Flooding Crisis in Canada

A systems thinking approach of the inputs, system dynamics and outputs leading to the flooding crisis

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Background

-Flooding is the most prominent natural disaster in Canada
-22% of residential properties are vulnerable to overland flooding
-Wetlands occupy 16% of the country with over 8500 rivers and more than 2 million lakes cover Canada
-With climate change, the frequency and severity of flooding is on the rise

Over the past 10 years:

>$5 billion losses

1.3 million affected (directly & indirectly)

Immeasurable social & cultural losses

Our research methods comprised:

Academic
72 Literature reviews
Government - federal & provincial
15 Publications

Interviews
40 Qualitative interviews
Intergovernmental
5 Publications

Problem Landscape

What are the top 3 challenges in Canada?

Aging and vulnerable infrastructure

- 40% of roads and bridges in fair, poor or very poor condition
- 30% of water infrastructure in fair, poor or very poor condition.

Canadian Infrastructure Report Card (CIRC), Nov 2019

Lack of climate adaptation-focused policies

"Canadian municipalities will need to invest $5.3 billion annually to mitigate the worst impacts of climate change"

Federation of Canadian Municipalities & Insurance Bureau of Canada report, Feb 2020

Integrated operations concerns

"Canada needs continued federal leadership to create a cohesive National Action Plan on Flooding"

Insurance Bureau of Canada, Sep 2019

Stakeholders Map

Who are the stakeholders at the federal/provincial/territorial levels and what are the interrelationships?

Working Groups

Four core groups exist with frontline workers involved in:

- **Prevention/Mitigation**
- **Response**
- **Preparedness**
- **Recovery**

Advisory Committees

Two groups exist with no reporting relationship between them:

- **Senior Officials Responsible for Emergency Management**
- **Canada's Platform for Disaster Risk Reduction Advisory Committee**

F/P/T Ministries

The federal/provincial/territorial ministries have two main members:

- **Deputy Ministers** - responsible for setting priorities & responsibilities
- **Ministers** - act as links to the Premier's Office ensuring pubic safety & maintaining oversight of ministries' commitments

**Emergency & disaster management policies are informed by opinions of each group starting from left to right*

Solutions Landscape

What solutions can solve the current challenge?

Infrastructure: Resilience and detection

" Build more resilient infrastructure while integrating environmental protection, disaster prediction and sustainable development concepts"

-Emergency Management Framework for Canada: Toward a resilient 2030

Institutional: Insurance-focused Policy Planning

EM Framework report articulates core concepts that guide governments, to save lives, protect property and the economy, and preserve the environment

-Emergency Management Framework for Canada, 2017

Asset-Based Community Development initiatives

"Community-based initiatives that focus on mobilizing community assets to enhance local resiliency and preparedness as done around the world"

e.g. Tamarack Institute, Coady International Institute

Gaps & Levers

What is missing and what current efforts could be joined up or improved?

Limited collaboration between stakeholders
Enhance whole-of-society collaboration to improve understanding of risks, needs, resources, capacities, and vulnerabilities incl. inter & intradepartmental groups

Limited capital injection
Agree on government-backed, national flood insurance program, invest in new infrastructure projects where deficiencies exist, household vulnerability & water damage awareness programs

Limited community-based adaptive capacity
Promote, fund and foster proactive, self-directed asset-based community development initiatives that focus on mobilizing community assets to enhance preparedness & response efforts

APPENDIX

Problem Landscape			
Factor	**Major issues**	**Facts & Examples**	**Impacts**
Environment	Large hydrological, catchment & watershed areas	Mean precipitation across Canada increasing by about 12%	Increased runoff
	Inadequate drainage system	In southern Ontario, 72% of the original wetlands have been lost to development (e.g., agriculture, urban sprawl and other land conversion)	Reduced infiltration capacity
	Poor spatial planning - 80% of Canadians living in urban areas	In Alberta, approximately 64% of the original wetlands in settled areas no longer exist.	Poor water retention
Technology	Limited flood warning system	Agencies use inventory planning with no real-time resource location feedback e.g. Microsoft Dynamics AX	Reactive planning, response and recovery efforts
	Lack of efficient decision support systems – alerts, predictive resource planning and real-time monitoring	Federal Flood Mapping Guidelines exist but no advance flood mapping technologies exist that provide real-time and predictive visibility of flooding threats	Poor flooding risk visibility and monitoring
	Lack of below ground wireless hydrological sensors		
Institutional & Socio-cultural	Limited disaster assistance	A 2017 study in Montreal that experienced flooding found that "almost 70% of respondents reported having suffered from anxiety, sleep disturbances or concentration problems since the floods.	Limited coordination between provincial agencies
	Absence of provincial ties promoting knowledge	34% of Canadians are insured for overland flood coverage	Limited understanding of flood risk and transparency
	transfer, information sharing, technical skills		
	Lack of community capital & social capacity	Of 2,300 homeowners surveyed, only 6% know that their home is in a designated flood risk area and only 21% believe that the risk of flooding will increase over the next 25 years.	Governance concerns
	Loss of security, safety and increased stress		Ambiguous and overlapping roles, responsibilities

Economic	Limited infrastructure capital investment	Average annual federal share of response and recovery costs has increased from $10 million (1970-1995) to $110 million (1996-2010) $13 to $360 million (2011-2016)	Loss of business and economic continuity
	Absence of low-cost national flood insurance program	Insurance payouts for flooding related catastrophic losses exceeded $1 billion per year (2009-2017)	Damage to machinery and equipment, transport infrastructure and property
	Lack of overland flooding insurance offered by private insurers	Flood-related lawsuits involving homeowners, developers, local governments, provinces and private businesses are on the rise in Canada e.g. $900 million Muskoka Class Action, 2016 (ongoing), $950-million Anderson et al. v. Manitoba class action lawsuit, 2017 (ongoing)	Disruption to energy supply networks
	Flooding affects local and federal credit ratings		
Infrastructure	Land use and development increasing flooding vulnerability	1.7 million Canadian households (19% of Canada's population) at risk of river (fluvial) and surface water (pluvial) flooding	Inadequate infrastructure system
	Limited flood resilient infra planning and development	Canadians personally bear roughly $600 million in flood-related losses every year.	Inadequate drainage system
	Flood control real-time monitoring & forecasting technologies		

Solutions Landscape

Desired national outcome	Provincial, territorial and federal institutions and community-based disaster & emergency response team preparedness in Canada			
Strategic Outcomes - Local, provincial & federal levels	Provincial, territorial and federal institutions and emergency response teams organize lessons learned workshops and reporting framework	Encourage and facilitate reporting & collaboration between SOREM and Advisory councils. This supports accountability, transparency and whole-of-organization governance	Define common outcomes, establish join strategies Identify roles and responsibilities Establish compatible procedures, policies and cross-agency borders	Canadian public awareness and information sessions on disaster & emergency response practices and action plans
Intermediate Outcomes	Provincial, territorial and federal institutions and community-based disaster & emergency response team preparedness in Canada			
Outputs	Joint provincial exercises Post incident reports Capability improvement plans	Promote and facilitate information sharing, consultations and awareness programs Develop governance structures, policies, strategies, guidelines and standards Define post-incident reporting framework and lessons learned	Develop panning standards, guides and best practices Plan multistakeholder engagement between infrastructure, prevention, mitigation, response and recovery teams/groups	Public awareness campaigns Outreach & awareness weeks
Activities	Joint provincial exercises	Disaster & Emergency Management Policy & Planning	Strategic Coordination	Communications
Local, provincial & federal initiatives	Emergency Management Exercises	Disaster & Emergency Management Planning		Preparedness and Response