What the

Just happened?

THOMPSON WATERSHED DISASTER MITIGATION
COMMUNITY FORUM
FEBRUARY 14, 2018

Dwayne Meredith, P.Ag.
Agenda

- Historic context and recent events
- Policy and scientific information
- Why this is happening
- What can be done
Take Away Message

- Flood and Debris Flows (maybe other natural hazards!) will be occurring more often.

- Risk Assessments are a valuable tool and are needed to complete mitigation efforts.

- To address these hazards, a wide range of individuals need to be involved.
# History of Flood Costs

<table>
<thead>
<tr>
<th>Year</th>
<th>Province</th>
<th>Event Description</th>
<th>2016 (Millions)</th>
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<tbody>
<tr>
<td>2013</td>
<td>AB</td>
<td>Calgary</td>
<td>$6,200</td>
</tr>
<tr>
<td>1954</td>
<td>ON</td>
<td>Southern ON (Hurricane Hazel)</td>
<td>$6,124</td>
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<tr>
<td>1948</td>
<td>BC</td>
<td>Fraser River</td>
<td>$5,875</td>
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<tr>
<td>1950</td>
<td>MB</td>
<td>Winnipeg</td>
<td>$5,284</td>
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<tr>
<td>1996</td>
<td>QC</td>
<td>Saguenay</td>
<td>$3,066</td>
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<tr>
<td>2005</td>
<td>ON</td>
<td>Southern Ontario</td>
<td>$1,803</td>
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<tr>
<td>2005</td>
<td>AB</td>
<td>High River, Southern AB</td>
<td>$1,725</td>
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<tr>
<td>1997</td>
<td>MB</td>
<td>Southern Manitoba</td>
<td>$1,397</td>
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<tr>
<td>1948</td>
<td>ON</td>
<td>Southern Ontario</td>
<td>$802</td>
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<tr>
<td>1993</td>
<td>MB</td>
<td>Winnipeg</td>
<td>$702</td>
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<tr>
<td>1937</td>
<td>ON</td>
<td>Southern Ontario</td>
<td>$534</td>
</tr>
<tr>
<td>1923</td>
<td>NB</td>
<td>Saint John River Basin</td>
<td>$526</td>
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<tr>
<td>1955</td>
<td>SK/MB</td>
<td>Manitoba and Saskatchewan</td>
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<td>2004</td>
<td>AB</td>
<td>Edmonton</td>
<td>$344</td>
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<tr>
<td>1995</td>
<td>AB</td>
<td>Southern Alberta</td>
<td>$324</td>
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<tr>
<td>1934</td>
<td>NB</td>
<td>Plaster Rock</td>
<td>$225</td>
</tr>
<tr>
<td>1936</td>
<td>NB</td>
<td>New Brunswick</td>
<td>$214</td>
</tr>
<tr>
<td>1999</td>
<td>MB</td>
<td>Melita</td>
<td>$185</td>
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<tr>
<td>1916</td>
<td>ON</td>
<td>Central Ontario</td>
<td>$183</td>
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<tr>
<td>1909</td>
<td>NB</td>
<td>Chester</td>
<td>$169</td>
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<tr>
<td>1961</td>
<td>NB</td>
<td>Saint John River Basin</td>
<td>$168</td>
</tr>
<tr>
<td>1987</td>
<td>QC</td>
<td>Montréal</td>
<td>$167</td>
</tr>
<tr>
<td>1996</td>
<td>QC</td>
<td>Montréal and Mauricie Region</td>
<td>$165</td>
</tr>
<tr>
<td>1920</td>
<td>ON</td>
<td>Southwestern Ontario</td>
<td>$150</td>
</tr>
<tr>
<td>1920</td>
<td>BC</td>
<td>Prince George</td>
<td>$149</td>
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<td>2004</td>
<td>ON</td>
<td>Peterborough</td>
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<td>1972</td>
<td>QC</td>
<td>Richelieu River</td>
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<td>1983</td>
<td>NF</td>
<td>Newfoundland</td>
<td>$131</td>
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<tr>
<td>1974</td>
<td>QC</td>
<td>Maniwaki</td>
<td>$117</td>
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Floodwaters are once again rising

Lumby, May 5 and June 21, 2017

Armstrong, May 5, 2017

Vancouver, October 12, 2017
Flood 2017

Helmer Lake Dam

Guichon Creek

Cache Creek
BC Flood Management

- 2003/4 Amended Legislation to “Local Authority” from Province
- 2004 BC Flood Hazard Area Land Use Guidelines
- Designated FPs 30 years ago no longer considered designated
- Province retained authority for diking oversight
- Prepared flood guidelines but no standards/regulations ever produced
- Local Authority responsible for hazard mapping and development approval
Landslides 2017

May 6: Debris flow into Shuswap Lake

May 14: evacuation order has been issued for 17 properties near West Kelowna

Nov 23: Rainfall warning issued for Vancouver, Fraser Valley with up to 150mm expected
Landslide – Debris Flow Management

- 2004 BC Flood Hazard Area Land Use Guidelines
- Province considers protective works to be authorized under DMA
- No Provincial landslide guidelines
- Local Authority (or Provincial Approving Officers) responsible development approval

3.4 Areas Subject to Debris Flows

Development should be discouraged in areas where local knowledge, experience or studies indicate concern that there may be a debris flow hazard.

3.4.1 Professional Evaluation

Consent to develop may be granted, with standard requirements as established for alluvial fans in section 3.3, where:

- There is no other land available, and
- Where an assessment of the land by a suitably qualified professional indicates that development may occur safely.
Landslide – Debris Flow Management

What is a Landslide? Debris Flow?

“Landslide A movement of a mass of rock, debris, or earth down a slope” (Cruden 1991).

Usual triggering mechanism:

- Water
- Seismic Activity
- Volcanic Activity
Why is this happening?
Why is this happening?
Why is this Happening?

- Find the susceptible areas or system weak points:
  - Post wildfire – changed hydrology, hydrophobic soils
  - Exposed streambanks following past flood.
  - Tufa or other calcareous deposits
  - Past forest practices
  - Culvert placements
  - Systems with little/no redundancies
  - Systems with design compromises
  - Etc.
What’s Involved

Starting Point:
- Understanding the Hazard
- Understanding the Consequences – or at least what we currently value.

Risk = Hazard x Consequence
What’s Involved

Included in the process: determine who’s included.

Engagement: involving the right people to influence project outcomes
What’s Involved

- Participation

Select your level of Engagement
1. Client expectations & tolerance (early buy-in)
2. Engagement objectives (desired outcomes)
3. Who is your audience? (skills, absent voices)
4. What are public concerns/expectations? (who cares?)

![Diagram showing levels of public engagement: Inform, Consult, Involve, Collaborate, Empower.](chart)

**Influence Over Outcome**
# Mitigation Strategies

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
<th>Examples</th>
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</table>
| Protect | Protect existing development in its current form and location, balancing costs and increasing vulnerability against societal cost and risk associated with other strategies. | - Construct and maintain dikes to keep floodwater within the river floodway  
- Provide erosion protection works to mitigate the potential for channel migration toward developed areas  
- Construct dams and diversions that can attenuate or bypass peak flows |
| Accommodate | Accommodate the potential consequences of ongoing changes by changing human activities and/or infrastructure to increase resilience. | - Raise land elevation with structural fill  
- Raise elevation of habitable uses above riverine flood risk  
- Provide floodproofed ground floor parking below residential/commercial uses  
- Require flood resistant building materials for commercial uses at ground level  
- Allow water dependent industrial uses (e.g., log sort) |
| Retreat | Manage Retreat by gradually withdrawing potentially-vulnerable infrastructure and services from hazard areas in recognition of their increasing vulnerability. | - Reclaim developed area to natural state as a community amenity |
| Avoid | Avoid increasing the presence or density of potentially-vulnerable populations, infrastructure or services within hazard areas. | - Existing river floodway  
- Areas where a dike breach would result in unacceptable risk or consequence  
- Areas where development could exacerbate hazards or risk for others |
Risk Management: Stepping Down the Risk
I have a dream!

**What is an Integrated Flood Management Framework?**
- Builds on existing templates: Metro Vancouver Integrated Stormwater Management, Squamish IFMP
- Considers Science, Safety, Environment, Community Values, Economics
- Is Holistic and Inclusive
- Balances risks, consequences and costs

**Assessing Hazards**
- River and creek
- Lake
- Stormwater
- Groundwater
- Debris flow/flood
- Seismic
- Coastal

**Mitigation**
Best available to balance risk and consequences

**Decision Making**
- Look at full range of impacts and benefits
- Cost to people
- Benefits to community and environment
IFMP Principles

- Equitably reduce shared flood risks for all floodplain users
- Identify opportunities for economic, environmental, and social development
- Integrated Flood Hazard Management Planning
- Promote socially and environmentally sustainable decisions
- Create realistic, achievable solutions supported by the local community
Take Away Message

- Flood and Debris Flows will be occurring more often.

- Risk Assessments are a valuable tool and are needed to complete mitigation efforts.

- To address these hazards, a wide range of individuals need to be involved.
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Dwayne Meredith, P.Ag.
Kerr Wood Leidal Associates
DMeredith@kwrl.ca
250-550-6762