WESTERN FLOOD MAPPING CONFERENCE

Uniting Minds, Mapping Futures: Collaborative Solutions for Western Flood Mapping

Key Takeaways

ClimateWest
Building Prairie Resilience

Natural Resources Canada
Ressources naturelles Canada

Prepared by ClimateWest for Natural Resources Canada
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Contents

Executive Summary

The Western Flood Mapping Conference, held on February 19, 2025, is an outcome of Natural Resources Canada's Flood Hazard Identification and Mapping Program (FHIMP). The conference brought together representatives from multiple levels of government, industry experts, Indigenous communities and organizations, academia, and non-profit organizations. Discussions centered around flood hazard mapping methodologies and outcomes specific to Western provinces and northern territories including British Columbia, Alberta, Saskatchewan, Manitoba, Yukon, Northwest Territories, and Nunavut. Over the course of the conference, four recurring themes were identified and will be detailed in this report. These include:

- Three key challenges to implementing flood mapping outcomes are communication, regulation, and funding. It can be difficult to communicate to the public the need for proactive resources and planning to go towards flood mapping, and engagement was identified as critical. Regulation, both enacting initial regulation and enforcing existing, is another challenge, with a sentiment that senior levels of government could do more to help local governments succeed in this regard. Finally, funding was returned to again and again as the critical piece to both developing flood maps, and to conducting the communication and engagement required to moving mapping outcomes into regulation.
- Equity was recognized as a key piece of successful mapping and implementation. Testimonials from First Nations communities who experienced flooding because of upstream decision-making highlighted the need for diverse and regional perspectives in decision-making. Strategies to improve representation and equity are outlined.
- Mapping strategies and technologies continue to evolve. Guidelines are being developed and updated, and modelling techniques are becoming faster and able to analyze more dynamic scenarios such as multiple hazards and ice jams.
- Climate change has emerged as an important hazard which should be included in any flood mapping project to be used for future planning.

The conference was an opportunity to learn from and network with others in the field, from both technical and non-technical backgrounds. It highlighted innovation in the field as well as pathways for improvement.

Introduction

Natural Resources Canada (NRCan) and ClimateWest partnered to host the Western Flood Mapping Conference in Calgary, Alberta on February 19, 2025. The Western Flood Mapping Conference is an outcome of NRCan's Flood Hazard Identification and Mapping Program (FHIMP) and brought together invested parties from related sectors to address key challenges concerning flood hazard mapping methodologies specific to Western provinces and northern territories including British Columbia, Alberta, Saskatchewan, Manitoba, Yukon, Northwest Territories, and Nunavut.

Insights, opinions, and solutions were discussed with a range of perspectives. Attendees had the opportunity to hear presentations from leading flood mapping professionals and practitioners, offering insights into the latest advancements and challenges in the field. Of the approximately 150 people who attended the conference, nearly one third came from industry with the remainder evenly split among federal government, provincial, and territorial governments, municipal governments, academia, Indigenous organizations or communities, and non-profit/other. Speakers skewed towards industry and government, with limited representation from Indigenous and other groups.

Keynote speaker, Dr. Anna Warwick Sears, Okanagan Basin Water Board

Key Takeaways

This report highlights key takeaways from the conference. These include key challenges to implementing flood mapping outcomes, the need for equity in flood mapping projects and decision-making, the dynamic nature of models and guidelines, and the need for incorporating climate change considerations into flood mapping. Many challenges were identified but these were often matched with ideas for solutions or improvements. These are outlined below and can act as a springboard for positive momentum in the field of flood hazard mapping.

1. Three key challenges to implementation of flood mapping outcomes: communication, regulation, and funding

Communication of flood maps to the public can be difficult but, wide-reaching and equitable engagement is critical. There is need for a shift to proactive, rather than reactive, planning. Communicating the need to proactively put resources towards flood preparedness planning is a common challenge for communities who have not yet experienced the effects of natural disasters first-hand. Therefore, most communities with a comprehensive Emergency Management Plan created it after experiencing a catastrophic flood. Knowing the purpose and the audience behind the mapping at its inception contributes to easier communication down the line, and more successful implementation outcomes. Being able to contextualize and communicate uncertainty in modelling and maps is important for building support, especially around regulatory decisions. One suggestion for improving communication of maps was to create two different, tailored versions of maps and resources; one developed for the general public and decision-makers, and another for subject-matter experts. Another example of a communication strategy for flood maps came from Public Safety Canada, who use a qualitative label approach (low, moderate, high, extreme) to communicate risk and uncertainty to the public. Notably, they do not include a "no" risk category, as there is no location in Canada that is entirely free of risk.

Enacting and enforcing regulation based on outcomes of flood hazard mapping is difficult. While federal, provincial, and territorial governments have guidelines around flood hazard mapping, developing and implementing legislation or regulations fall to local municipal governments. This has resulted in a landscape of regulation around flood hazard mapping that is inconsistent and easily impacted by shifting government priorities. For example, there was

discussion that housing quotas from the B.C. provincial government combined with lobbying from developers disrupts progress on flood hazard legislation by driving development on opportunistic lands which can be floodplains. There was a sentiment, especially among the industry and municipal professionals present, that the senior governments should do more to incorporate flood hazard into development regulations rather than leave it up to municipal governments who may lack capacity.

Funding is a common barrier for communities, both on availability and spending specifications. Throughout the conference, there was discussion from provincial governments who find co-funding requirements to be a positive mechanism to expand investment in flood mapping, contrasted with municipalities who find co-funding can be a hurdle due to limited funds and competing priorities. If co-funding was tailored to jurisdictional capacity, this could address some barriers to flood mapping, especially for smaller communities. There is also a need to expand the activities that are eligible for funding to include communication plans, outreach and engagement, and emergency preparedness planning. Funding these activities can address the gap between mapping and taking action. There is a need for equity in this discussion as smaller, remote, or First Nations communities may need more capacity support to develop plans.

Panel Discussion: Successes and Challenges in Flood Mapping

2. Equity is needed in flood mapping approaches and engagement

Discussions around flood hazard mapping often focus on the technical side but it is important to remember the human impact of flooding, especially downstream of decision-making. There is a need for more regional-scale flood hazard mapping so that decision-makers can see potential downstream impacts, as well as the need for equity and diverse perspectives when planning flood resilience for communities. For example, the Pinaymootang First Nations community experienced flooding of homes and community spaces in 2011 due to an intentionally breached dike upstream of the community, to avoid flooding in the city of Winnipeg. The community had little to no warning before the flood and had to be relocated for a decade afterwards as their community was rebuilt. They were not able to rebuild in the same place as the area is now designated a flood zone, and the people were not consulted on how these decisions were made. As a result of the flood and the community's relocation, they have noticed long-lasting impacts to their way of life as a result of dead trees, traditional medicines lost from the area, spring water impacted, changes in currents of local streams and migratory routes, and contaminated fish. This experience also highlights the potential usefulness of developing community-response guidelines or training for on-the-ground flood response.

Dakota Marsden, Pinaymootang First Nation

Tabitha Clavecillas, Crown-Indigenous Relations and Northern Affairs Canada

It is apparent that governments need to do due diligence to understand and respect the priorities of all communities, from large metropolitan centers to small, remote, and Indigenous communities. Colonial history needs to be recognized when developing guidelines or supporting flood hazard projects, such as the fact that hundreds of First Nations communities were not prioritized in the first national flood damage reduction program because their land was not seen as valuable. Additionally, it is important to recognize that not all engagement is meaningful. To return to Pinaymootang First Nation's experience, the community resorted to grassroots organizing to have their concerns respected following the flood, when the Manitoba government drafted a plan to create a flood channel cutting through 60 kilometers of Pinaymootang territory that would divert water away from the city. The community did not give consent or feel engaged on the plan, so they organized against its construction and the channel did not go forward.

Increased representation and integration of Indigenous knowledge and perspectives is needed throughout all stages of planning, developing, and implementing flood mapping projects. Feedback from this conference mentioned that a lack of Indigenous speakers or panelists gave the feeling that Indigenous representatives were only there to learn from technical experts, rather than there being opportunity for reciprocal learning. Much Indigenous knowledge is not available in the form of technical documentation typically used, such as scientific, peer-reviewed papers and reports. This was acknowledged as a challenge to weaving Indigenous knowledges into guideline development and should act as a springboard to utilizing diverse formats of information in flood mapping projects.

Suggestions to improve equity in flood mapping approaches and engagement include:

- Incorporating two-eyed seeing, a concept that encourages seeing the world through both Indigenous ways of knowing and Western ways of knowing. Two-eyed seeing emphasizes the value of multiple perspectives, using Indigenous knowledge *and* Western sciences in planning and decision-making. There is a need to consider the value of more than just infrastructure, and to consider lives or environments without monetizing their value. These considerations can be recognized in different ways if decision-makers are open to new ways of knowing and doing, including expanded knowledge capture beyond traditional academic and non-academic articles.
- More Indigenous representation in spaces such as conferences and workshops, shift more focus to human and environmental impact (place-based values) rather than

technical aspects to have a more balanced and integrated approach to flood hazard mapping, especially at a regional scale.

- Relationship building should be a continuous effort, not specific to or centered around events. This will improve Indigenous representation in the planning from the start- they know best how to facilitate Indigenous inclusion.
- Have a third-party moderator for workshops rather than someone from the government.
- Involve First Nations representation when having panels with various levels of government to recognize First Nations sovereignty.
- Highlight Indigenous knowledge, expertise, talents, and perspectives throughout the conference rather than singling these out in isolated presentations.
- No consultation without accommodation. Engagement is not meaningful unless concerns are addressed and accommodated in mapping and planning.

3. Mapping strategies and technologies are still evolving and improving

Development of flood mapping strategies fall to the communities or organizations undertaking the effort. Knowing the main purpose or end goal will steer the approach used. Different approaches to prioritize flood hazard mapping were discussed throughout the conference and include:

- **Risk-based approaches:** using the risk triangle of hazard, exposure, and vulnerability to prioritize mapping efforts. Both infrastructure and environment should be included in risk assessments.
- **Place-based approaches:** consultants don't necessarily live in the places they map and thus don't have a long knowledge record to inform realistic models. Communities know their local landscapes best, but accessing this knowledge requires broad engagement which takes time and money.
- **Success-based approaches:** these aim to practically reduce risk and vulnerabilities. Background information needed for a success-based approach includes knowing available tools to reduce risk and a strategy for incorporating equity. One idea for incorporating equity into risk reduction was to explicitly and transparently include multipliers for small, remote, or Indigenous communities; if we only think in terms of numbers, we gravitate towards the south.

Wolf Ploeger, WSP

Flood map modelling technology continues to improve with better and faster models. There is no standard modelling technique to fit every scenario because with dynamic landscapes comes the need for dynamic models, tailored to local conditions. Good practices for choosing a model were discussed and include:

- Start with the key area to address (e.g. overland flooding) and build out from there. Iterations can add more variables in a time and cost-efficient manner;
- Maps should be made with function in mind;
- Model scenarios need to be plausible, realistic, and transparent.

Areas with room for improvement were also identified:

- There was discussion around the need for periodically updating maps and whether that should be a standard practice with standard time frames. Environment and Climate Change Canada (ECCC) is currently developing a technical bulletin to address when and how flood maps should be reviewed and revised, with the goal of providing a consistent guideline to provincial, territorial, and municipal governments who are the ultimate decision-makers;

- Canada-wide models do not incorporate engineering maps, so pipe flow is either not included or included as an assumption;
- Ice jam flood mapping remains a challenge and requires a physically-based approach to embed human interests (i.e. ice roads, boat access) and climate change into models. The Government of Northwest Territories has developed a guideline for ice jam flood mapping;
- There is a need for open-source data and model portals, including a discussion on where and who should host data for public consumption (general agreement among industry and municipal representatives that higher levels of government should host data).

Jad Saade, Government of Northwest Territories

Federal, provincial, and territorial governments have developed best practices guidelines for flood hazard mapping. However, it is currently the responsibility of local jurisdictions to interpret those and make final decisions on the best approach to adopt, which will in turn inform modelling. This is a dynamic field as consultants with expertise in flood mapping continue to develop and improve modelling techniques. For example, traditional modelling approaches are limited when it comes to ice jams, incorporating climate change, and

modelling mixed regime watersheds. There is opportunity to work towards better understanding and approaches to handle these.

4. Incorporating climate change into flood hazard mapping is a work in progress

The conference saw presentations ranging from climate change being considered out of scope, to a set of guidelines (under development) detailing how to incorporate climate change into flood mapping. Considering climate change when developing flood hazard maps is not currently standard practice, and there is room for a conversation about quantitative versus qualitative considerations of climate change in modelling. However, it is known that the climate has changed and continues to change. Flood hazard maps intended for long-term infrastructure planning need to consider climate projections or risk maladaptive outcomes, where communities or infrastructure are not adequately protected against future flood risks and could face increased damages when flooding events do occur. Therefore, climate change should not be considered an independent variable but rather as one of the dominant mechanisms driving future flood risk. For example, traditional models may analyze at one variable at a time, but as mixed regime models (including multiple hazard types) improve, it should be standard practise to embed climate considerations in models. The City of Calgary found that when they layered multiple hazards in their flood mapping and planning, a larger return-period flood was indicated to adequately regulate risks (1:200 year versus the 1:100 year in provincial guidelines). As a known hazard across the country, climate change should be considered in all flood mapping projects, although challenges remain in communicating uncertainty around projected emissions pathways and associated shifts in precipitation regimes.

ECCC is currently working on voluntary guidelines for incorporating climate change into flood hazard mapping. Climate change considerations are a suggestion in FHIMP funded projects, but implementation varies from province to province/territory depending on their own applicable guidelines. Standardizing climate considerations could be done through more explicit requirements for funding. Consultants have a voice to advocate for climate change in flood mapping projects, and some are becoming more outspoken in spaces like the conference and online. Governments can support consultants in developing better models that incorporate climate change through appropriate project budgets to do more analysis such as mixed regime.

Final Remarks

There were many great speakers over the course of the conference, and the slide decks from these presentations can be found here. It was an opportunity to learn from and network with others in the field, from both technical and non-technical backgrounds. The conference highlighted that innovation in modelling and guidelines is ongoing yet there is room for improvement, with emphasis on equity and climate change. Meaningful engagement is critical for holistic flood hazard mapping plans due to the real-world implications, both locally and regionally that were presented throughout the day. Indigenous knowledge and expertise need to be woven into all aspects of flood hazard mapping projects, with conference feedback providing pathways towards achieving this. Communication and funding were identified as key hurdles to move from mapping to implementation and regulation.

These discussions do not happen in isolation – they are part of an ongoing effort to improve flood resilience, inform decision-making, and ensure that flood mapping continues to evolve to meet the needs of communities, whether a rural township or a large city. A comment from the conference keynote, Anna Warwick-Sears, resonated as an important reminder to build forwards from the insights gained, connections made, and conversations had during the conference: "unexpected ideas come from collaboration at events such as this."

> Solutions may not be perfect, and there may be different ideas on what to prioritize but, continuing conversations, collaboration, and relationship building will move the flood mapping community forward in a positive direction.

Appendix A: Resources highlighted throughout the conference

Appendix B: Western Flood Mapping Conference Agenda

Appendix A: Resources

Flood Maps – Okanagan Basin Water Board

Okanagan Basin Flood Portal provides publicly accessible maps and data for the Okanagan Basin.

Canada Flood Map Inventory (CFM) - Open Government Portal

The Canada Flood Map inventory shows areas in Canada where a copy of a flood hazard map has been collected by Natural Resources Canada (NRCan). The inventory provides information on how to access these flood hazard maps.

First Nation Adapt Program

The First Nation Adapt (FNA) program works closely with the FHIMP team and the provinces on a regular basis to avoid duplication in flood mapping efforts, and to ensure that First Nations could benefit from equal flood mapping services as non-Indigenous partners. This is done through information sharing initiatives and ongoing collaboration with FHIMP. FNA's sister program, Climate Change Preparedness in the North (CCPN), works similarly with FHIMP to support Northern and Indigenous communities in the three Territories and across Inuit Nunangat.

Peak Flow Assessment under a Changing Climate: Recommendations for the Canadian Highway Bridge Design Code - CSA Group

A resource that lays out a methodology for incorporating climate change into adjusting flows/hydrology.

Alberta Flood Awareness Map Application

Publicly accessible flood hazard information for Alberta. Flood maps and alluvial fan boundaries displayed in the Flood Awareness Map Application are based on provincial flood studies developed using the best data available when a study is conducted.

heronhydrologic.ca/blackbird/

Blackbird C++ Alpha is an open-source model that provides accurate mapping results at large scales while maintaining efficient computational speeds. The software is used for real-time and large-scale flood mapping, suitable for emergency response and engineering flood map updates.

Flood Hazard Identification and Mapping Program - Natural Resources Canada
The FHIMP is co-sharing costs with provincial and territorial governments to fund eligible activities to improve flood mapping. Over 1000 flood hazard maps produced to date, impacting over 800 communities.

Canadian Hydrospatial Network - Natural Resources Canada
The Canadian Hydrospatial Network (CHN) is a geospatial data product that represents Canada's surface water features lakes, rivers, watersheds and more and the connections between them.

Toolbox for Flood Hazard Education and Information - Natural Resources Canada
The toolbox offers existing or innovative communication tools for flood hazards and mapping. It contains a variety of tools to reach a wide range of people, with the aim of helping to build a risk culture in Canada.

Federal Flood Mapping Guidelines - Natural Resources Canada
The Federal Flood Mapping Guidelines Series are resources to advance and standardize flood mapping projects and activities in Canada. These guidelines address each step of the flood mapping process and provide advice to individuals and organizations in Canada that need to understand and manage flood risks and their consequences to communities. The Standards Council of Canada, Natural Resources Canada and Public Safety Canada are working together to develop some of these guidelines into National Standards of Canada.

Federal Land Use Guide for Flood Risk Areas - Natural Resources Canada
This guide defines watersheds and governance; the role of land use planning in flood risk reduction; the types of floods and flood risk assessment; and the role of the planning professional in mitigating and managing flood risks by way of land use planning tools in the context of the Flood Mapping Framework (FMF).

To watch for:

- The Federally Identified Flood Risk Areas (FIFRA) will identify the appropriate mitigation conditions and risk tolerances that federal investments at risk of flooding are required to adhere to receive federal funding. The development of this product is currently underway and is expected to be completed by April 2025.

- Public Safety Canada discussed the Revamped Disaster Financial Assistance Arrangements program which will take effect April 1, 2025. The program prioritizes "building back better", proactive climate resilience-building, and disaster risk reduction. Updating flood hazard maps and implementing floodplain redevelopment restrictions are eligible activities under this funding stream.
- Technical bulletin for updating flood maps in Canada will be published sometime in the next fiscal year, they are open to feedback through email (geoinfo@nrcan-rncan.gc.ca).

Appendix B: Western Flood Mapping Conference Agenda

AGENDA

WESTERN FLOOD MAPPING CONFERENCE

8:30 AM	**Registration**	
9:00 AM	**Welcome and Opening Remarks**	
9:40 AM	**Keynote Presentation: Flood Mapping Adventures in the Okanagan** Dr. Anna Warwick Sears, Okanagan Basin Water Board	
10:25 AM	**Break**	
	MAIN ROOM Spectrum 4/5	**BREAK OUT ROOM** Spectrum 1/2/3
10:45 AM - 12:15 PM	**SESSION 1A:** **Advances in Flood Hazard Mapping Methodologies** Moderated by Monica Mannerström, Northwest Hydraulic Consultants	**SESSION 2A:** **Updates on Federal & Provincial Flood Mapping Programs** Moderated by Jean-Samuel Proulx-Bourque, Natural Resources Canada
	Emerging from Darkness: Pluvial Flood Mapping Brad Larson & Santosh Nishtala, City of Calgary	**NRCan – FHIMP Updates on Research Initiatives & Program Impact** Andrew Plowright Natural Resources Canada
	Subtractive Flow Methodology for Flood Mapping at Tributary Confluences Wolf Ploeger, WSP	**Alberta's Flood Hazard Identification Program** Peter Onyshko, Government of Alberta
	Mapping of Floodplains Protected by Dikes: A Fraser River Case Study Vanessa O'Connor, Northwest Hydraulic Consultants	**Introducing the First Nation Adapt Program** Tabitha Clavecillas, Crown-Indigenous Relations and Northern Affairs Canada
	Flood Hazard Mapping of the Red River Valley Andrew Weiss, KGS	**Using Canada-Wide Flood Hazard Modelling** Julie Van de Valk & Robin Bourke, Public Safety Canada

AGENDA

WESTERN FLOOD MAPPING CONFERENCE

12:15 PM	Lunch	
1:15 PM - 2:45 PM	**SESSION 1B:** **Ice Jams & Debris Flows** Moderated by Zahidul Islam, Government of Alberta	**SESSION 2B:** **Indigenous Perspectives, Guidelines & Standards** Moderated by Sandy Davis, City of Calgary
	Application of Direct and Indirect Methods for Estimation of Ice Jam Flood Frequency Dan Healy, Northwest Hydraulic Consultants	**Floodplain Mapping in Drumheller: A Case Study on Mapping Uses** Deighen Blakely & Darryl Drohomerski, Town of Drumheller
	Building Resilience: Alberta's Approach to Hydrogeomorphic Hazards Lance Katan, Government of Alberta	**Flood Realities: Sharing Lived Experiences and Lasting Impacts,** Dakota Marsden, Pinaymootang First Nation
		Flood Plain Mapping Scoping Study: Lower Mainland Tamsin Lyle, Ebbwater
	The Pas Flood Hazard Mapping Study Melissa Haresign, KGS	**Northwest Territories' Ice Jam Flood Mapping Guidelines** Jad Saade, Government of Northwest Territories & Dan Healy, Northwest Hydraulic Consultants
2:45 PM	Break	

AGENDA

WESTERN FLOOD MAPPING CONFERENCE

	SESSION 1C: Research & Guidance on Climate Change Moderated by Joel Trubilowicz, Environment and Climate Change Canada	SESSION 2C: From Maps to Regulation Moderated by Andrew Plowright, Natural Resources Canada
3:05 PM - 4:15 PM	**Application of FHIMP Climate Change Guidelines on Water Survey of Canada Gauge Design** Katie Slimmon, Environment and Climate Change Canada	**Flood Maps Are Only The First Step: How we moved from maps to regulations** Sandy Davis, City of Calgary
	Lessons from a Decade of Considering Climate Change in Floodplain Mapping Studies Genevieve Brown, Northwest Hydraulic Consultants	**Town of Canmore Regulation of Steep Creek Hazards** Devin Bartley and Félix Camiré, Town of Canmore
	Blackbird: Towards Regional Flood Mapping and Inundation Forecasting Under Climate Change Dr. Robert Chlumsky & Brian Peng, Heron Hydrologic	**Technical Bulletin For Updating Flood Maps in Canada** Apurba Das, Environment and Climate Change Canada
4:15 PM - 5:00 PM	**Panel Discussion: Successes and Challenges in Flood Mapping** MJ Valiquette | Zahidul Islam | Sandy Davis | Anna Warwick Sears **Moderated by Kerra Chomlak, ClimateWest** Highlighting success stories, addressing common challenges, and identifying opportunities for collaboration across jurisdictions and sectors. Includes open floor for questions and discussion.	

The Western Flood Mapping Conference is hosted in partnership between Natural Resources Canada, ClimateWest and The Pacific Institute for Climate Solutions

ClimateWest Building Prairie Resilience

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