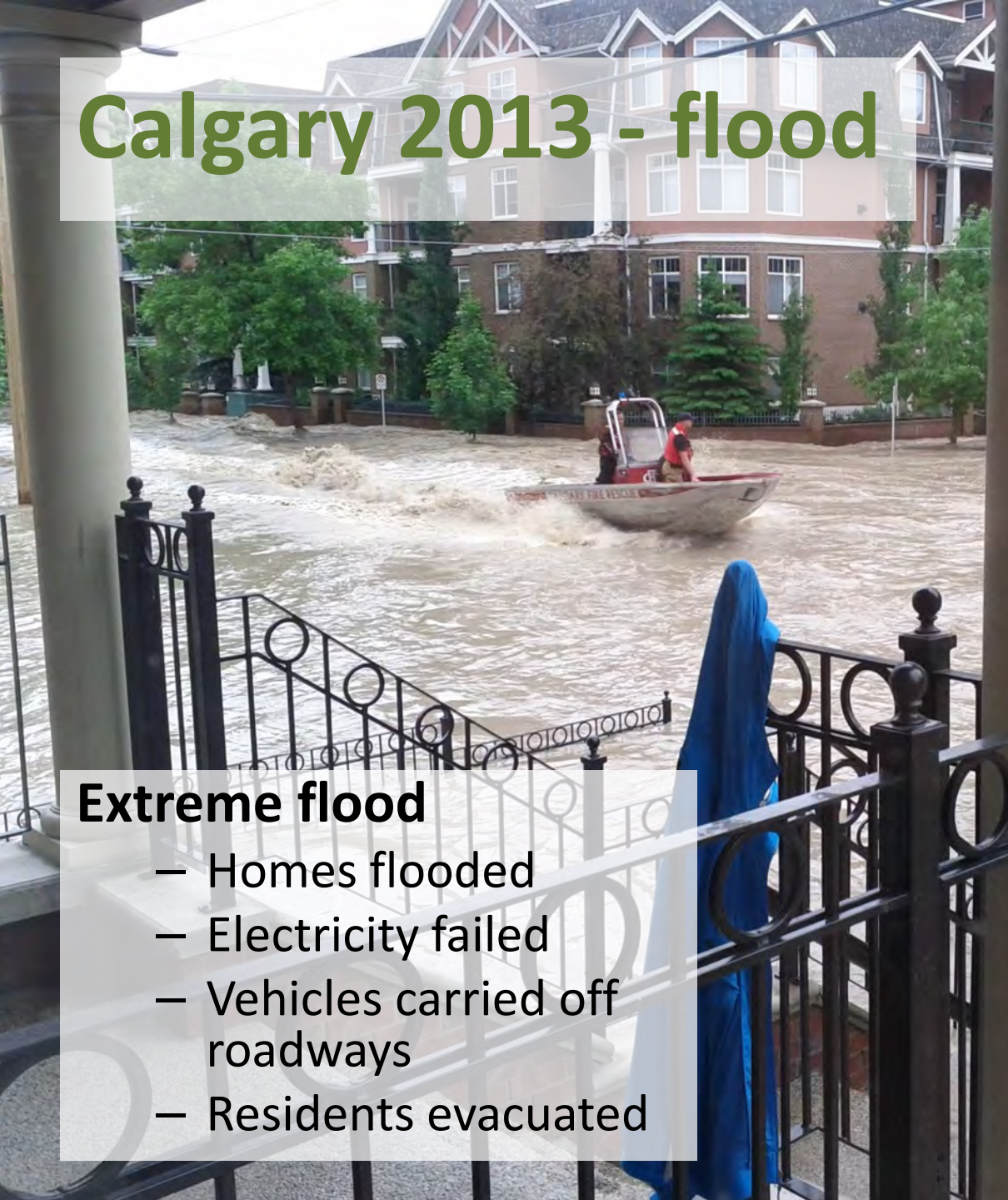
# Extreme Flood Events

- Flood of 1948
  - +1 metre depth
  - flowing water





# Calgary 2013 - flood



## Extreme flood

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









# Flood Frequency

**0.5%**

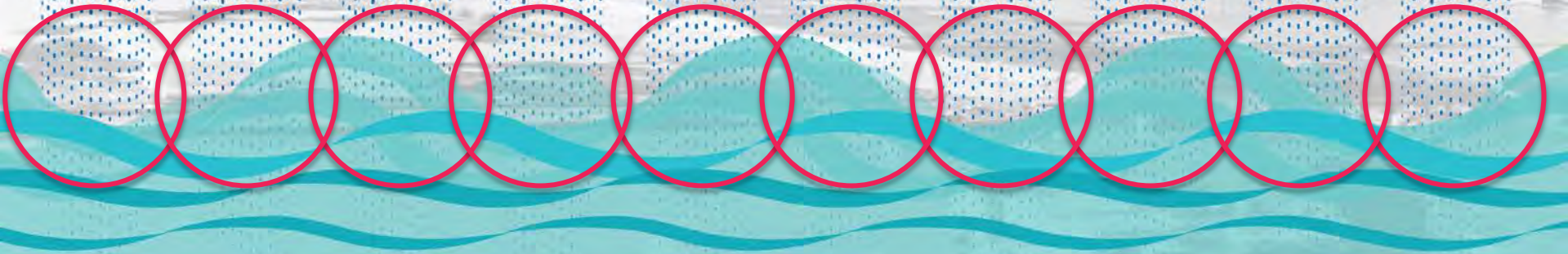
chance of an  
extreme  
flood today





# Flood Frequency

**50%**  
chance of an  
extreme  
flood in  
2100





# England 2016 - flooding



© Barbara Cook / Demotix

## Extreme flood

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



© Reuters



# Hazards and Impacts



- **Agriculture**
  - Increased flooding
  - Poor and reduced field drainage
  - Increased risk of soil salination
  - Impacts field crop planting, growing season, and harvesting



# Hazards and Impacts

- **Community & Residential**

- Surface ponding and so-called nuisance flooding may become near permanent over time in Crescent Beach
- Increased chance of road closures and lengthy detours from flooding and overtopping during storm surges
- Property damage – residential and commercial
- Business interruptions
- Catastrophic flooding will become frequent (without future improvements)



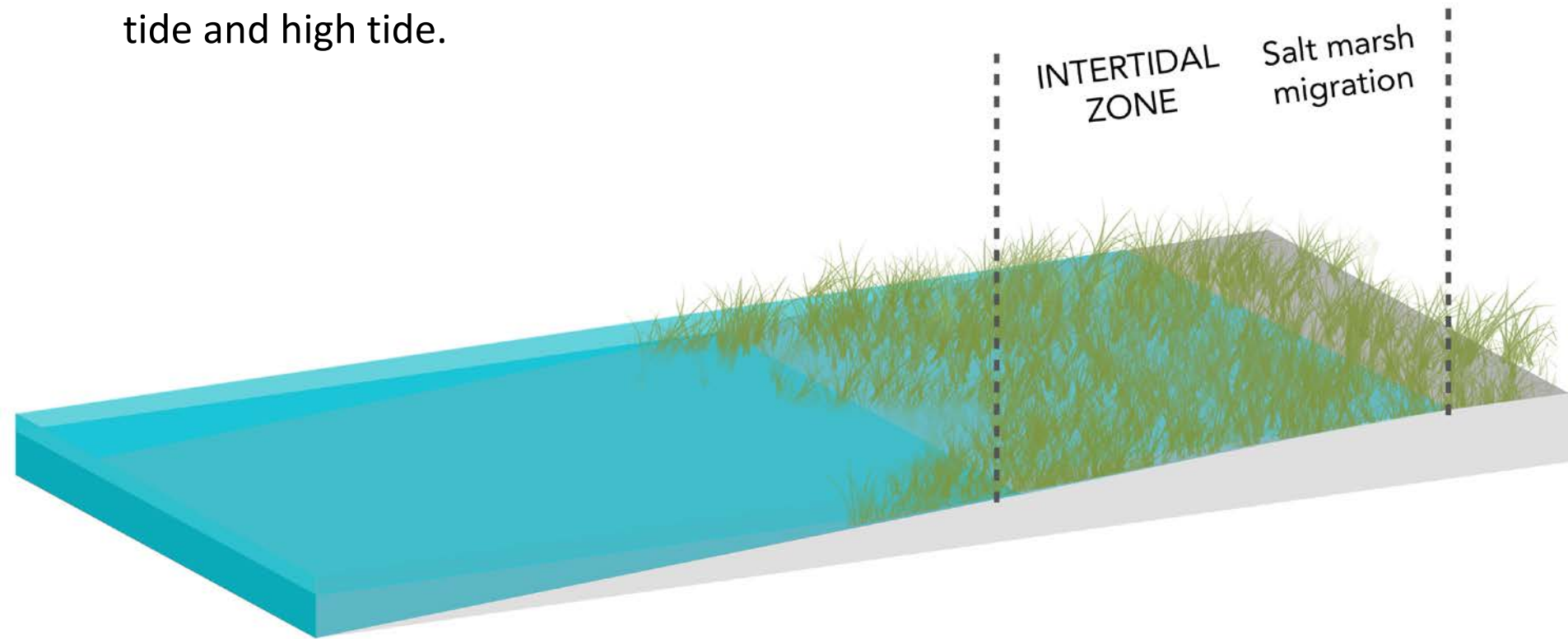
# Hazards and Impacts

- **Environmental & Recreation**
  - Foreshore and coastal habitat loss from sea level rise
  - Riverbank habitat loss from river flooding and erosions
  - Species loss (and extirpation) due to habitat loss
  - Increased predation of spawning salmon trapped on ocean-side of closed sea dams



# Natural Shoreline

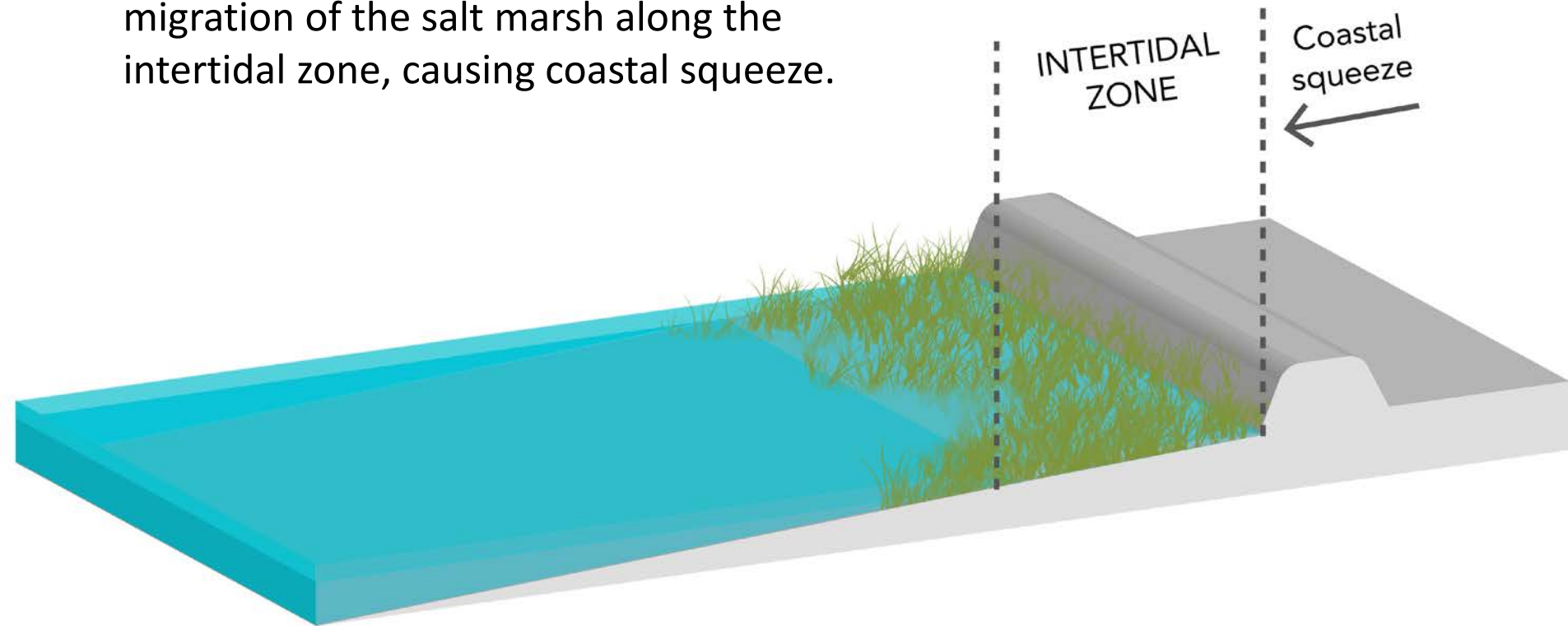
The Intertidal zone occurs between the low tide and high tide.





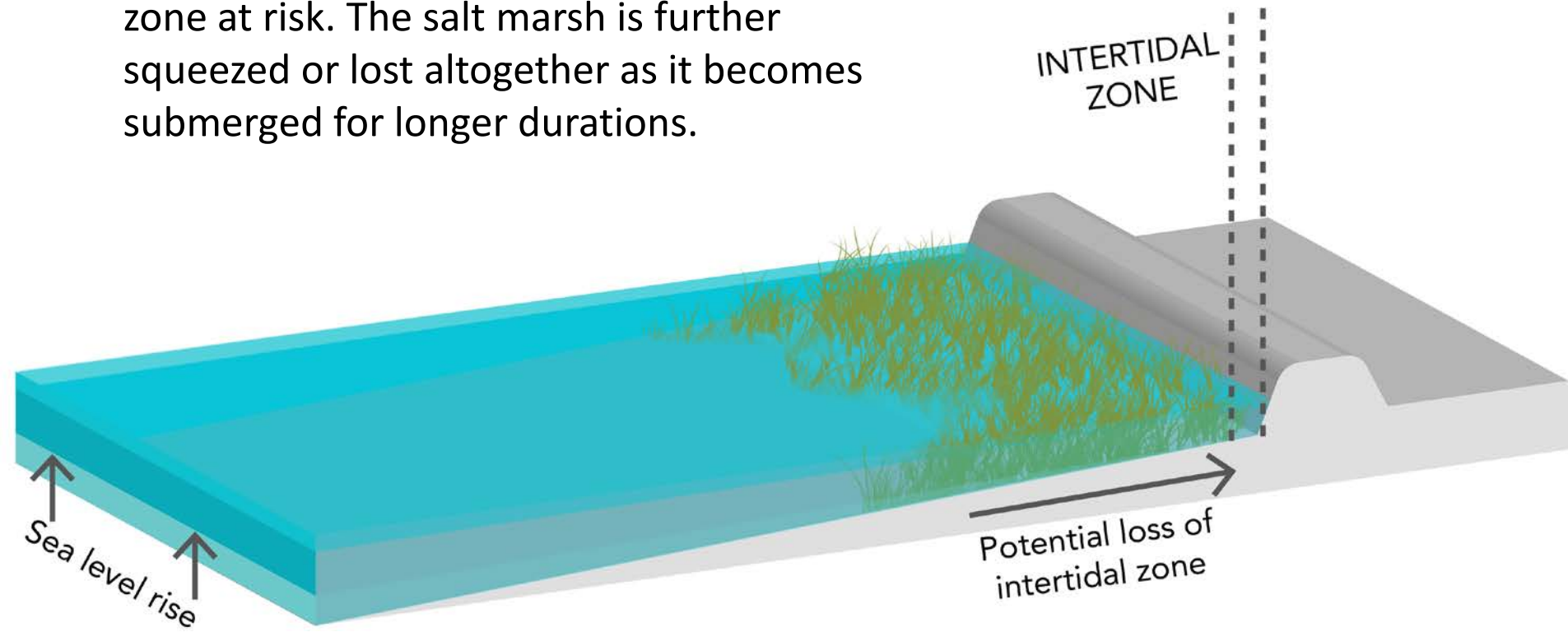
# Shoreline with Dyke

The placement of a dyke prevents natural migration of the salt marsh along the intertidal zone, causing coastal squeeze.



# Sea Level Rise

Sea level rise further places the intertidal zone at risk. The salt marsh is further squeezed or lost altogether as it becomes submerged for longer durations.





# Hazards and Impacts

- **Transportation & Infrastructure**

- Changing climate and more extreme weather is exposing infrastructure to impacts it was not originally designed to withstand
- This exposure may reduce its useable lifespan and as well as expose residents to disruptions to their lives and daily routines.
- Serpentine sea dam is not seismically sound
- Few Serpentine or Nicomekl River dykes will meet the Provincial 200-year flood standard by 2020
- By 2070, it is expected that all dykes will be overtopped multiple times per year, with overtopping likely resulting in dyke failure.
- At present, under the 200-year flood condition, a portion of Highway 99 would be inundated, including bridge decks at three locations
- Serpentine and Nicomekl dykes not high enough to protect against anticipated 2100 flood levels
- Erosion, interruption of railway operations and goods movement

# Adaptation Approaches

**Protect**



**Accommodate  
Combination**

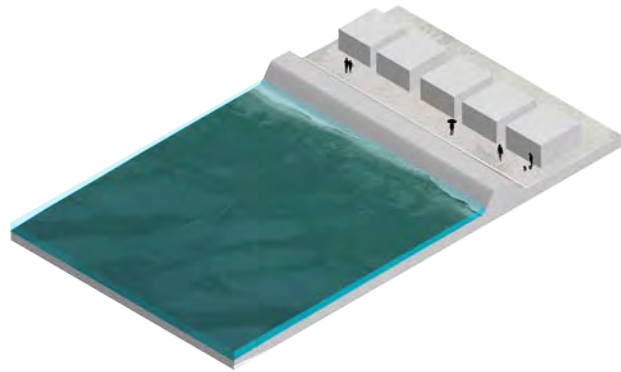


**Retreat**





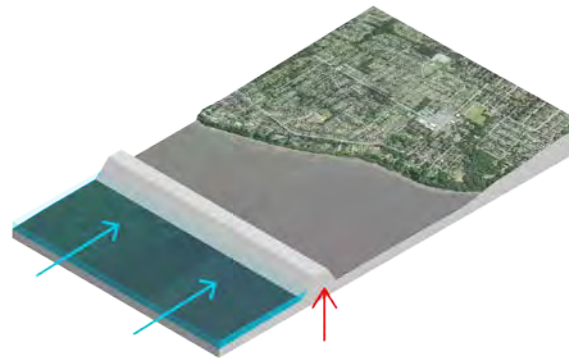
**Protect**



Raise Coastal and River Dykes



Offshore Barrier Islands



Offshore Sea Barrier



Breakwater or  
Jetty

Offshore  
Islands

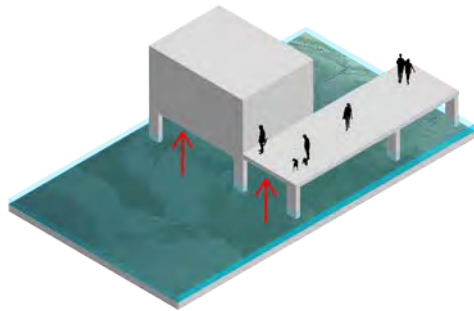
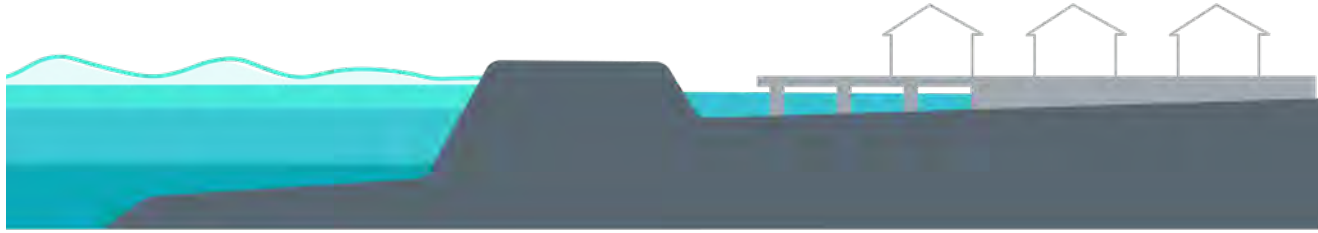
57



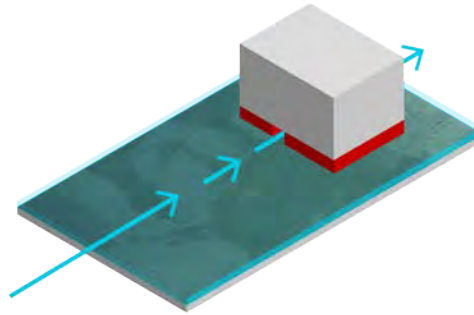


Source: <http://www.industrytap.com/the-great-wall-of-louisiana/677>

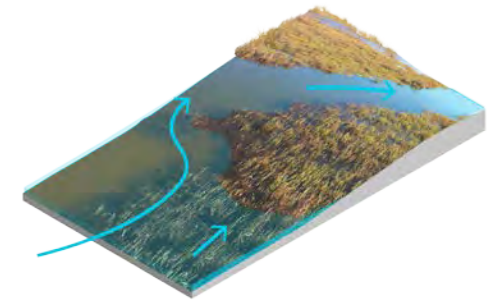
# Accommodate



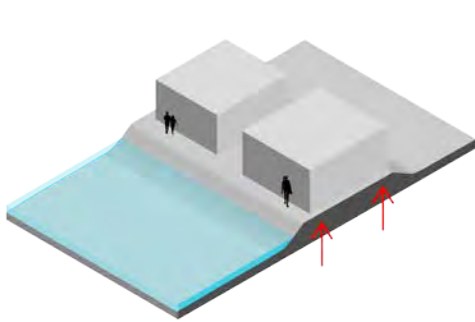
Raised Structures



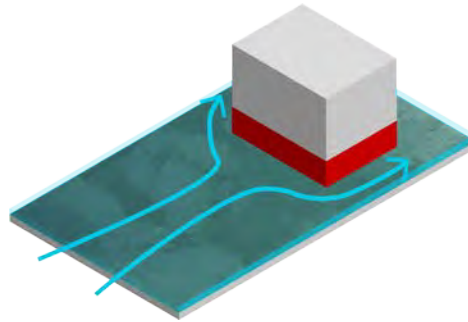
Wet Proofing



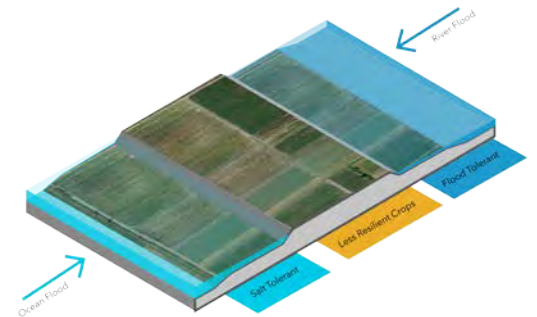
Wetland Restoration



Build on Fill



Dry Proofing



Crop Reorganization





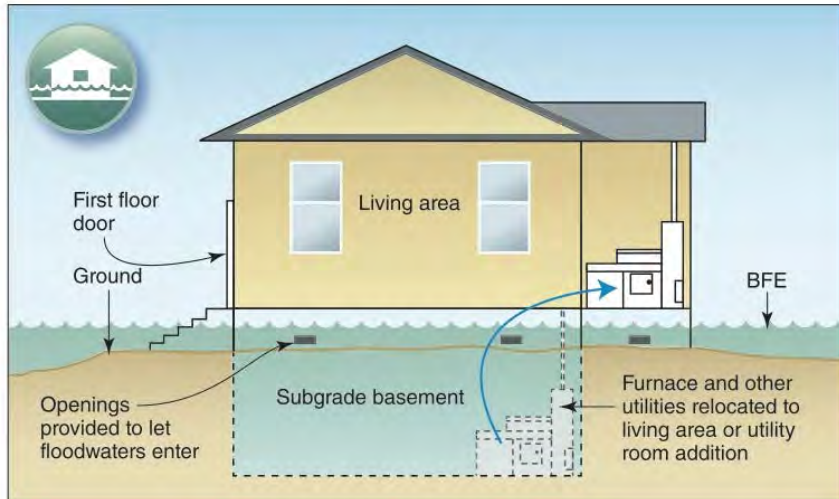
## Housing on pile foundations in Rotterdam

<http://frameworks.ced.berkeley.edu/2015/a-modest-proposal-adapting-to-sea-level-rise/>



## Coastal marsh restoration

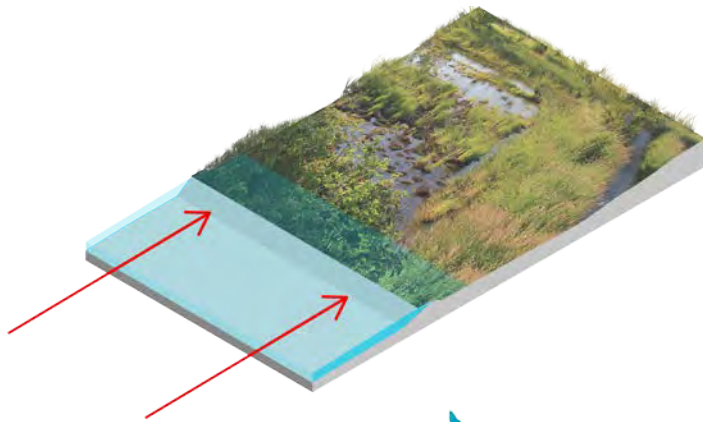
<https://blog.savesfbay.org/2014/04/climate-report-supports-wetland-restoration-as-sea-level-rise-adaptation-strategy/>



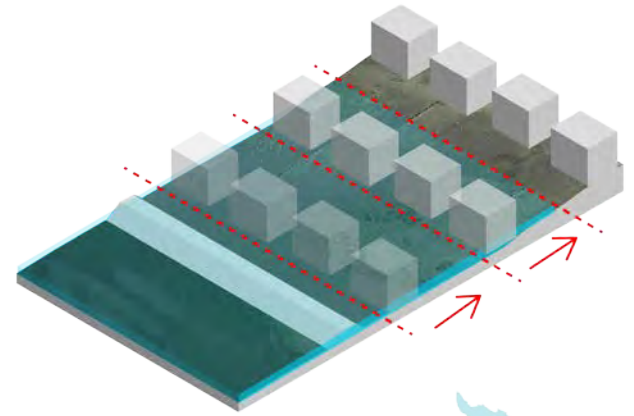
## Wet Proofing Strategies

<http://cnycn.org/2014/10/copin-g-with-big-flood-insurance-changes-in-nyc-part-iv-mitigation/>

**Retreat**



**Complete Retreat**



**Managed Retreat**





© Terry Whittaker/2020VISION / Rex

## Retreat at Abbots Hall Farm, Essex UK

<http://factfile.org/8-facts-about-abbotts-hall-farm>

CFAS Focus Group

# NEXT STEPS



# CFAS Next Steps

- City Speaks Survey
- Open house April 26



## PHASE 1

*What matters most and who is affected?*



**FOCUS:** Education, awareness building, and community values

SUMMER 2016 - SPRING 2017

## PHASE 2

*What can we do?*



**FOCUS:** Exploring adaptation options

SPRING 2017 - SUMMER 2017

## PHASE 3

*What is acceptable?*



**FOCUS:** Developing adaptation strategies

SUMMER 2017 - FALL 2017

## PHASE 4

*How will we do it?*



**FOCUS:** Detailing preferred strategies

FALL 2017 - SPRING 2018

## PHASE 5

*Reporting back*



**FOCUS:** Final reporting

SPRING 2018

# CFAS Next Steps

- Issues and concerns – issues to objectives
- Objectives and measures – rank and prioritize
- Using objectives to evaluate adaptation options



# More information?





# SURREY COASTAL FLOOD ADAPTATION STRATEGY (CFAS)

Thank you!

