LULU ISLAND DIKE MASTER PLAN

Lulu Island is currently protected from flooding by a 49 km dike. The dikes must be adapted to a landscape that is changing due to climate change and sea level rise, as well as new urban development. The Master Plan addresses short, medium and long term planning needs for flood protection on Lulu Island.

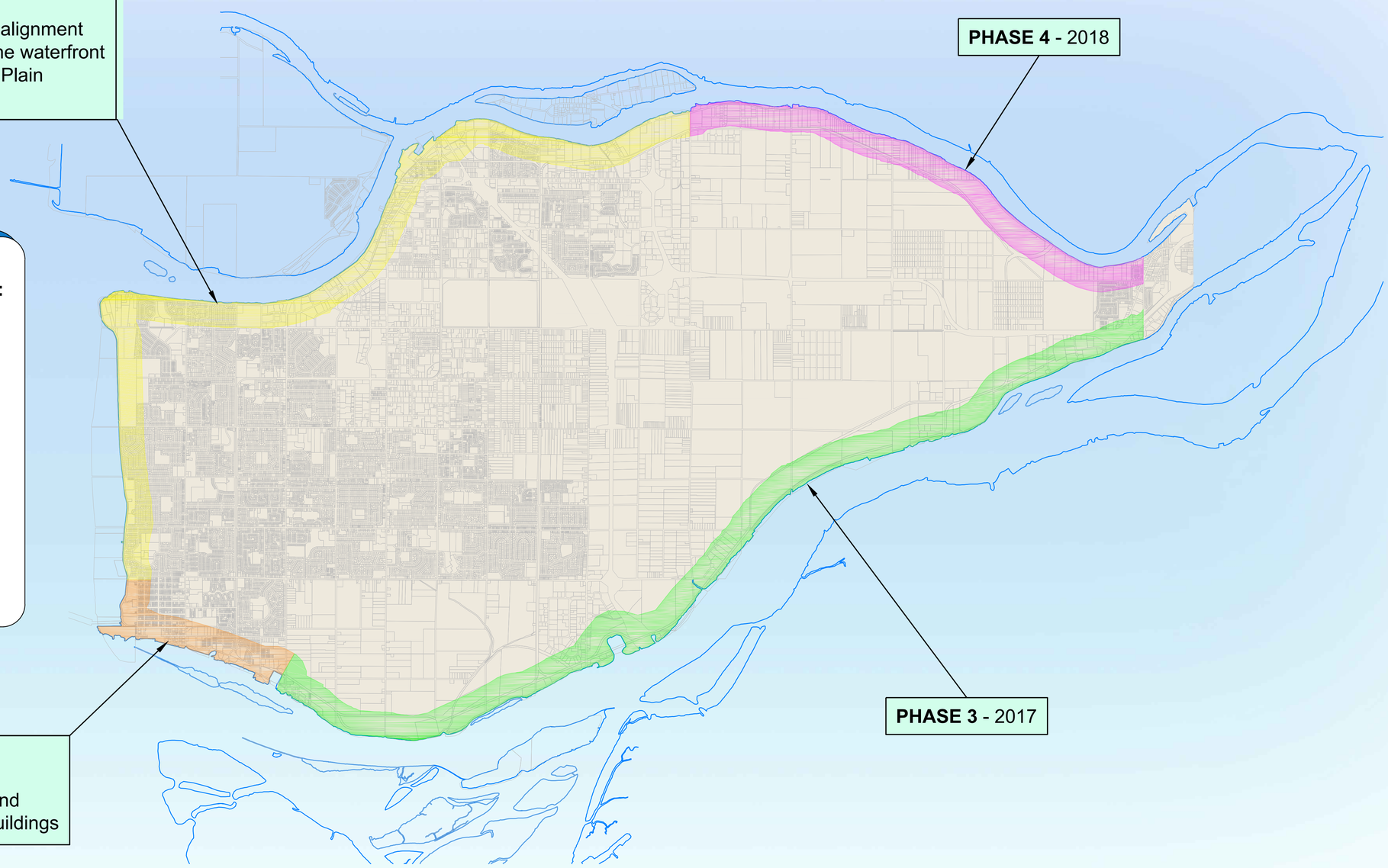


PHASE 2 - Current Phase
Key Considerations:

- Dike to be raised generally along its existing alignment
- Create superdikes by raising the ground at the waterfront
- Conduct an assessment of a modified Flood Plain Designation and Protection Bylaw

CONSIDERATIONS FOR THE DEVELOPMENT OF THE MASTER PLAN:

- Flood Protection
- Environmental
- Infrastructure
- Unique Sites
- Social
- Property
- Economic
- Operational
- Cost



DIKE ADAPTATIONS BY AREA

Strategies for raising the dike crest to the target elevation of 4.7 m are site specific.



Oval:
Lands have been raised to 4.0m. The City requirement is 4.7m. Raising can be deferred until 0.5m of sea level rise is realized.

Thompson Dover:
Raise the dike on the existing alignment.
Plan to raise River Road over the long-term.

Thompson Terra Nova:
Raise the dike on the existing alignment.
Plan to raise River Road over the long-term.

Terra Nova:
Raise the dike on the existing alignment.
Consider barrier islands on Sturgeon Banks.

Seafair:
Raise the dike on the existing alignment.
Consider barrier islands on Sturgeon Banks.

Industrial North East 1:
Raise the dike on the existing alignment.

Industrial North East 2:
Dike upgrades to be coordinated with private landowners.

Industrial North East 3:
Raise the dike on the existing alignment.

Bridgeport Tait:
Developers have committed to constructing a superdike to the target crest elevation. Partially complete.

Industrial :
Coordinate with private landowners to raise the dike on the existing alignment.

Duck Island:
Dike upgrade plans are advancing in conjunction with development plans.

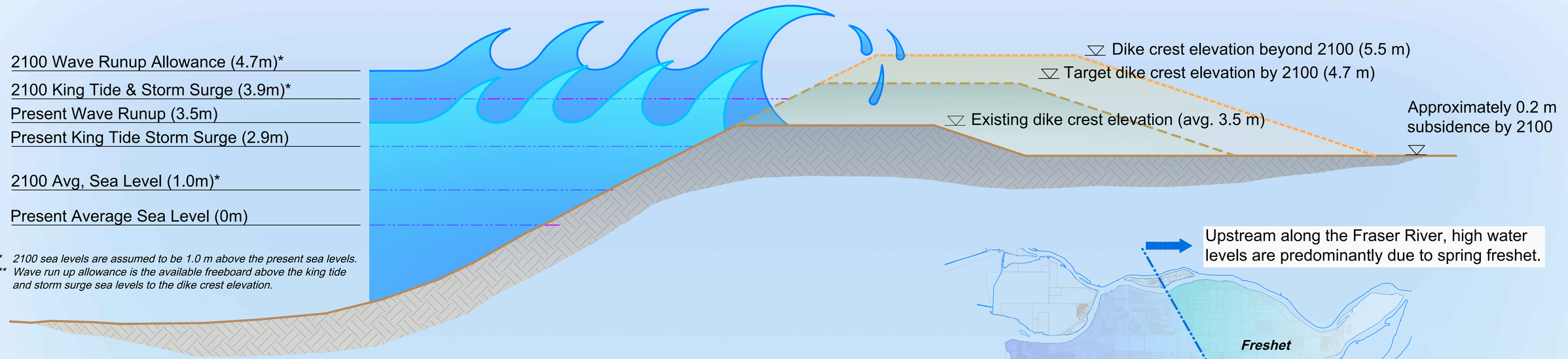
City Centre 2:
Raise lands to a superdike with redevelopment.

City Centre 1:
Raise lands to a superdike with redevelopment and creation of the new park.

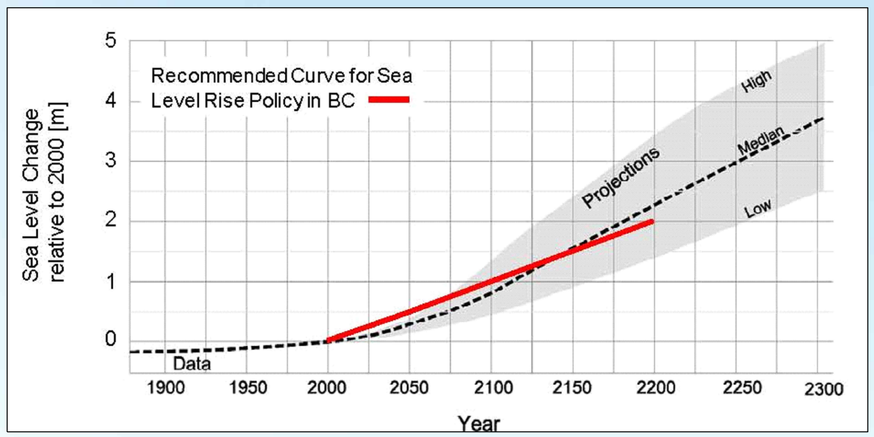
CLIMATE CHANGE INDUCED SEA LEVEL RISE

As sea level rises in the long term, the existing dikes will no longer be adequate to protect Lulu Island from flooding during extreme storm events. Sea level is predicted to rise by one metre in the next 100 years.

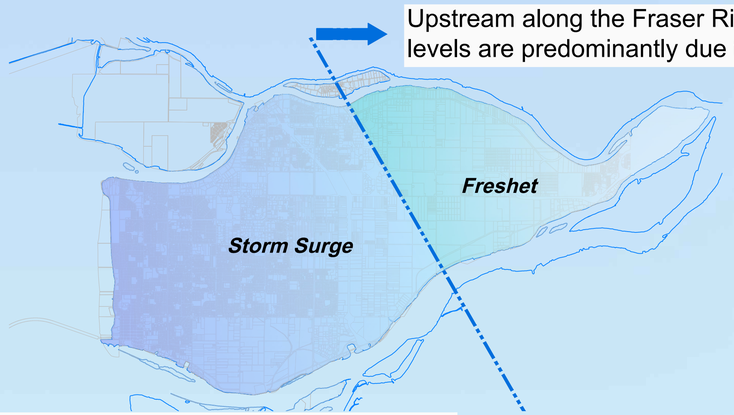




* *2100 sea levels are assumed to be 1.0 m above the present sea levels.*
** *Wave run up allowance is the available freeboard above the king tide and storm surge sea levels to the dike crest elevation.*



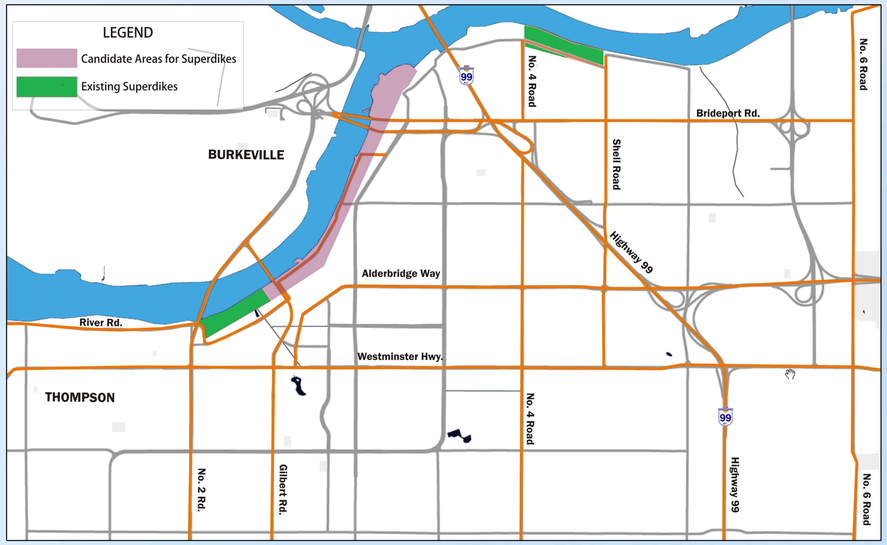
Ausenco Sandwell, Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use Draft Policy Discussion Paper, BC Ministry of Environment, January 2011.



King Tide:	The highest of high tides, caused by the gravitational pull of the sun and the moon.
Storm Surge:	High water level created by low pressure weather, typically accompanied by wind acceleration and rainfall.
Freshet:	High water level generated by melting ice and snow upstream flowing into the rivers and out to the sea, generally in the spring.

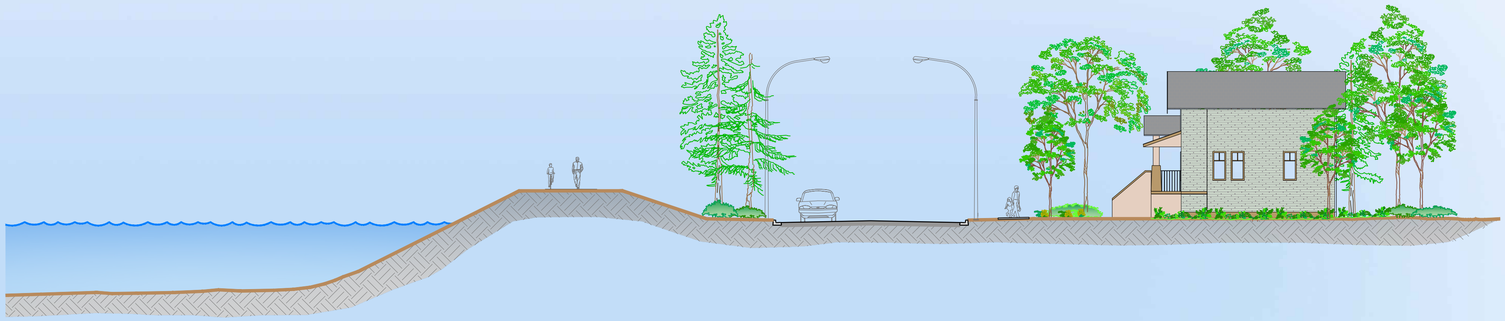
SUPERDIKES





Existing Superdikes & Potential Future Superdike Sites

A superdike is formed where the lands behind the dike are filled to the same elevation as the dike crest. The city is then redeveloped on top of the new ground. Ideally multiple lots can be redeveloped at the same time so that larger areas of the waterfront can be raised together to the new ground elevation. Assembling multiple lots to be redeveloped together helps to avoid steep slopes from one lot to the next, for example if a low lot was left between two lots raised into superdikes.



STANDARD DIKE



SUPERDIKE

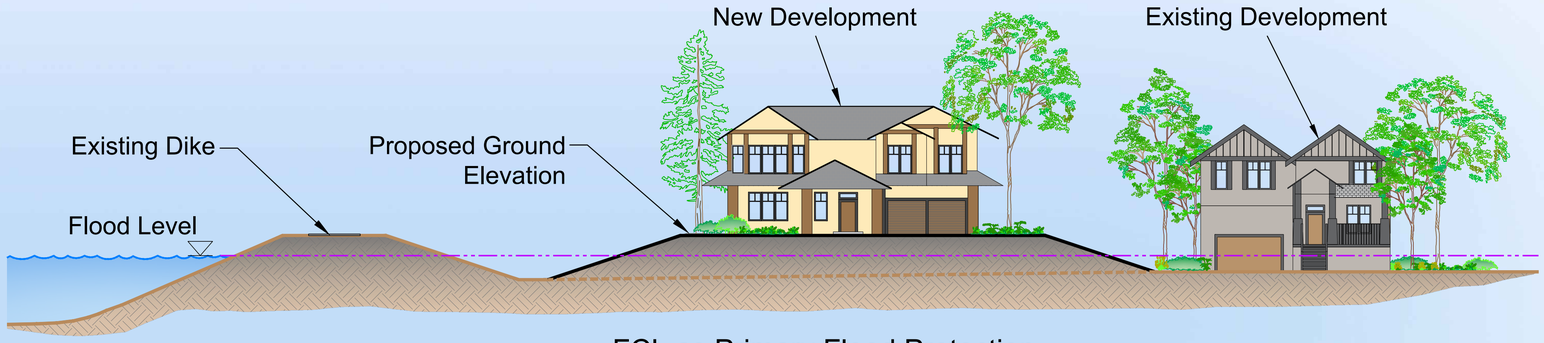
COMPREHENSIVE STRATEGY:

- Waterfront lands are raised out of the flood plain
- Redevelopment is an opportunity to create superdikes

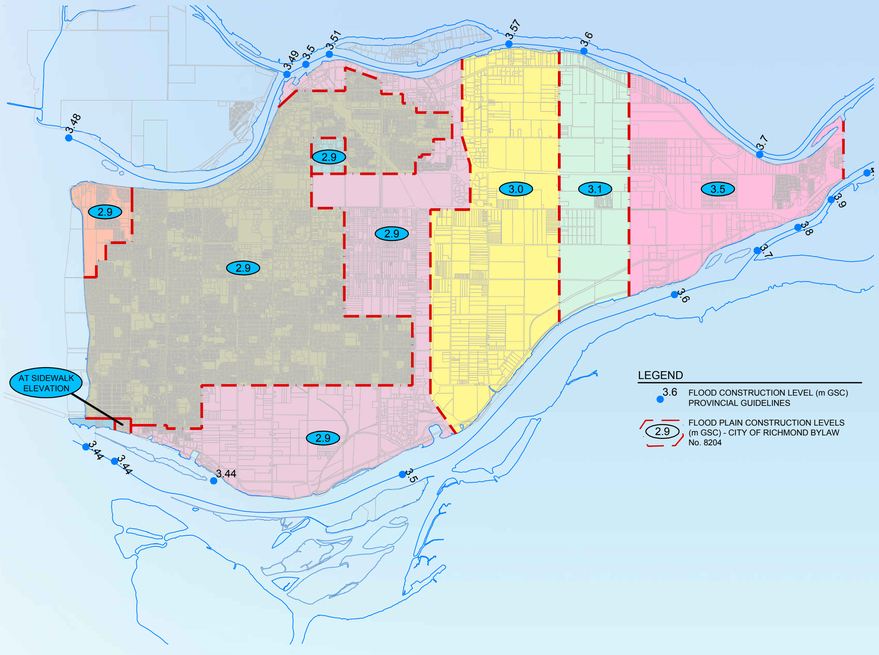
FLOOD PROOFING &
FLOOD CONSTRUCTION LEVELS (FCL's)



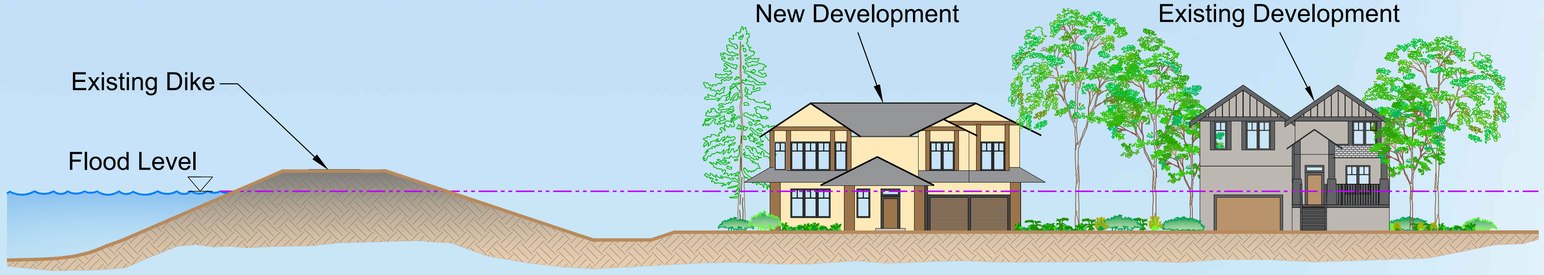
Buildings can be constructed as flood proofed by setting the floor elevation above the flood risk elevation. This minimum floor elevation is called the Flood Construction Level (FCL). Currently the City of Richmond mandates a minimum FCL through the Flood Plain Designation and Protection Bylaw No. 8204.



FCL as Primary Flood Protection



FCL's by area on Lulu Island.



Dike as Primary Flood Protection

GOALS:
- Minimize damage to critical infrastructure in the event of flooding
- Increase overall ground elevation over time

CHALLENGES:
- Inconsistent grading across neighbouring properties
- FCL's are only applicable to new development

NEXT STEPS:
- Consultation with architects, planners and developers
- Consider amendments to the Flood Plain Designation and Protection Bylaw No. 8204

WEST DIKE

The primary strategy for the West Dike is to raise the dike crest to 4.7 m.
Construction of barrier islands may allow for future deferrals of crest height increases.



Barrier islands can dissipate waves before they reach the shore, reducing the risk of waves overtopping the dike, and reducing the impact of waves breaking on the dike face. In combination with a barrier island, a dike with a lower crest elevation may be adequate to withstand increased wave run-up associated with increased water depths due to climate change and sea level rise.

A key issue in constructing barrier islands is the potential environmental impact. With appropriate environmental consideration during design and construction, barrier islands can create intertidal habitat, such as sand flats, mud flats, salt marsh and eelgrass beds. These ecological features can contribute to dissipating waves and protecting the dike from erosion. The intertidal habitat can work in combination with a dike to mitigate flood risk.



Artistic rendering of the barrier island concept for Sturgeon Bank

