

Metro Vancouver Flood Resilience Task Force

Lower Mainland Flood Management Strategy
Presentation by Fraser Basin Council
February 23, 2022

Presentation Outline

1. Flood Management

2. LMFMS Phase 1

3. LMFMS Phase 2

4. Next Steps

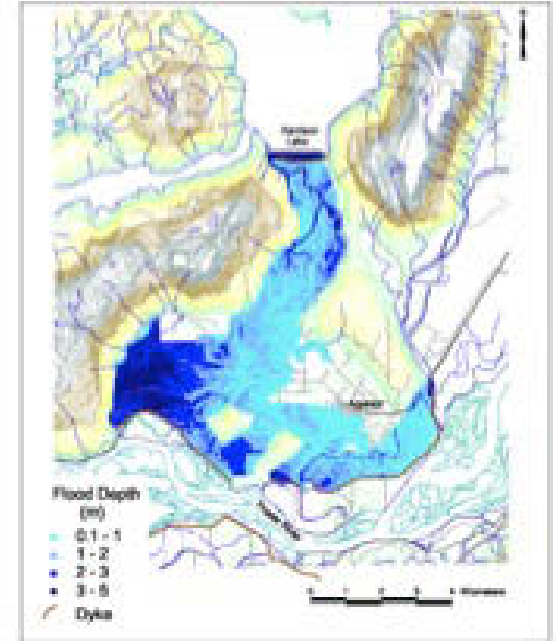
The Fraser Basin Council – Who Are We?



- Nongovernmental, not for profit organization
- Educator and convener/facilitator of inclusive and constructive dialogue
- Role to assist in resolution of complex, inter-jurisdictional sustainability issues

1. Flood Management

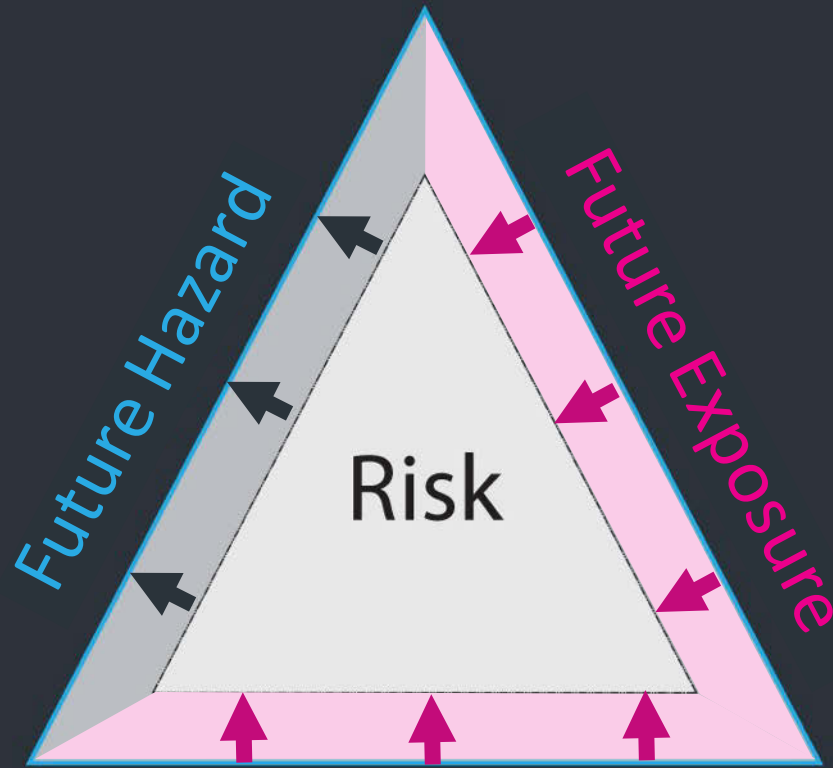
- **Flood protection works** – diking systems, pumps, erosion protection and other engineering
- **Floodplain management** – guiding growth out of floodplains and building up above flood levels
- **Emergency management** – emergency planning, response and recovery
- **Information** – maps, models, monitoring networks, forecasting







Climate
Change



Future Vulnerability

Investment in
Resilience



Targeted
Development

Flood Management in British Columbia

Floodplain Management Policy

- Setbacks and flood construction levels

After 1972 floods

1950s – 1995 (after 1948 floods)

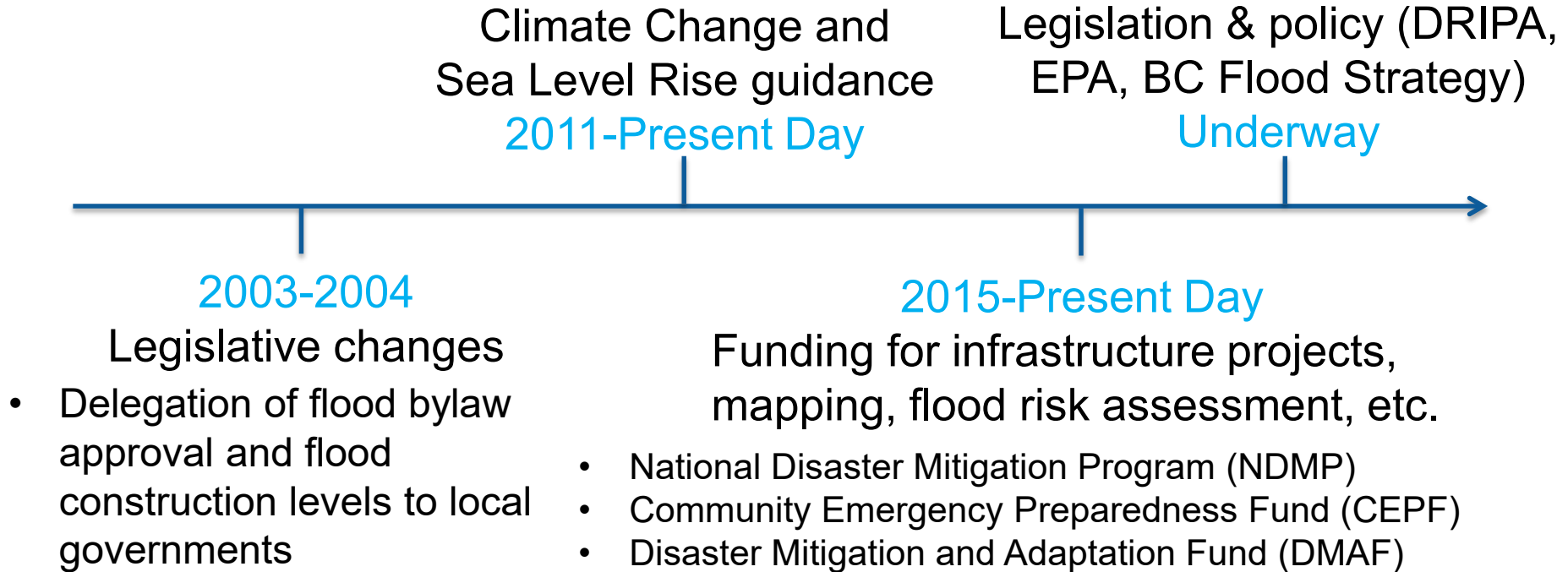
Fraser River Flood Control Program

- Upgrades to flood protection infrastructure
- Cost-shared 50/50 Canada and BC
- Local governments to take on dike ownership, RoW, and O&M

1987-1998

Floodplain Mapping

Flood Management in British Columbia



Flood Management – Roles and Responsibilities

Flood protection works

- Standards and regulations by province
- Operations and maintenance by local authorities
- Periodic funding programs from provincial / federal governments

Floodplain management

- Guidance by province
- Local authority decisions about zoning, bylaws, regulations, FCLs

Emergency management

- Local authorities first, then provincial resources, then federal

Flood Management – Challenges

- Funding is ad hoc, insufficient, unpredictable, and inconsistent
- Flood consequences are inter-jurisdictional
- Management and decision-making roles are distributed and uncoordinated. Many have roles, but no one is fully responsible or accountable
- Different legislation sometimes has competing objectives
- Regulatory processes can delay or prevent implementation of flood risk reduction actions
- Legislation, policy and governance is evolving

Flood Management – Infrastructure Gaps

- Upgrades needed for existing flood infrastructure (to meet current standards and evolving needs including climate change, environment, and seismic resilience)
- Potential for new flood protection infrastructure (e.g. currently unprotected First Nations communities, coastal communities in response to new SLR flood hazards)
- Flood resilience of non-flood infrastructure (e.g. transportation, hydro-electric, water/wastewater, etc.)

Flood Management and FBC

- Facilitation of multi-jurisdictional / multi-interest flood planning
- Development of flood hazard and risk information
- Education and informed decision-making
- Help professionals, practitioners, and policy-makers connect





Questions?



2. Lower Mainland Flood Management Strategy – Phase 1

Lower Mainland



Floods Addressed by the Strategy

Fraser River Freshet



Coastal Storm Surge



Roles of FBC and Partners

Fraser Basin Council

- Convenor, facilitator, coordinator, administrator (***not decision-maker***)

Partners / participating organizations
– all orders of government, the private sector and civil society

- Funding, data, advice and expertise
- Decision makers
- Other key work in parallel

Phase 1 of the Strategy (2014-2016)

Building a better understanding of:

- **Flood hazards** – more and bigger Fraser and coastal floods with climate change
- **Flood vulnerabilities** – 300,000 people displaced, \$20-30 Billion in losses
- **Flood protection infrastructure, policies and practices** – most dikes in the don't meet provincial standards for height and seismic resilience

Lower Mainland Dike Assessment

Dike integrity depends on many factors such as:

- Dike crest height
- Geometry
- Geotechnical stability during floods & earthquakes
- Erosion protection
- Control of vegetation/animal encroachments
- Appurtenant structures on dikes
- Administrative arrangement including secured rights of way and inspection practices

Lower Mainland Dike Assessment


75 dikes included in desktop assessment:


- 69% were rated as Poor to Fair ; 18% Unacceptable to Poor; 13% as Fair to Good
- 71% of assessed dikes are vulnerable to failure by overtopping
- Only 4% of assessed dike segments meet current provincial standards for dike crest height – includes 0.6m of freeboard above water surface elevation of design flood event.

Fraser River Flood Scenarios Map


Regional Assessment of Flood Vulnerability

A Map Showing Estimated Flood Extents for:

 Scenario C (Present Day)

 Scenario D (Year 2100)
– Further Extent of Flooding

 Existing Waterways

 First Nations Reserves & Treaty Lands

 Municipal Boundaries (white line)

 Highways

 Rail & Shipping Connections

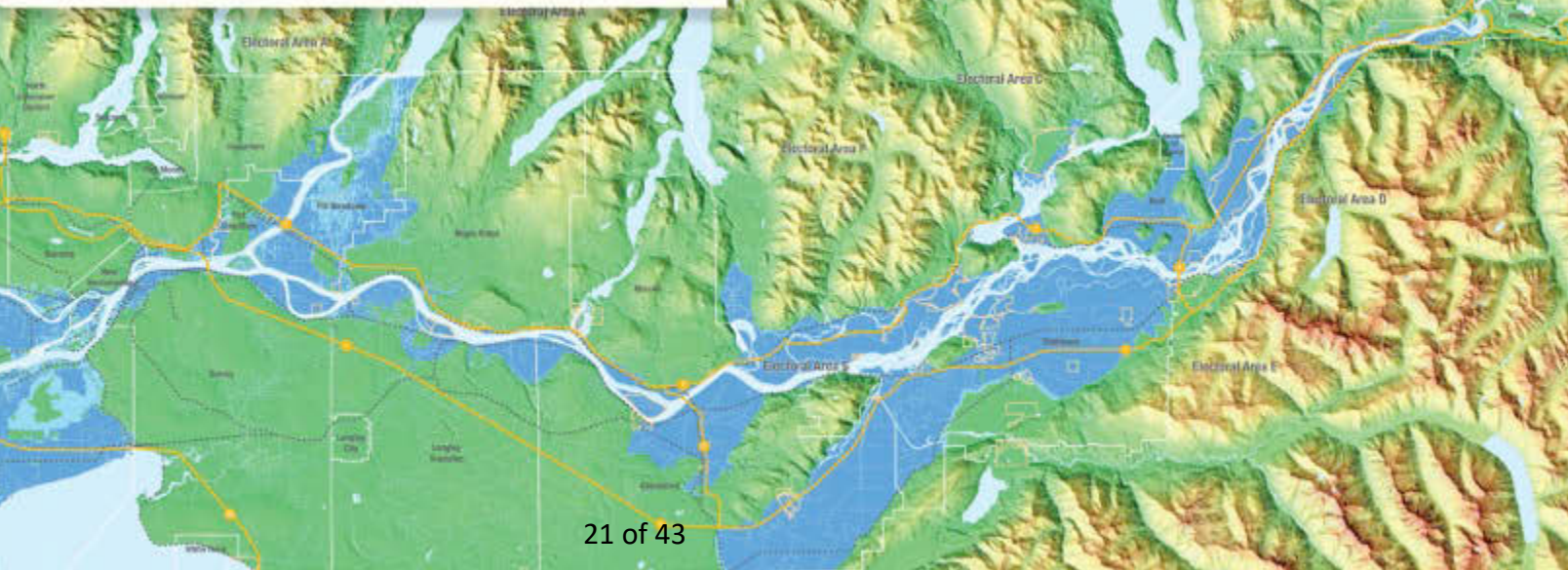
 N
 0 5km 10km



For more detail, including some essential facilities located in floodplain areas, see regional and subregional maps in the report *Regional Assessment of Flood Vulnerability*.

These maps will also be posted separately at floodstrategy.ca.

Note on Maps: All maps prepared for this project are for general illustration purposes at a regional scale. They are not floodplain maps and do not have official designation of floodplains. For this reason, they should not be used for site-specific flood management planning. See the full vulnerability assessment report for more detailed maps and explanation on use.



Regional Assessment of Flood Vulnerability

Estimated People Impacted

Flood Scenario	Total population seeking shelter	Number of Municipalities	Number of First Nations	Number of Reserve / Treaty lands
A. Coastal Present Day	238,000	15	4	7
B. Coastal Year 2100	261,000	15	5	9
C. River Present Day	266,000	17	22	43
D. River Year 2100	311,000	17	23	47



Regional Assessment of Flood Vulnerability

Total Economic Loss Projections

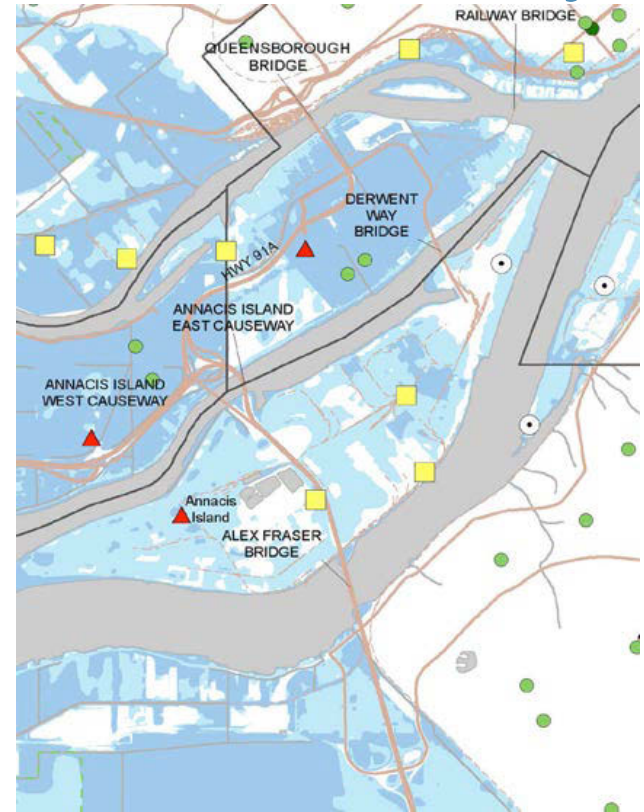


Flood Scenario	Residential	Commercial	Industrial	Public/ Institutional Buildings	Interrupted Cargo Shipments	Infra- structure	Agriculture	Total
A. Coastal Present Day	\$5.6 B	\$6.3 B	\$1.6 B	\$720 M	\$3.6 B	\$1.4 B	\$100 M	\$19.3 B
B. Coastal Year 2100	\$7.1 B	\$8.6 B	\$2.6 B	\$910 M	\$3.6 B	\$1.8 B	\$200 M	\$24.7 B
C. River Present Day	\$2.6 B	\$3.8 B	\$1.6 B	\$880 M	\$7.7 B	\$4.6 B	\$1.6 B	\$22.9 B
D. River Year 2100	\$6.6 B	\$7.6 B	\$2.9 B	\$1.2 B	\$7.7 B	\$5.0 B	\$1.6 B	\$32.7 B

Regional Assessment of Flood Vulnerability

Flood extent maps include locations of critical facilities:

- Fire, Police and Emergency Operations Centres
- Hydroelectric sub-stations
- Airport & Port facilities
- Hospitals
- Schools



An aerial photograph showing a large body of water that has flooded an industrial or commercial area. Numerous buildings, including large warehouses and smaller structures, are partially submerged. Several large ships and barges are visible in the water. In the background, there are dark, forested mountains under a cloudy sky. The foreground shows the tops of some evergreen trees and a portion of a brown roof.

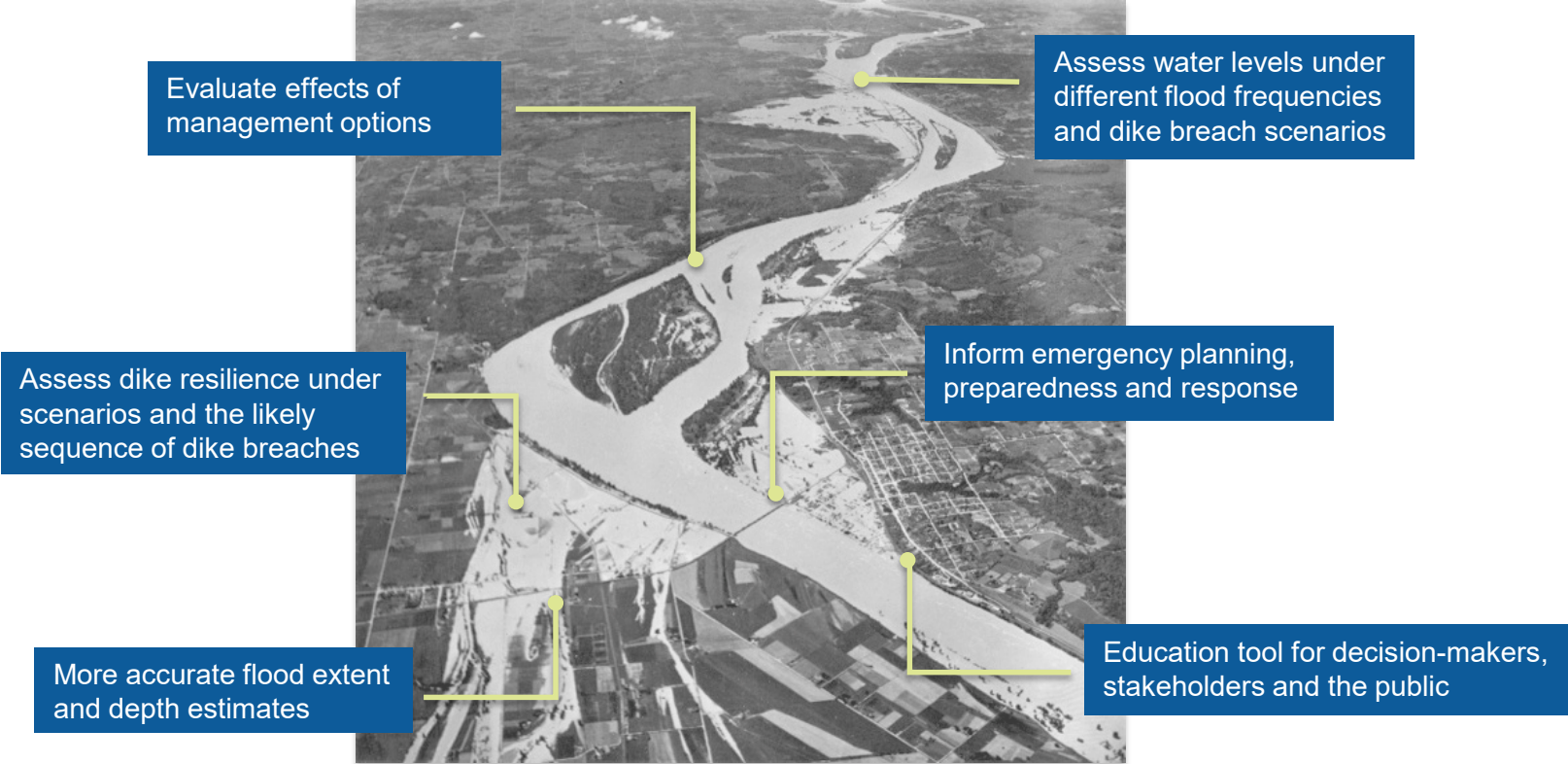
Questions?

Christina Toth,
Nov 2021



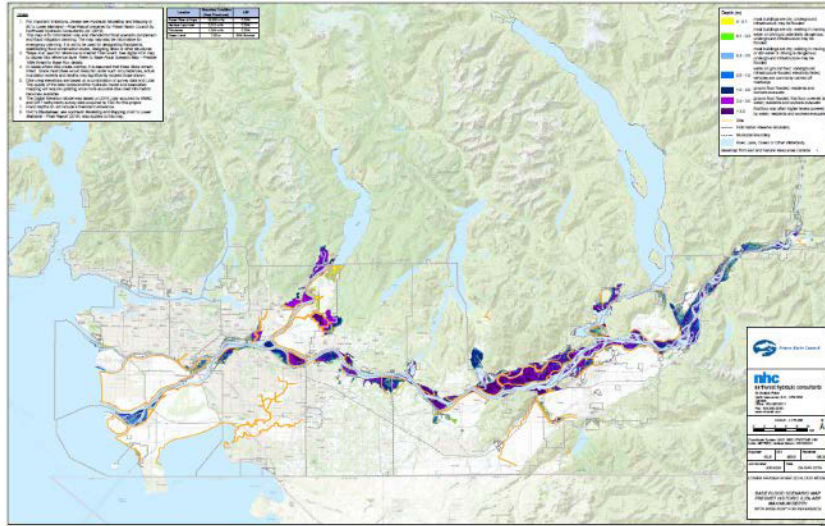
3. Lower Mainland Flood Management Strategy – Phase 2

Lower Fraser Flood Model: A Tool for the Region



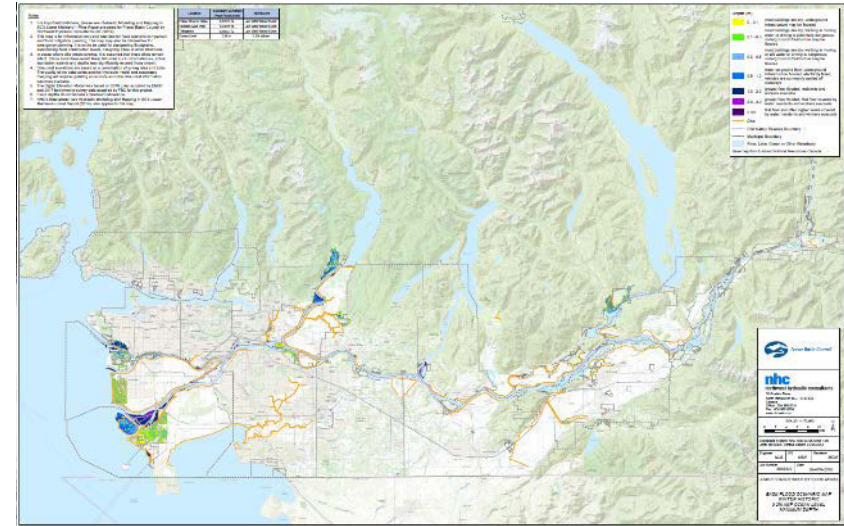
Modeling and Mapping Flood Hazards

Fraser River Freshet



0.2% AEP (500-year) flood (modelled)

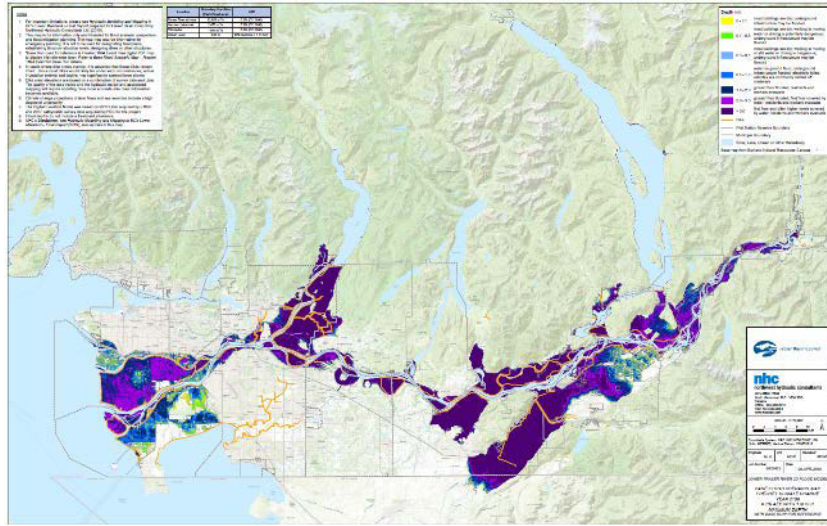
Coastal Storm Surge



0.2% AEP (modelled; Fraser River floodplain only)

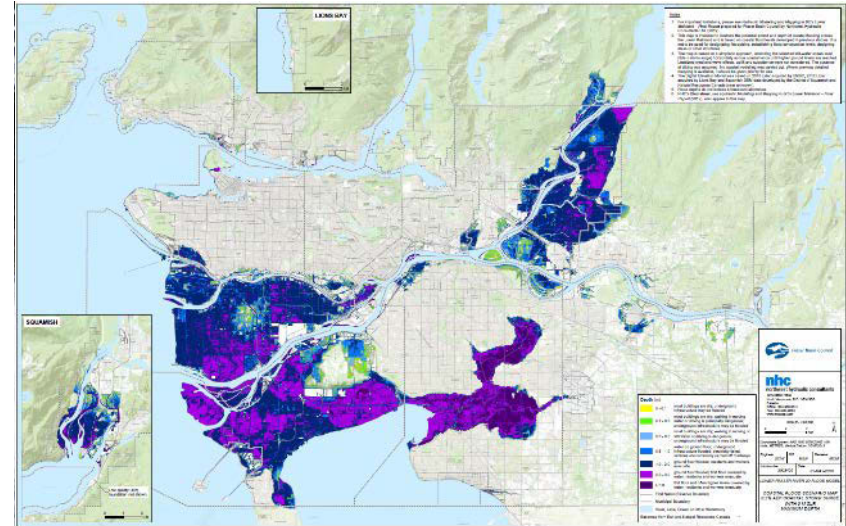
Modeling and Mapping Flood Hazards

Fraser River Freshet



0.2% AEP (500-year) flood in 2100 with climate change (modelled)

Coastal Storm Surge



0.2% AEP with 1m sea level rise (simplified)

Flood Hazard Modelling and Mapping Key Findings

Many areas not currently protected by dikes will be flooded by even a small flood event.

Total area flooded and dikes overtopped increase as freshet flood scenarios become more severe.

Climate change is expected to increase water levels (1m plus) and total area impacted.

Dike breaches upstream could cause severe impacts and would have limited and temporary effects on peak water levels.

5 mitigation measures were modelled

Dike raising prevented overtopping but increased flood water levels

Other measures reduced river levels in the range of 10-30 cm

Lower Mainland Flood Risk Assessment – Risk Categories

Category	Sub-category	Definition/Variables	Metric
Tangible Direct Damage	Residential	Direct damage to residential structures and contents	Damage \$
	Non-residential	Direct damages to commercial and industrial structures and contents	
	Public	Direct damage to public buildings and infrastructure	
	Agricultural	Direct damage to agriculture production, buildings, and equipment	
Intangible Community Impacts	Education and Culture	Schools, libraries, & museums	(Exposure * Units)
	Community Centres	Community associations, rec centres, halls, & churches	
	Heritage	registered heritage buildings/sites	
	Archaeological	registered archaeological sites and cemeteries	

Lower Mainland Flood Risk Assessment – Risk Categories

Category	Sub-category	Definition/Variables	Metric
Social Vulnerability	Shelter	Residents facing difficulty acquiring emergency & permanent shelter	(Exposure * Units * census factor)
	Financial Capacity	residents with lower financial capacity	
	Social Services	residents with greater dependence on social services	
Environment	Hazardous material	Locations with potential hazardous material release	(Exposure * Units)
	Sewage	Potential sewage pollution from inundated network and treatment plants	
	Sensitive areas	Area of green space inundated	
Lifeline Disruptions	Transportation	Number of affected trips	(Exposure * Units)
	Road Network	Kms of road inundated	
	Emergency services	Number of police, fire, or EMS facilities inundated	
	Health services	Hospitals, medical centres, care facilities inundated	
	Electrical Service	Substations and transformers inundated	

Lower Mainland Flood Risk Assessment

SCP

Lower Mainland Flood Risk Assessment

↑ ? ↶

Select Geography

Census Subdivision

Census Tract

Dissemination Area

Select Scenario

Freshet - 0.2% AEP (500-...

Freshet - 0.5% AEP (200-...

Freshet - Estimated Annual...

Winter - 0.2% AEP (500-y...

Winter - 0.5% AEP (200-y...

Winter - Estimated Annual...

Combined - 0.2% AEP (5...

Combined - 0.5% AEP (2...

Combined - Estimated An...

Please Note

Map navigation options available on hover including pan

Click selected geography a second time to show all again

Default weighting is from advisory group workshop

Click 'Reset' and 'Default' to set all

Tangible Direct Damage		Community Impacts		Lifeline Disruptions		Social Vulnerability		Environment			
25%		10%		31%		15%		19%			
Weighting Categories											
								Select Value	2	Reset	Default
Agricultu...	<input type="text" value="6"/>	Archaeolo...	<input type="text" value="2"/>	Electrical ..	<input type="text" value="6"/>	Financial Ca	<input type="text" value="3"/>	Sensitiv..	<input type="text" value="6"/>		
Non-Resi..	<input type="text" value="6"/>	Heritage	<input type="text" value="2"/>	Road Netwo	<input type="text" value="6"/>	Social Serv..	<input type="text" value="3"/>	Hazardo	<input type="text" value="7"/>		
Public	<input type="text" value="6"/>	Communit..	<input type="text" value="3"/>	Trips	<input type="text" value="6"/>	Shelter	<input type="text" value="3"/>	Sewage	<input type="text" value="6"/>		
Resident..	<input type="text" value="7"/>	Education and Culture	<input type="text" value="3"/>	Emergency	<input type="text" value="7"/>	Exposed Population	<input type="text" value="6"/>				
				Health Serv	<input type="text" value="6"/>						

Ranking			
Ra..	ID	Census Subdivi..	Weighted To
1	CTDA338	Kent	53.44
2	CTDA92	Surrey	44.68
3	CTDA304	Chilliwack	33.20
4	CTDA259	Richmond	32.88
5	CTDA109	Richmond	32.24
6	CTDA104	New Westminst..	30.40
7	CTDA414	Richmond	26.19
8	CTDA355	Chilliwack	24.49
9	CTDA325	Chilliwack	23.37
10	CTDA332	Maple Ridge	22.60
11	CTDA191	Richmond	22.50
12	CTDA326	Chilliwack	19.35

FloodWise.ca

FL**ODWISE**
IN BC'S LOWER MAINLAND

Protect Your Home & Business ▾

Flood Strategy ▾

Flood 101 ▾

Reduce Flood Risk ▾

Flood Toolkit ▾

Flood Maps ▾

EMERGENCY INFO



FL**ODWISE**
IN BC'S LOWER MAINLAND

Your information portal on flood risk management

FLOOD 101

Draft Goals of the Strategy (in Draft 1)



Improve understanding of Lower Mainland flood risk and increase awareness



Support investment and actions to reduce flood risk, avoid the creation of new risk, and build resilience of communities, ecosystems and critical infrastructure



Strengthen flood risk governance in the Lower Mainland

Draft Recommended Actions (in Draft 1)



5.1

Improve Understanding of Flood Risk

Flood Hazard and Risk Information
Information Access and Sharing
Educating on Flood Hazard and Risk



5.2

Reduce Flood Risk and Increase Resilience

Enabling and Regulating Proactive Flood Risk Management
Evaluating, Selecting and Designing Flood Risk Reduction Initiatives
Guidance and Knowledge-building for Flood Risk Reduction
Further Study on Flood Risk Reduction Opportunities
Enhancing Emergency Response and Recovery



5.3

Flood Risk Governance

Collaborative and Coordinated Flood Planning
Reconciliation with First Nations
Regional Prioritization of Flood Risk Areas

Some Highlights of What We've Heard

- Much support for a majority of the draft 1 recommendations
- It's time for action. There is an urgent need. This has been studied to death.
- Need more analysis on flood hazards, risks, and risk reduction measures before finalizing the LMFMS such as:
 - Expand the flood risk assessment to fill gaps
 - Include other flood hazards (e.g. atmospheric rivers)
 - Expand to include the entire Fraser watershed
 - Evaluate the suitability of different measures for different locations or characteristics in the Lower Mainland
 - Integrate environmental values
 - Evaluate the suitability of different governance arrangements

Some Highlights of What We've Heard

- First Nations rights, interests and worldviews have not been adequately included in Draft 1. There is especially a need for more foundational work regarding key articles of UNDRIP
- More is required on formalizing the process of Strategy development (who decides what, when?)
- There are different views on:
 - Purpose and scope of the Strategy
 - How to set priorities
 - How prescriptive vs. enabling the Strategy should be
 - How to improve consistency vs. maintain local autonomy
 - Appropriate governance and funding arrangements for implementation

4. Next Steps

- Inform urgent action with work and input received to date
- Formalize the process of strategy development including the decision-making roles and responsibilities of the Leadership Committee and participating organizations
- Clarify the roles, responsibilities and expectations of the Provincial, First Nations and Federal governments as well as the Fraser Basin Council on integration and implementation of the articles of UNDRIP
- Strengthen opportunities and resources for First Nations participation
- Continue engagement with all jurisdictions to clarify direction on:
 - Scope of the strategy
 - Governance and funding arrangements
 - Regional priorities, risk reduction measures, and more

Next Steps – What will it cost?

- It depends, there is much uncertainty
- \$9.5 Billion in the 2012 Cost of Adaptation report

Variables include:

- What mix of structural and non-structural measures?
- What standard of flood hazard / what tolerance of risk?
- How much land is needed, at what cost?
- When are investments made and how are costs amortized over time?
- How much seismic resilience and through what means?
- Design for co-benefits?

Next Steps – Other Opportunities

- Increased awareness
- Emergency Program Act modernization
- BC Flood Strategy
- Other regional and local strategies and actions

Questions?



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See also
FloodWise.ca