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Indigenous flood mapping guideline
Phase 4 final report

Acosys Consulting

2023

Canada

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Permanent link: https://doi.org/10.4095/331964

This publication is available for free download through GEOSCAN (https://geoscan.nrcan.gc.ca/).

Recommended citation
Acosys Consulting, 2023. Indigenous flood mapping guideline phase 4 final report; Geomatics Canada, Open File 76, 31 p. https://doi.org/10.4095/331964

Publications in this series have not been edited; they are released as submitted by the author.

ISSN 2292-7875
ISBN 978-0-660-49294-0
Catalogue No. M103-3/76-2023E-PDF

Indigenous Flood Mapping Guideline – Phase 4 Final Report

Natural Resources Canada (NRCan)

2023-03-31

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Introduction

Acosys Consulting Services Inc. (Acosys) aims to create a platform for Indigenous stakeholder engagement and pilot sessions to gather valuable feedback from diverse participants on the effectiveness of the Federal Flood Mapping Guidelines (FFMG) developed by Natural Resources Canada (NRCan) and how they can be implemented to provide benefits to Indigenous communities. The goal of the platform is to offer a collaborative development approach and provide concrete opportunities for Indigenous stakeholders to identify and record best practices, requirements, and capacity in flood mapping that are meaningful and relevant to their needs. The platform includes both engagement and pilot sessions.

The FFMGs is a set of documents that aim to standardize and advance flood mapping activities across Canada. The guidelines were developed by a partnership of federal departments and agencies, in consultation with provincial and territorial partners and key stakeholders including Indigenous communities. The guidelines cover various aspects of flood mapping, such as data acquisition, hazard delineation, risk assessment, and land use planning. The guidelines also address the impacts of climate change on flood risk and the needs of Indigenous communities. The guidelines are intended to inform any individual or organization involved with flood management in Canada.

The objectives of the project are to assess the utility of the Federal Flood Mapping Guidelines for Indigenous communities and determine how the FFMGs can be implemented in Indigenous communities. To achieve these objectives the Acosys team completed two engagements and two pilot sessions in Indigenous communities located in Manitoba and Saskatchewan. Community engagement followed a two-step approach:

> Step 1: Engage with the community leadership, which may include a designated point of contact, elected leaders, community organizations, and other individuals suggested by the community.
>
> Step 2: Conduct focused engagement interviews with individual community members using a directed participatory format such as email, virtual meetings, virtual surveys, phone interviews, or in-person discussions (on-site).

The community leadership engagements and individual community interviews aimed to gain a deeper understanding of the community's perspective on flooding, flood mapping, flood events, and flood mapping guidelines in local contexts. They also aimed to provide a comprehensive understanding of the best practices for implementing the FFMG at the national level.

Engagement session were followed by pilot sessions with Indigenous stakeholders to promote a collaborative development approach and integrate feedback, best practices, requirements, and capacity of each community in the flood mapping process. The pilot sessions also aimed to demonstrate how the FFMG can assist Indigenous communities in reducing their flood risk and strengthening their resilience.

Engagement and Pilot Sessions During a Pandemic

At the time of scoping the project workplan and deliverables, the worldwide pandemic caused by SARS-CoV-2 was unknown. The emergence of the pandemic in late winter/early spring 2020 resulted in uneven closures across Canada. As a result, communication with contacts in the communities was crucial to assess the risks associated with the project and the selection of community participants' access. A re-evaluation of the engagement and pilot session approach was necessary to ensure safety. In-person community forums, public meetings, and group sessions were replaced with outdoor engagements and virtual platforms. The modified approach for each community was established through engagement sessions with community leaders. Early engagement with community leaders is recommended as a best practice and will be

implemented before all future Phases to maximize community input and lessons learned. Pilot sessions were more challenging to adapt and were postponed until the SARS-CoV-2 pandemic started to improve in early 2022. This created a lag of about 18 months between the completion of the engagement sessions and the initiation of the pilot sessions.

Methods and Approaches

Community Context

The project team engaged with Indigenous communities that are knowledgeable about flooding and flooding events, and are able to provide valuable feedback and recommendations. The selection criteria for these communities included being situated in areas with a history of flooding events, having diverse flooding contexts across different parts of the country, having strong community leadership support for the project's objectives, having local subject matter expertise and responsibility, and having an existing relationship and foundation of trust with the project team.

Cumberland House, Saskatchewan, and four communities located in the Interlake Region of Manitoba (Dauphin River First Nation, Lake St. Martin First Nation, and Fisher River First Nation) were initially selected for participation in this project beginning in February 2020. Engagement with these communities occurred throughout the year and into early 2021; however, the pilot sessions were postponed until the conclusion of the pandemic in mid-2022. Given the time-lag between engagement and pilot session, the communities from the Interlake Region dropped-out of the project and were subsequently replaced by Sioux Valley Dakota Nation in southwestern Manitoba. The location of all communities involved in this project are shown in Figure 1.

Cumberland House

The community of Cumberland House is located on an island in the Saskatchewan River Delta, which is located in a broad flat area of the boreal plain on the east edge of Saskatchewan and into Manitoba, where the Saskatchewan River flows south and eastward. The Saskatchewan River Delta is one of the world's largest inland deltas, and it and the community of Cumberland House are located downstream of three dams operated by Saskatchewan's Crown Utility SaskPower. The community has a single unpaved access road, SK HWY 123. The community experiences periodic flooding of varying severity and with uncertain timing, and community members have been evacuated several times in the past decade. The community has two distinct administrative jurisdictions: 1) the Northern Village of Cumberland House (NVCH), which has approximately 600 residents, and 2) Cumberland House Cree Nation (CHCN), which is a reserve with approximately 1000 residents. The municipality has an elected Mayor and Council that represent the mixture of Indigenous and non-Indigenous residents, and CHCN reserve has an elected Chief and Council. Additional local governance participation is provided by the President and Executive of the Métis Local #42, the N-28 Trappers Association, the Outfitters Association, and the local Commercial Fishing Association, all of which represent community members in both the village and in CHCN.

The complexity of both the physical environment and the human (administrative) environment of the community of Cumberland House make it an ideal case study for the present work. The lasting impacts of a flood on a community includes trauma, loss and impact on financial security, and loss of access to traditional territories and/or traditional diets. This is relevant to Cumberland House. Additionally, community support for the project was estimated to be high, as the community tends to be proactive in working to solve issues that affect quality of life for residents, and the question of flooding is of prime importance to the community.

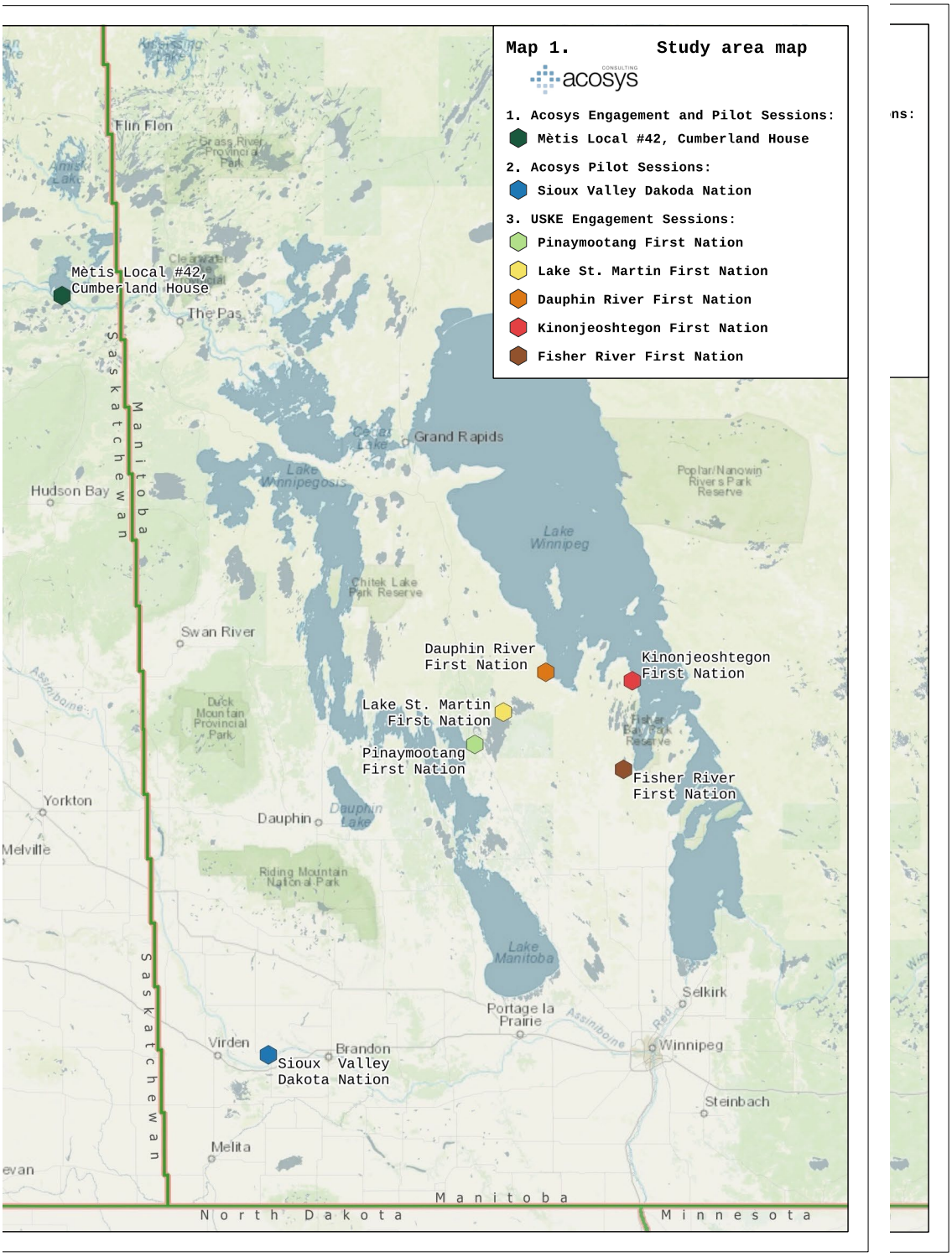

Figure 1. Location of Indigenous communities selected for engagement and pilot session.

Interlake Region

The Interlake Region of Manitoba is a geographic area that lies roughly between Lake Winnipeg and Lake Manitoba. The region covers about 20,000 square kilometers and has a population of about 100,000 people. The region is known for its diverse landscape, rich history, and vibrant culture. The Interlake Region is home to several Indigenous communities, including the Dauphin River First Nation, the Lake St. Martin First Nation, and the Fisher River First Nation. These communities belong to the Anishinaabe (Ojibwe) and Cree peoples, who have lived in the region for thousands of years. They have a strong connection to the land and water, and practice their traditional customs, languages, and spirituality.

The Interlake region is a low-lying area that is prone to flooding from spring runoff, heavy rainfall and high lake levels. Many Indigenous communities in this region have experienced devastating impacts from flooding over the years, especially in 2011 and 2022. Some of the affected First Nations include Peguis, Lake Manitoba, Lake St. Martin, Little Saskatchewan, Dauphin River and Pinaymootang. Lake Manitoba and Lake St. Martin First Nations also faced severe flooding in 2011 and 2022, forcing many residents to live in temporary accommodations for years. The province has been working on a project to build two outlet channels to enhance flood protection for these communities, but the project has been delayed by legal challenges and inadequate consultation with the affected First Nations.

The Manitoba floods have caused lasting trauma for the First Nations in the Interlake region, affecting their health, culture, economy and environment. Many of these communities are still waiting for fair compensation, adequate housing, proper infrastructure and meaningful consultation from the provincial and federal governments.

Sioux Valley Dakota Nation

The Sioux Valley Dakota Nation is a band of Dakota people who live in southwestern Manitoba. They are not a signatory to any treaty and have achieved self-government status in 2014. They have two reserves, one of which is shared with other Dakota and Ojibway bands. They are part of the Dakota Ojibway Tribal Council and have a strong culture, language and tradition. SVDN was formerly known as Oak River Reserve, which was established by the Canadian government in 1876. The reserve is located on the banks of the Assiniboine River, also known as Wipazoka Wakpa ('Saskatoon River') in Dakota. The name comes from the abundance of Saskatoon bushes along the river. The reserve is about 45 minutes west of Brandon, Manitoba and 10 kilometers north of the Trans-Canada Highway #1.

Sioux Valley Dakota Nation is the largest Dakota Nation in Canada with a membership of approximately 2,400 members. About half of them live on their own reserve, while the rest live off-reserve or on other reserves. SVDN also has a Fishing Station 62A Reserve, which is shared with Birdtail Sioux First Nation and Canupawakpa Dakota First Nation. Sioux Valley Dakota Nation has a vision of self-determination and self-reliance for its people. They have negotiated with Canada and Manitoba for over 20 years to achieve self-government with recognized jurisdiction over more than 50 areas. This creates a true Nation-to-Nation and Government-to-Government relationship between Sioux Valley Dakota Nation, Canada and Manitoba. Sioux Valley Dakota Nation is the only self-governing Dakota Nation in Canada and the only self-governing First Nation in the Prairie Provinces.

Flooding in Sioux Valley Dakota Nation is a recurrent problem that affects many residents and damages their homes. The community, has experienced several floods in recent years, often caused by overland water or high river levels from the Assiniboine River. In 2014, the community was hit by a tornado and a flood in the same year, forcing 145 people out of their homes. In 2017, another flood displaced 205 people, some of whom stayed in hotels for weeks. The community was under a flood watch warning in March 2022, as the Shellmouth Dam released water and the forecast predicted more precipitation. The

community monitors the water levels and takes precautionary measures to protect the residents and their properties. Flooding in Sioux Valley Dakota Nation is a serious issue that requires long-term solutions and support from various levels of government.

General Community Engagement Platform

The general community engagement platform was created prior to the onset of SARS-CoV-2 and was modified based on feedback from each of the communities.

Engagement Methods

The Acosys project team employed a strategic selection of engagement methods to ensure substantive quantitative and qualitative community input was documented, as well as relevant data collection on flood mapping and the Flood Mapping Guidelines, and information sharing within selected Indigenous communities.

Key actions included:

- Identifying and integrating end-user experience, information, and requirements
- Engaging and integrating local and regional Indigenous Traditional Knowledge (ITK), practices, and resources
- Assessing the utility and accessibility of existing and potential mapping formats (i.e., paper flood maps versus digital), and
- Improving overall awareness, capacity, and communication on the Flood Mapping Guidelines to and with the selected Indigenous communities.

The specific methods the project team utilized included community partner engagement and interviews.

Community Partner Engagement

The project team identified, engaged, and worked with community partners, including leaders and/or project or program coordinators, on the co-development and deployment of local engagement activities and pilot projects. Community partners included individuals employed by the local communities or external local government partners experienced and engaged in land use management or related projects and initiatives. Community partners supported the successful delivery of the project by:

- Participating in the co-development of strategies, presentations, and materials
- Providing strategic guidance to the project management team, and
- Facilitating relevant respectful communication and engagement amongst the project team, community leadership, and community members.

This approach helped the project team identify locally relevant and valuable engagement opportunities that were not immediately evident during the engagement planning process. A structured project management and reporting framework was employed throughout the community partner engagement process and included regularly scheduled telephone calls and video meetings as appropriate.

Interviews

The project team worked with the community partner(s) to arrange interviews with local youth, cultural leaders, and Elders to capture core Indigenous Traditional Knowledge and practices relevant to the project, as well as contemporary knowledge, experiences, and resources. Interviews were conducted face-to-face in the community, by telephone, or video call to ensure access, and promote participation, engagement, and unfettered input from participants, while respecting the need for social distancing due to SAR-CoV-2. The interviews were conducted using a semi-structured interview approach. This format is flexible and adaptable, allowing for the interviewer to respond to the interview environment and atmosphere,

accommodate for cultural practices or protocols, follow relevant lines of enquiry, and capture pertinent qualitative data. Interview results were fully documented in the relevant format, anonymized, and summaries were provided to participants for comment or correction prior to use in the reporting process.

Interview Questions

The same thematic approach was used in both communities. However, based on the application of a *community-led approach*, they were employed using different methods. Five themes addressed distinct knowledge topics:

Local Context

Knowledge: Local flooding issues, risks and hazards, community priorities, and user requirements

- Are you aware of flooding issues in your community?
- Where does the flooding occur?
- When does the flooding occur?
- Are there known signs or signals that indicate the following: Imminence, Severity, Duration
- Have you noticed any changes to the location, severity, or duration of flooding over time?
- What are the risks and hazards presented by flooding?
- Have you noticed any changes to the risk and hazards over time?
- How does flooding impact community infrastructure and activities?
- What local areas are priorities for flood planning, preparation, and management?
- How does the community identify areas of high risk and priority?
- Have the impacts of flooding, and community priorities changed over time?
- What tools or resources would help you better plan and prepare for floods in your community?

Information Management

Knowledge: Collection, assessment, maintenance

- How is local and expert flood knowledge identified and collected?
- How is the collected information reconciled, assessed, and incorporated into the community flood planning processes and preparations?
- Is the collected information updated regularly? How often?

Resources

Knowledge: Cartographic design, map formats

- Have you used paper flood maps? Y or N? Please note any challenges or benefits to this format, including accessibility
- Have you used digital flood maps? Y or N? Please note any challenges or benefits to this format, including accessibility

Communication

Knowledge: Awareness

- Does your community communicate with, and educate members on flooding issues, and flood maps? Y or N? How, and how often?
- Are you aware of the Federal Flood Mapping Guidelines? Y or N? If yes, how did you become aware/involved?
- What would be the most effective method(s) to educate community members about flooding, flood maps, and the Flood Mapping Guidelines? (examples were provided: Training/certificates,

Information session/engagement session, Webinars, Safety workshops, Risk assessment training Other (_____?))

- What would be the most effective method(s) to communicate updates or changes to flood maps, plans, and guidelines? (examples were provided: Not sure? Community announcements, Community meeting, Social media, Trappers/fishers/outfitters meetings, Radio media, Other? (_____))

Capacity Development

Knowledge: Community development, expert development

- What tools, resources, or training would help your community better plan and prepare for flooding? (community members – examples were provided: Not applicable, Social media, School resources, Online/web-links, GIS/map software, Binders of maps, Phone app, Other (_____))
- How are local experts trained on flooding issues, flood maps, and the Flood Mapping Guidelines? (examples were provided: Provincial training, Municipal training, On-the stop training, Emergency training, FN/Metis training, Volunteer organizations (rangers), Other (____?))
- What tools, resources, or training would help local expert's better plan, prepare for, and respond to flooding? (ex – emergency responder's examples were provided: Not applicable, Social media, Online/web-links, GIS/map software, Binders of maps, Phone app, Other (_____))

Participatory Community Forums

The project team worked with the community partner(s) to co-develop and arrange local community forums. The Community forums facilitated the sharing and collection of local contemporary and traditional knowledge and experience, and provided an opportunity for collaborative community problem solving, and the co-development of planning and policy recommendations. Community forums included face-to-face facilitated meetings, conference calls, video calls, or webinars to ensure accessibility, and maximize information sharing from a diverse cross section of the community, while respecting the need for social distancing due to SARS-CoV-2. Additional benefits to this approach include building shared ownership, community capacity through development and training opportunities, and traditional knowledge transfer. The design and planning of community forums was informed by the preliminary findings and recommendations from the preceding interviews (as outlined above). Community forum results were fully documented in the relevant format, synthesized, and summaries were provided to participants for comment or correction prior to use in the reporting process.

Expert Interviews and Meetings

The project team worked with the community partner(s) to co-develop and arrange focused interviews or group meetings with local Indigenous community political, institutional, and organizational leaders, as well as experts knowledgeable on flooding, flood mapping and emergency management. Interviews and meetings included face-to-face facilitated meetings, conference calls, video calls, or webinars to ensure accessibility, and maximize information sharing from a diverse cross section of the local community leadership, while providing for safety relevant to SARS-CoV-2. The expert interviews and meetings collected their relevant experience, input, and perspectives, and provided an opportunity for presenting and examining planning and policy recommendations. Preliminary findings from the previous two activities were used to enhance this process. Interview and meeting results were fully documented in the relevant format, anonymized, and summaries were provided to participants for comment or correction prior to use in the reporting process.

Pilot Sessions

The pilot studies were designed to integrate information collated from the engagement sessions with actual flood modelling and mapping products prepared here for each community. Feedback generated from the pilot studies will be used to evaluate and refine recommendations derived from the Indigenous stakeholder engagement sessions regarding the utility of NRCan's FFMGs and how they can be implemented to deliver material benefits to Indigenous communities.

The goals of the pilot studies were to:

- Improve the understanding of the role of Indigenous leaders' input into the flood mapping process;
- Exchange on ways Indigenous communities apply the Federal Flood Mapping Guidelines; and,
- Discuss ways in which traditional knowledge is applied to flood mapping.

The objectives of the pilot studies were to:

- Identify best practices for improving awareness, capacity building, partnerships, and communication with Indigenous communities on flood mapping; and,
- Compile results from pilot studies and provide a report with full project descriptions, objectives, outcomes and recommendations for improvements to the guidelines as a result of these exercises.

Relatively short informational exchanges place a challenging constraint on both the facilitator and the participants from the communities. Information must be presented at a level and pace suitable for the learning styles of the participants and within the time available. If the facilitator over or under-estimates these parameters, we run the risk of having the participants "tune-out" during these sessions, hampering our ability to gather meaningful feedback from the communities.

The pilot sessions were geared to the needs of the communities. This required a thorough understanding of the demographics of the participants, their level of background knowledge, their associated problems and needs related to flood risk management, and their expectations from the sessions. To achieve this, we prepared a biographical sketch of those we expected to meet during the pilot sessions. Information was distilled down to the essential core required to meet the needs of the participants. Information was presented in terms of how the communities can use flood mapping products and, in turn, how members of the communities can contribute to flood mapping efforts by integrating their own local knowledge into the process. We drew upon local examples of floods and the flood history of the region and offered ample time for the participants to discuss their needs.

Structure

Pilot sessions in Sioux Valley and Cumberland House followed the same agenda for the one-day workshop on community flood mapping and the FFMGs. The workshop aimed to provide an overview of flood and flood mapping concepts, share the results of the community engagement survey, and facilitate a participatory exercise to create a community flood map using traditional knowledge and local observations. The pilot sessions were facilitated by Stephen Bird and Erika Quiring of Acosys.

The agenda of the pilot sessions is given below:

9:00 – 9:20 am: Arrival

Participants were welcomed by the workshop organizers and given name tags and materials. They were given a chance to network with other participants and enjoy some refreshments.

9:20 – 9:30 am: Introduction

The workshop began with a brief introduction by the facilitator, who explained the objectives and expected outcomes of the workshop, as well as the ground-rules and norms for participation. An Elder was invited to open the session with a Prayer. The facilitatorsalso invited each participant to introduce themselves and share their interest or experience in floods and flood mapping.

9:30 – 10:00 am: Flood & Flood Mapping

The facilitators presented some basic concepts and definitions related to floods and flood mapping, such as types of floods, flood hazards and risks, flood frequency and return period, flood extent and depth, and flood maps and their uses. The facilitators also shared some examples of different types of flood maps from various sources and contexts.

10:00 – 10:30 am: Hands-on with Flood Maps

The participants were divided into small groups and given a set of flood maps to examine and analyze. The groups were asked to identify the main features and characteristics of each map, such as scale, resolution, data sources, accuracy, currency, and limitations. The groups were also asked to compare and contrast the maps and discuss their advantages and disadvantages for different purposes and audiences.

10:30 – 10:45 am: Morning Break

The participants enjoyed a 15-minute break to stretch their legs, use the washroom, or grab a snack.

10:45 – 11:00 am: Review of Hands-on with Flood Maps

The facilitators reconvened the session and invited each group to share their findings and observations from the hands-on activity. The facilitators also summarized the main points and lessons learned from the activity and answered any questions or clarifications from the participants.

11:00 – 11:30 am: Community Engagement Results

The facilitators presented the results of the community engagement survey that was conducted prior to the workshop. The survey aimed to assess the level of awareness, interest, and capacity of the community members in relation to flood mapping. The facilitators highlighted the key findings and recommendations from the survey and invited feedback and comments from the participants.

11:30 – 12:00 pm: Use of Traditional Knowledge

The facilitators introduced the concept of Traditional Knowledge and its relevance and value for flood mapping. The facilitators also shared some examples of how Traditional Knowledge has been used or integrated in flood mapping projects in other communities or regions. The facilitators then

lead a discussion with the participants on how they can use or incorporate their own Traditional Knowledge in their community flood mapping efforts.

12:00 – 1:00 pm: Lunch Break

The participants had an hour-long break to enjoy a catered lunch and socialize with other participants.

1:00 - 3:00 pm: Community Flood Mapping Exercise

The participants were divided into small groups again and given a large-scale map of their community. The groups were asked to use their Traditional Knowledge and local observations to identify and mark on the map the areas that are prone to flooding, as well as the areas that are safe or resilient to flooding. The groups were also asked to indicate on the map any historical or recent flood events that they are aware of or have experienced. The groups were provided with different coloured markers, stickers, symbols, or labels to annotate their maps.

3:00 – 3:15 pm: Afternoon Break

The participants had another 15-minute break to refresh themselves.

3:15 – 3:45 pm: Review the Community Flood Mapping Exercise

The facilitators reconvened the session again and invited each group to present their community flood maps to the rest of the participants. The facilitators also facilitated a discussion among the participants on the similarities and differences among their maps, as well as the challenges and opportunities they faced or encountered during the exercise.

3:45 – 4:15 pm: Information and Training Gaps

The facilitators asked the participants to reflect on their learning experience throughout the workshop and identify any information or training gaps that they still have or need in relation to flood mapping.

Materials

Information about the flood mapping guidelines project and its goals and application was presented to the participants in a power point presentation. An interactive session with paper maps illustrating flood inundation, flood hazards, and flood risks were used to generate discussion among the group.

Results

Engagement Sessions

Cumberland House Community Leadership Engagement

Engagement with the community leadership of Cumberland House was deferred several times due to cases of SARS-CoV-2, which necessitated lockdowns in the community, as well as due to SARS-CoV-2-related deaths in the community. Cumberland House is a small community, and most residents are closely linked. Additionally, many people in leadership roles hold numerous responsibilities and must shift focus to manage and assist in times of crisis.

In consideration of the impacts to the community experienced during the project, additional goals and objectives were co-developed with the community partners:

- Develop and apply a safe work procedure that will provide for safety for participants in consideration of SARS CoV-2, and
- Respect the needs of community partners considering the losses experienced by the community to ensure that community partner experiences are positive and supported.

Facilitation on these aspects was provided by a community liaison. This role (2 persons) facilitated execution of the project, acted as a guide, counsel, and intermediary between the project team and the community to ensure maximum collaboration through locally relevant and culturally respectful communication, interactions, and engagement. One of the persons in this role provided office space to be used as the hub for communication/activity related to the project in the community.

Ultimately, four engagement sessions were able to be held on January 25, 26, 27, and March 8, 2021. Project objectives and content were reviewed with community leadership. An overview of the project including timelines for interviews, reporting, and future engagement was presented. Advice was requested on engagement format, including translations (if required), timelines, cultural protocols for working with Elders and other community members, consent forms, and appropriate honoraria. Topical relevance was discussed, and feedback on content was gained. Verbal approval or support in other formats (e.g., band council resolution, letter, other, as relevant) was requested from the community leadership for the project team to carry out the engagement in a co-developed format.

Also resulting from the engagement sessions with the Cumberland House community leadership were modifications to the engagement format, including the inclusion of an open (accessible) interview format, requests for several one-on-one interviews, and specific cultural protocols to be followed at the time of requesting interviews.

Interlake Engagement

Engagement sessions held in the Interlake Region were undertaken Manitoba USKE upon request of the origination. Manitoba USKE is a technical land management body that supports First Nations Lands Managers in Manitoba. It offers capacity building, training and expertise in land administration, as well as communication and networking opportunities. Initial engagement with the USKE team began in November 2020 and was consistent through to the completion of the project deliverables in March 2021. The methods that were employed were under the direction of USKE and represented a perspective that made sense for the community in the context of SARS-CoV-2-related lock-downs and travel restrictions in Manitoba during this phase of the project.

The Acosys team partnered with USKE and worked closely with its leadership to deliver the project, including the co-development of engagement protocols, knowledge collection protocols, methods, questions, content, the interview guide, and communications. Partnering with USKE provided community access, knowledge, valuable insights on concepts, and perspectives that are currently missing in existing flood maps, tools, and resources.

Target Engagement: USKE, Community Liaison (as identified by the community), Elders, Land Managers, Land Users, and Community Members.

USKE engagement focused on Indigenous communities surrounding Lake Manitoba and Lake St. Martin. There was a Community Coordinator that helped to facilitate the execution of this aspect of the project. The Community Coordinator acted as a guide and intermediary between the project team and the community providing counsel and ensuring maximum collaboration through locally relevant and culturally respectful communication, interactions, and engagement. The Community Coordinator executed all aspects of the USKE engagement process, largely taking the form of individual or small group dialogue sessions on the land.

The objective of the engagement was to conduct one-on-one interviews with community members who hold knowledge of flooding (trappers), emergency preparedness (emergency volunteers), and resources such as maps, guidelines, and services (leadership and staff), according to the designated community liaison, in the manner that was suitable to their community interests.

After the initial engagement sessions with USKE were completed, it was determined that the community would self-direct the interviews, using a pre-determined interview format (that followed the same questions employed by Cumberland House). The proposed engagements and interviews would be "virtual" or using a "remote-desk" work and follow provincial guidelines, in light of the COVID-19. Once completed, the recordings and transcriptions were transferred to the Acosys Team for analysis and report development.

The co-developed approach utilized:

- Remote/contactless methods of interviews
- Payment for participation
- Video recordings of interviews submitted to the Acosys team
- Cultural protocols for working with Elders and community members (including consent forms and honoraria). For confidentiality, these documents/audio files are held by the USKE Team.

Community support for this project was provided by USKE in accordance with the deliverables that were identified by the USKE team.

Tailored Research Platform Results

Co-Developed Cumberland House Research Platform

Interviews

The timing of the interviews was deferred to ensure the project team had enough time to include the modified approaches and new cultural protocols. Through engagement with community leadership and the engagement interviews, additional resources were identified to engage as part of the pre-pilot phased on the project. As a result, the total number of interviews that have been requested by the community leadership far exceeds the amount we initially proposed, with specific people in the community that were identified as critical to our project goals and objectives. The interviews are a set of interviews with community elders to capture ITK, a set of interviews for community members in key roles (school, health

sector, housing), and finally for technical members (grader operator, community administration personnel and community elected leaders). All interviews employ a semi-structured interview approach.

Participatory Community Meetings

Participatory community meetings were deferred by the community and will not be reinitiated until after provincial restrictions relevant to SARS-CoV-2 are lifted.

Expert Interviews and Meetings

Some of the planned one-on-one interviews have been partially delayed due to the timing of the preceding engagement sessions. The remaining interviews will now be part of the pre-pilot session work and will be focused conversations/meetings with community leaders and experts knowledgeable on flooding, flood mapping and emergency management/response.

General community interviews were conducted at the request of the community leadership, which was completed by use of a web-based survey platform. Complete results are presented in the *Cumberland House Community Engagement Report.* Participation was very good, with 53 participants engaging in the web-based survey. Results are detailed and provide an excellent baseline understanding of community knowledge around floods, flood mapping, and the Flood Mapping Guidelines. In general, community members were receptive to participation in the next phase of the project.

Co-Developed USKE Research Platform

Interviews

USKE reported conducting ninety-six community interviews to support the research goals of the project, after funding was committed and training was provided to the project team. The total number of interviews completed were based on the availability of the community members of interest.

Participatory Community Meetings

Participatory community meetings were deferred by the community and will not be reinitiated until after provincial restrictions relevant to SARS-CoV-2 are lifted.

Expert Interviews and Meetings

Indigenous communities surrounding Lake Manitoba and Lake St. Martin were interviewed and provided very intimate knowledge of the history of flooding and flooding events in their region. The results were documented and provide insights to the project goals and objectives and momentum for Phase 3 of the project (Pilot Projects). The community members were also very receptive to the idea of leading the next phase of this project.

Critical Findings

Federal Flood Mapping Guideline Series

According to the Federal Flood Mapping Guideline Series, flooding and flooding events are the single largest draw on the Disaster Financial Assistance Arrangements (DFAA). Indigenous communities have additional concerns including land use, animal ecosystems, and traditional diets that make flooding and flooding events extremely impactful and therefore critical to better manage, prepare for, and mitigate.

In the Federal Flood Mapping Framework (FFMF v.2.0), there are areas of particular interest that will help guide Phase 3 of the project (the Pilot Study). The sections of interest include:

3.0 Target Audience (Page 4). *The listed target audience includes various levels of government agencies, planners, policy makers and managers.*

- Based on the results of Phase 2, Indigenous communities may lack central capacity and authority to receive information about impending flood events, may lack infrastructure to deal with flooding events, may lack access to resources that would build capacity, may not have access to pertinent knowledge and resources, may lack structured communication and awareness, and may lack regional input and investment to create these resources.

Potential area to address in Phase 3: Not every Indigenous community will have the capacity to develop, plan, and execute the required resources or activities in their community. It will be important to know how to connect with communities that are not in position to participate in this process in a detailed and constructive manner. For example, by providing resources that are easy to access, to understand, and have relevant local information for them will be vitally important if this engagement plan is to be considered effective at a national level.

4.0 Importance of Flood Maps (Page 5). The list of benefits of completed flooding mapping is important at a local level for Indigenous communities, as flooding impacts a regional area, the township boundaries and/or the reserve lands. Many Indigenous communities are not able to develop their own maps, and if there are maps, there is limited or no access to the resources once they are created by government or other regulatory agencies.

Potential area to address in Phase 3: Provide opportunities for Indigenous communities to ensure the full context of the community and relevant surrounding area is fully mapped; ensure they have access to these maps; ensure there are owners of these maps; and determine how the map owners protect the information included in the maps, especially if there is Indigenous Traditional Knowledge embedded. Additionally, develop procedures relevant to the maintenance of maps.

8.0 Flood Mapping Framework (Page 12). The framework is generalized and linear in nature. Based on the results of the community engagements, it is important to recognize that Indigenous communities would like to be part of map development and have input into "Where to Start Flood Mapping". The areas that may be impacted by floods include municipal, federal (reserve), crown, and private lands and extend beyond boundaries into outlying/surrounding territories, which may include sacred sites, burial grounds, and traditional encampment areas. Many of these areas are not covered through insurance or any other known government relief program. This leads to more uncertainty, as well as to the question "Does this *Flood Mapping Framework* make sense for Indigenous Communities?".

Potential area to address in Phase 3: Inferences from Phase 2 indicate that Indigenous communities need an opportunity to make the framework adaptable and iterative, so more of a circular model that integrates feedback over time may be more relevant and more valuable in the Indigenous context.

9.0 Stakeholder and Community Engagement (Page 14). This section lacks reference to Indigeneity and application to the Indigenous context. A full description of the potential complexities of interagency governance within Indigenous communities and a procedure outlining how the guidelines can be used to address related areas of concern that may be identified by communities would be useful to include. A focus on inclusivity for all rights holders and a mechanism to address areas of concern would be valuable.

Potential area to address in Phase 3: Build capacity and understanding on how Indigenous communities can benefit from the guidelines by increasing inclusive processes; increase awareness; and provide mechanisms for planning and preparation for future events.

Pilot Sessions

Participants

The pilot session for Sioux Valley Dakota Nation was attended by a group of 12 community members and a guest. The attendees included Elders and leadership. They also included staff members who work on different aspects of community development, such as climate change adaptation, infrastructure, housing, emergency response, and planning. They discussed their concerns and aspirations for their community in relation to flooding, and how they can use their strengths and resources to cope with its impacts.

The pilot session for Métis Local #42 was attended by a diverse group of ten Métis citizens and guests from Cumberland House, a historic community in northern Saskatchewan. The attendees represented various roles and interests in the community, such as Elders and leadership, culture, environment, economy, and social services. They shared their perspectives and experiences on how flooding affects their lives and livelihoods, and how they can adapt to the challenges and opportunities it presents.

Figure 2. *(left)* Members of Sioux Valley Dakota Nation reviewing flood maps as part of the pilot session held in Brandon, MB, on March 17, 2022. Photograph by Acosys Consulting. NRCan photo 2023-019. *(right)* Members of Métis Local #42 reviewing flood maps as part of the pilot session held in Cumberland House, SK, on August 22, 2022. Photograph by Acosys Consulting. NRCan photo 2023-020.

Sioux Valley Dakota Nation

The Sioux Valley Dakota Nation participants analyzed flood maps in small groups, identifying features and characteristics such as accuracy, data sources, and limitations. They also compared and contrasted the maps and discussed their advantages and disadvantages. The main outcomes were:

1. The participants expressed their worry about the lack of information on the critical infrastructure, especially the culverts that drain water from the hills to the Assiniboine River. The town could be flooded if the culverts are blocked. The Public Works Department is in charge of everything related to this issue, but only the Public Works Manager knows the location and condition of the culverts and this information is not recorded anywhere. The participants wondered if they could do the infrastructure mapping themselves (e.g. using GoogleEarth). The community has advanced GPS and GIS tools, but they have not been used yet (training was scheduled for 2022). No engineers have

assessed the condition of culverts, berms, etc., within the community. All maintenance is based on immediate need and not planned. Flood maps should capture the location and condition of each culvert.

2. The participants expressed their interest in having a visual representation of the places where beavers are present. They also indicated that there is no current strategy for dealing with beavers, unlike in the past when they were controlled in the 1980s. The participants acknowledged the beneficial role of beavers in the local environment, but also expressed concern about their potential to create or worsen flood situations.

3. The community has faced challenges in diverting flood waters into nearby fields to reduce the impact of flooding. Both Fisheries and Oceans Canada and Environment Canada have denied these requests in the past. A possible solution is to use a flood map that shows the extent and elevation of the floodplain in relation to the surrounding land use. A flood map can help the community to demonstrate the benefits of their proposal and to address any concerns from the authorities.

4. According to the participants, the Shellmouth Dam is the source of all the water and flood issues. They are curious about the dam's operation and planning. They wonder if Sioux Valley Dakota Nation is taken into account when large amounts of water are released. They note that the older generation recalls how the Assiniboine River was different before the dam was built. They question who is responsible for the downstream effects of the dam and feel excluded from the decision-making process related to dam operations.

5. The participants expressed their views on how the Federal Flood Mapping Guidelines should consider upstream issues that influence flood risk, such as farming and land use, altered drainage systems, soil erosion, and beaver activity. They said that other stakeholders rarely involve their community when there are upstream projects like water control structures, dams, or agriculture. They wanted flood maps that reflect these impacts and account for climate change.

Use of Traditional Knowledge

The next session of the workshop focused on the use of Traditional Knowledge in flood mapping. The facilitators explained that Traditional Knowledge can provide valuable insights and information for flood mapping, such as historical flood events, seasonal patterns, water sources, land use, and adaptation strategies. The facilitators also noted that Traditional Knowledge is dynamic and evolving, and that it can complement and enrich scientific data and methods.

The facilitators asked the participants to share their own Traditional Knowledge related to flooding in their community. Some of the participants shared stories and anecdotes about how their ancestors dealt with floods, how they observed and predicted flood risks, and how they protected and restored their lands and resources after floods. The facilitators suggested some ways to integrate Traditional Knowledge into flood mapping, such as using participatory mapping tools, conducting interviews and focus groups, and collaborating with Elders and knowledge holders. The main outcomes were:

1. The participants discussed how to apply their Indigenous Knowledge to improve the accuracy and relevance of the flood mapping models and results. They proposed using trail cameras and citizen science as ways to collect and share their observations. They also saw this as an opportunity to

involve youth and students with their community and provide a means of learning about the local ecosystem.

2. The participants acknowledged that their Indigenous Knowledge could complement and inform scientific knowledge. For example, they recalled a recent flood that left a mark on a stop sign (the high water mark) that they called a "ghost line". However, they lacked a system to document and preserve their Indigenous Knowledge in Sioux Valley.

Community Flood Mapping Exercise

Using their Traditional Knowledge and local observations, the participants split into small groups and marked on a large-scale map of their community the areas that are susceptible to flooding and the areas that are safe or resilient to flooding. The groups also indicated on the map any flood events that they knew of or had experienced, either historically or recently. The groups then used this information to create a hypothetical emergency response plan. The facilitators asked the groups to note the effects floods, the areas that are going to be flooded, what areas are exposed to low and high hazards, and what are the risks? They focused on access, transportation, types of access from outside communities, infrastructure, lagoons, water systems, people's homes, other important areas. The main outcomes were:

1. A discussion about the trade-offs between coping with emergencies in the short term and taking preventive measures in the long term. The participants agreed that both were important, but they also recognized the challenges of implementing long-term solutions, such as relocating houses or building infrastructure.

2. An analysis of the erosion risk caused by winding streams that threatened some houses along Oak Creek and Oak River. The participants suggested monitoring the stream banks and reinforcing them with vegetation or rocks to prevent further erosion. They also considered relocating some houses that were too close to the streams.

3. A proposal for using flood maps to guide future housing development in the community. The participants recommended building new houses on higher ground or using pads on footings to elevate them above the flood level. They also preferred to repair or retrofit existing houses rather than moving them to another location.

4. A question about the funding sources and opportunities for flood risk reduction and emergency response planning in their community. The participants wondered if they could access funds from the Investing in Canada Infrastructure Program or other federal or provincial programs. They also expressed their interest in integrated programs that would address multiple needs and priorities of their community, such as housing, health, education, culture, and environment.

5. A recognition of the role of berms as roads during a flood. The participants noted that berms were the main access routes to reach flooded areas or evacuate people and belongings. They suggested maintaining and improving the berms to ensure their functionality and safety during a flood. They planned to use boats, trucks, and ATVs to transport people and supplies to and from the flooded areas. They also designated safe evacuation routes and shelters for different scenarios.

6. A prioritization of the critical infrastructure and facilities that needed protection from flooding. The participants chose to focus their plans on housing, two sewage lagoons (one main and one for the school), one freshwater treatment plant, and the gas station. They identified potential threats and impacts from flooding on these assets and proposed mitigation measures, such as sandbags, pumps, generators, or relocation.

7. A coordination of emergency management with Oak Lake, an adjacent community that was less affected by flooding. The participants noted that the road connecting Oak Creek and Oak Lake was usually not inundated during floods and could be used as an alternative route or a staging area for emergency operations. They suggested establishing communication and collaboration protocols with Oak Lake to enhance their mutual support and preparedness.

8. A consideration of the ongoing construction and development activities in areas prone to flooding, especially in and around the historic centre of the community. The participants stressed the need for integrating flood risk assessment and emergency response planning into housing and other zone planning processes. They also emphasized the importance of preserving and enhancing the cultural and historical values of their community while reducing their exposure and vulnerability to flooding.

9. The participants also considered nesting waterbirds in their plans.

The groups were then requested by the facilitators to identify the infrastructure that could be affected by flooding according to their maps. The participants highlighted the following areas as the most critical to safeguard and manage during a flood event:

1. The lodge for the Elders, the water treatment plant, residential buildings, gas station, sewage ponds, north Oak Creek subdivisions, roads/access routes, school, and any related power infrastructure.
2. The participants also observed that "secondary flooding" (i.e. water from upstream blocked by built controls such as the downslope part of berms can/has caused flooding of some houses. They suggested having pumps to control the accumulation of water in those areas.

The groups were then prompted by the facilitators to reflect on the ecological and cultural significance of nature and how these areas are addressed by the emergency response plan and flood map. The participants observed that:

1. There are plants with healing properties on the floodplain, as well as the wild fruits, berries and grazing land, could be affected by floods.

The facilitators then requested the groups to rank the areas in the community that need protection. The following list was proposed by the participants:

- Infrastructure/access
- Residential/gravesites/burial

- Gaming centre/financial
- Environmental/medicines

Finally, the facilitators asked the participants what they would do to reduce the risk of flooding in their area. The participants gave the following suggestions:

1. Building and maintaining structures that can prevent or divert floodwater, such as dikes, canals, and levees.
2. Using valves in culverts that can control the flow of water in both directions along the berm.
3. Leaving some land along the waterways undeveloped to act as a natural buffer against flooding.
4. Empowering the community to use their own resources to create a gravel pit that could provide material for sandbags and berms in case of an emergency.
5. Identifying and clearing any obstructions in the culverts that could impede the drainage of water.
6. Establishing more stations to measure and monitor the water levels and flow. Possibly using cameras to watch for beaver dams upstream that could cause blockages and backwater flooding.
7. Understanding how climate change affects the erosion of river banks, the frequency and severity of floods in their area.
8. They mentioned a major obstacle as a lack of funding for infrastructure upkeep. They also recognized they need better land use planning but need flood maps to support this.

Information and Training Gaps

The workshop participants were asked to evaluate their learning outcomes and identify any gaps or needs related to flood mapping. The facilitators used a set of questions to guide the discussion on various topics.

Q: Are FFMG guidelines useful?

A: YES definitely. More communities need to be aware of this initiative.

Q: Prior to this workshop, where you aware of the FFMGs?

A: No.

Q: How can the federal government collaborate with Indigenous communities and strengthen resilience to flood events?

A: The federal government could collaborate with Indigenous communities and strengthen resilience to flood events by helping to coordinate emergency response with neighbouring communities, providing funding for ice breakup to mitigate risk, and supporting strategic relocation of those at most risk. The federal government could facilitate such collaboration by providing clear guidance, information, and funding to Indigenous communities that want to engage with regional water management bodies.

Q: How can the federal government enhance disaster response capacity and coordination among Indigenous communities?

A: Allocate funds to create permanent positions in Indigenous communities that are dedicated to emergency management and coordination. These positions would enhance the local expertise and leadership in dealing with emergencies and disasters. Clarify the roles and responsibilities of different agencies involved in disaster response and eliminate any duplication or confusion. This would facilitate better communication and collaboration among federal, provincial, territorial, and Indigenous partners during emergencies. Support the development of formal emergency response plans for Indigenous communities that do not have them. For example, Sioux Valley does not have a person or a plan for disaster response and coordination. This task falls on the Public Works Department, which consists of one person. Having a formal plan would help Sioux Valley coordinate its activities and resources more effectively in case of an emergency.

Q: How to identify and integrate Indigenous user requirements?

A: Who would do this? Sioux Valley has limited resources and staff availability to conduct user research. Therefore, a designated person with multiple responsibilities ("chief cook and bottlewasher") would be in charge of this process. To support this position, a useful tool would be a visual guide or a set of criteria or a step-by-step diagram that can help them plan and evaluate their user needs.

Q: Do you prefer paper of digital maps?

A: Depending on the situation, I have different preferences for paper or digital maps. Paper maps are useful for communicating with older people who may not be familiar with digital technology. A paper map is also useful at a worksite. Digital maps are convenient for recording and maintaining data. Sioux Valley is acquiring a license for ArcGIS, so we would lean towards digital maps if we had to choose one option, and then print paper maps as needed.

Q: *What is the tole of leadership in the flood mapping process?*

A: Leadership is responsible for approving funding applications and infrastructure projects that can help mitigate flood risks. However, NRCan's point-of-contact is someone in the Band office (usually someone who handles environmental issues). NRCan does not have direct contact with leadership at the initial stage of the request. However, NRCan should ensure that its requests are clear and consistent, and that they align with the community's needs and priorities. Sometimes NRCan's requests may seem irrelevant or conflicting to leadership, especially when different staff work independently and do not coordinate their efforts. This can create tension and distrust with leadership. NRCan should also maintain continuity and avoid staff turnover that can affect the quality of their relationship with leadership.

Q: How would you use flood maps in housing?

A: Flood maps can help us choose a safe location for a house. This can increase our awareness of the potential impacts of flooding on our community (our community lacks this awareness). We could add the estimated cost of repairs for damaged houses to a flood map, and this could help persuade leadership to revise the zoning regulations.

Métis Local #42

The session in Cumberland House was not as effective as the one in Sioux Valley in terms of getting feedback and information from the participants. Some participants showed interest in flood mapping, but others did not see how it could help with planning. These participants dominated the session and may have discouraged others from sharing their views. This may reflect some of the differences in the community context, economic development and isolation of the community (as described above). More information was gathered during informal chats with participants while touring the diking system of Cumberland House on an ATV and during a group talk the next morning after breakfast. Therefore, the presentation below is relatively brief and less structured as compared to one completed for Sioux Valley but it captures the overall mood of the pilot session.

The facilitators tried to salvage the pilot session by repeating the same questions that they had asked Sioux Valley in the section "Information and Training Gaps" (see above). Note that some of the answers are summaries of responses collected during other parts of the pilot session in order to give a more comprehensive answer. They should not be viewed as precise transcriptions.

Q: Are FFMG guidelines useful?

A: Flood maps (and by proxy the FFMGs) are not very useful. We already know where to go when there is a flood: the highest point on the island. Flood maps might be good for some things, like protecting important buildings (for example, the airport) or fixing weak spots on the dike. They might also help us know which roads will be blocked by water (Cumberland is at the end of a long dirt road that follows the river). But we don't trust the maps or the information they show. I think we know better than anyone else what to do in a flood. Flood maps are not something we need or use here. All we need is a muster point and that’s the highest point on the island. The FFMGs are an exercise in endless studies that go nowhere.

Q: Prior to this workshop, where you aware of the FFMGs?

A: No.

Q: How can the federal government collaborate with Indigenous communities and strengthen resilience to flood events?

A: Cumberland House has faced many flood events that forced people to leave their homes. But not all of them were really needed. The government tried to work with us, but they used a lot of complex studies with technical figures and drawings that are hard to understand for most community members. We need a simpler way to understand what is going on. Maybe they can show us a model or a animation that makes it clear. Our people don't have enough education to deal with the current way of doing things. The federal government could help by forcing SaskPower and the province to listen to us.

Q: How can the federal government enhance disaster response capacity and coordination among Indigenous communities?

A: The federal government needs to address the gaps and challenges that hinder effective emergency management in the community. One of these gaps is the lack of a formal Emergency Response Plan for Cumberland House, which means that there is no clear guidance or framework for dealing with flood risks. Another challenge is the limited technical capacity in the community to conduct mapping or geographic information system (GIS) analysis, which are essential tools for assessing vulnerabilities and impacts.

Q: How to identify and integrate Indigenous user requirements?

A: There is no capacity in the community so there is nothing to integrate.

Q: Do you prefer paper of digital maps?

A: Both have a role to play.

Q: *What is the tole of leadership in the flood mapping process?*

A: Things are done “on-the-fly” in Cumberland House, one person decides during an emergency and then a plan is formed. Leadership does not really have a role during floods—“things work out themselves”.

Q: How would you use flood maps in housing?

A: We have no need for flood maps.

The people of Cumberland House were bitter towards the provincial and federal governments due to past wrongs and lack of positive action towards their community. They were reluctant to participate in the flood mapping process because of this. The province's decisions in Regina were seen as not beneficial for Cumberland House, with neglected infrastructure such as roads and unfinished projects like the dike. Vital infrastructure like the airport and sewage lagoon gates were also in need of repair. The EB Campbell Dam upstream was also a source of frustration for the community. Due to their anger about these issues, the participants were not fully engaged in the pilot session and believed other priorities were more important than flood mapping.

Discussion

The goal of the discussion is to explore the challenges and opportunities of engaging with Indigenous communities in Canada on flood mapping and risk reduction. The main themes we explore are to understand how:

1. The FFMGs can be used to the benefit of Indigenous stakeholders, and how to incorporate their knowledge, needs, and preferences into the flood mapping process;

2. The federal government can collaborate with Indigenous communities to enhance their resilience, awareness, and capacity to cope with flood events, especially in the context of climate change;
3. The federal government can address the communication and coordination issues that may arise between different levels of government, Indigenous leaders, and other partners involved in flood mapping and mitigation; and,
4. The cultural and technical aspects of producing and delivering flood mapping products that are relevant and accessible to Indigenous communities.

FFMGs and the benefit to Indigenous Stakeholders

Utility of the FFMGs

The utility of the FFMGs may vary depending on the context and needs of different Indigenous communities. Some communities found the FFMGs very useful and beneficial for their flood management needs. For example, some participants in the pilot sessions suggested that FFMGs can help them identify areas that are prone to flooding, plan for evacuation routes and emergency shelters, protect critical infrastructure and assets, and reduce future damages and losses. However, some communities may also face challenges in implementing the FFMGs, such as lack of technical capacity, resources, and time. They may need additional training, support, and tools to apply the FFMGs effectively and efficiently. They may also appreciate a simplified version of the FFMGs that summarizes the main steps and outcomes of the flood mapping process.

Other communities may not see much value in the FFMGs or the flood maps they produce. For example, these communities may have a strong local knowledge and experience of flooding, and rely on their own coping strategies and practices. They may not trust or use the information provided by the flood maps, or find it irrelevant or unnecessary for their situation. They may also perceive the FFMGs as a bureaucratic burden or a waste of time and money and may prefer to focus on other aspects of flood management.

Preparation, Response and Recovery from Flood Events

The federal government can help Indigenous communities prepare, respond and recover from flood events by considering the following:

- The federal government could support Indigenous communities in the development of flood risk management plans that take into account community values, Traditional Knowledge, and local conditions. This could involve providing resources and training to community members and partnering with Indigenous organizations to facilitate the planning process. These plans should outline the community's priorities, resources, and strategies for preparing for, preventing, responding to, and recovering from flood events.

- The federal government could support collaboration and coordination among all levels of government, Indigenous organizations, and other stakeholders are essential for effective flood risk management. The federal government could facilitate this by establishing communication channels and forums for information-sharing, collaboration, and decision-making. This would help to ensure that all stakeholders are informed, engaged, and working together towards common goals.

- Finally, the federal government could support research and innovation in flood risk management, particularly in the areas of climate change adaptation, infrastructure, cultural values, and

Traditional Knowledge. This would help to advance the knowledge and tools available for Indigenous communities and other stakeholders to effectively prepare for, prevent, respond to, and recover from flood events.

Collaboration with Indigenous Communities

Role of Leadership

Leadership is responsible for approving funding applications and infrastructure projects that can help mitigate flood risks. The federal government's point-of-contact is usually someone in the Band office who handles environmental issues, and leadership may be involved and informed throughout the process. The federal government's should ensure that its requests to leadership are clear and consistent, and that they align with the community's needs and priorities. Sometimes the federal government's requests may seem irrelevant or conflicting to leadership, especially when different staff work independently and do not coordinate their efforts. This can create tension and distrust with leadership. The federal government should strive to maintain continuity and avoid staff turnover that can affect the quality of their relationship with leadership.

In some communities, leadership does not have a significant role during floods. Things are done "on-the-fly", and one person decides during an emergency and then a plan is formed. However, this may not be the most effective or sustainable way of dealing with floods, as it can lead to confusion, inefficiency, and increased vulnerability. Most community members receive information on floods, flooding issues, and flood maps from various sources, such as community leadership, social media, email communications, media, responsible authorities, and more.

Strengthen Resilience to Flood Events

The federal government has a responsibility to collaborate with Indigenous communities and strengthen their resilience to flood events, which are becoming more frequent and severe due to climate change. Some of the ways that the federal government could do this are:

- Providing clear guidance, information, and funding to Indigenous communities that want to engage with regional water management bodies;
- Helping to coordinate emergency response with neighbouring communities;
- Providing funding for ice breakup to mitigate risk; and
- Supporting strategic relocation of those at most risk.

However, the federal government also needs to respect the perspectives and preferences of Indigenous communities, who may have different ways of understanding and coping with flood events. For example, some community members expressed a desire not to collaborate with the federal government and preferred a model of self-sufficiency. Ultimately, by working together in a respectful and meaningful way, the federal government and Indigenous communities can reduce the impacts of flood events and enhance their mutual trust and cooperation.

Identify and Integrate of Indigenous User Requirements

Identifying and integrating Indigenous user requirements is crucial for ensuring that policies and programs meet the needs of Indigenous communities. However, it is clear from the communities' responses that there are significant challenges in developing a user requirements table. To address these challenges, the federal government could work with Indigenous communities to develop a visual guide or a set of criteria

or step-by-step diagrams to help them plan and evaluate their user needs. These tools could be developed collaboratively with Indigenous partners and tailored to the specific needs of each community.

In addition, the federal government could support capacity-building efforts within Indigenous communities to help them develop the skills and expertise needed to identify and articulate their user requirements. This could include providing training and resources to community members, as well as partnering with Indigenous organizations to develop and deliver capacity-building programs. It is also important for the federal government to work closely with Indigenous communities to ensure that they are actively engaged in the process of identifying and integrating their user requirements. This could involve establishing a collaborative process that includes regular communication and consultation with Indigenous partners throughout the development and implementation of policies and programs.

Ultimately, building capacity within Indigenous communities and establishing strong partnerships between Indigenous and non-Indigenous partners will be critical to ensuring that the user requirements of Indigenous communities are properly identified and integrated into policies and programs.

Communication and Coordination

Disaster Response Capacity and Coordination

During the pilot sessions, participants highlighted the need for increased support from the federal government to enhance disaster response capacity and coordination. To achieve this, participants recommended that the federal government allocate funds to create permanent positions in Indigenous communities that are dedicated to emergency management and coordination. Such positions would provide local expertise and leadership in responding to emergencies and disasters. Participants also suggested that the federal government should clarify the roles and responsibilities of different agencies involved in disaster response and eliminate any duplication or confusion. This would ensure better communication and collaboration among federal, provincial, regional, and Indigenous partners during emergencies.

Additionally, participants emphasized that the federal government should support the development of formal emergency response plans for Indigenous communities that do not have them. A participant cited his community as an example of a community without a person or plan for disaster response and coordination, noting that this task currently falls on the Public Works Department, which consists of only one person. Having a formal plan would help his community coordinate activities and resources more effectively in case of an emergency. Finally, the participant highlighted some of the gaps and challenges that hinder effective emergency management in his community, including the lack of a formal Emergency Response Plan and limited technical capacity to conduct mapping or geographic information system (GIS) analysis, which are essential tools for assessing vulnerabilities and impacts during a crisis.

Concept of Risk

It is not uncommon for people to confuse the terms "risk" and "hazard" as they are related but distinct concepts. A hazard refers to any potential source of harm, while risk refers to the probability of harm occurring and the severity of the potential consequences. When asked to identify flood risks in their community, participants in the pilot session identified hazards that including inundation, erosion, and infrastructure deterioration. However, the risks associated with these hazards were not explicitly stated.

To further the discussion, a simple definition of risk as "the chance of something bad happening to something you care about" was introduced to the participants. The difference between exposure (the presence of people or assets in areas that could be affected by hazards), vulnerability (the susceptibility of people or assets to suffer harm or damage from hazards), and coping capacity (the ability of people or assets to withstand, adapt to, or recover from hazards) was introduced to the participants.

Participants were then able to identify not only the hazards that they faced, but also the values that they wanted to protect, the factors that influenced their level of risk, and the potential actions that they could take to reduce their risk. For example, some participants recognized that leaving some land along the waterways undeveloped could act as a natural buffer against flooding, but also acknowledged that this would require trade-offs with other land uses such as agriculture or housing. Some participants also expressed an interest in learning more about how climate change affects the erosion of river banks and the frequency and severity of floods in their area. Some participants highlighted the importance of infrastructure upkeep as a way of enhancing their coping capacity and reducing their vulnerability.

Improving the understanding of risk within Indigenous communities will require addressing the capability gaps that exist within some communities. The concepts outlined above were known to the participants but not formalized in a way that could easily be applied.

Identification of Needs

The federal government can identify culturally-relevant information on Indigenous flood mapping needs and communications on flood risk awareness by the following:

- Recognize the diversity and complexity of Indigenous governance structures and how they relate to flood mapping.
- Establish a clear and inclusive procedure for using the FFMGs to address any issues or concerns that Indigenous communities may have regarding flood mapping.
- Enhance the capacity and understanding of Indigenous communities on how the FFMGs can benefit them by promoting inclusive processes, raising awareness, and providing tools for planning and preparing for future flood events.

Communications should respect the Indigenous perspective on flood mapping and risk. This means understanding the complex governance structures within Indigenous communities and how they relate to the FFMGs. The federal government should also create a clear process for addressing the concerns and needs of Indigenous communities regarding flood mapping and risk communication, and ensure that they are included in all stages of planning and implementation. The federal government should also support capacity building and awareness raising among Indigenous communities on how they can benefit from the FFMGs and prepare for future flood events.

Awareness of Federal Initiatives and Programs

The FFMGs were unknow to most if not all participants in the engagement and pilot sessions. Considering the results obtained from both the engagement and pilot session, one possible way to improve awareness of federal initiatives and programs related to flood mapping, structural mitigation, and other flood risk reduction measures is to:

- Address the concerns and expectations of the stakeholders, such as fatigue with government processes, desire for concrete actions and simple examples, and need for clear communication and coordination among different levels of government.

- Showcase a series of demonstration projects that illustrate how federal initiatives and programs can help communities reduce their flood risks and costs, enhance their resilience and adaptation capacity, and access private residential insurance for overland flooding.
- Keep in mind that many in the target audience are hands-on learners that appreciate direct action. This means that communications should include interactive elements, such as demonstrations, exercises, or simulations, that allow participants to apply what they learn.

Communication of Climate Change Effects on Flood Events

The participants in both the engagement and pilot sessions had a good understanding of climate change and how it may condition flood events. For example, it was generally recognized that climate change increases the intensity of extreme precipitation and flood events, especially in regions and seasons with high water availability. It was also recognized that floods that used to occur once in a hundred years may become more frequent and severe due to climate change.

In addition, the participants had a good understanding of how these changes may affect their communities. They have observed changes in the natural environment, such as more frequent and intense flooding, erosion of river banks, altered drainage systems, and delayed freezing of lakes. In light of these changes, they also recognize the need to protect their family, Elders and children, the loss of property and land, and the disruption of their ancestral paths and livelihoods. They have expressed their views on how the FFMGs should consider climate change in relation to upstream issues that influence flood risk, such as farming and land use, water control structures, dams, and agriculture.

To communicate an understanding of the effect of climate change on flood events, it is important to acknowledge the diverse and complex factors that contribute to flood development and risk, as well as the local and indigenous knowledge and perspectives that can inform adaptation and mitigation strategies. It is also important to use reliable and updated data and information from scientific sources that can support evidence-based communication and action. Some participants suggested simple map animations that illustrate changes and different scenarios as an effective means of communicating the effect of climate change on flood events.

Cultural and Technical Aspects

Indigenous Traditional Knowledge

Indigenous communities can make unique contributions to the flood mapping process, including calibration and validation of models through physical evidence like high-water marks, “citizen science” using mobile phone images, and the incorporation of information derived from historical flood memory. However, information management processes for collecting and integrating local and expert knowledge into community flood planning are required and not always available. Regular updates and protection of information in the maps are also a critical component of the process.

The following framework can be used to ensure that Indigenous Traditional Knowledge is effectively incorporated into flood mapping:

1. Clarify the Focus: The initial focus of the activity should be to produce Indigenous-led content that is robust and represents the community's perspectives and needs.

2. Modify Existing Structures: The structure used by the federal government should be adapted and follow the format and content specified by the community leadership to ensure that the mapping is appropriate to the community. This may vary depending on each community.
3. Follow Ownership, Control, Access and Protection (OCAP) principles: Clarify the value of the federal government's strict adherence to these principles as they are essential to the benefit of the community participants at all stages of the project.
4. Use the CARE Approach: The CARE approach (Connecting, Assessing, Responding, Empowering) should be utilized in interactions to ensure community engagement and participation in the mapping process.
5. Provide Access to Maps: After Indigenous Traditional Knowledge is gathered and incorporated into flood maps, the federal government should provide opportunities for Indigenous communities to ensure the full context of the community and relevant surrounding area is fully mapped; ensure they have access to these maps; ensure there are owners of these maps; and determine how the map owners protect the information included in the maps, especially if there is Indigenous Traditional Knowledge embedded.
6. Develop Procedures for Map Maintenance: Develop procedures that reflect the maintenance of maps across time so that the data remains current, relevant, and useful to the community.

The engagement and pilot sessions revealed that the participants had ample knowledge about how floods affected the environment and the community in the past. Some information was obtained through Traditional Knowledge and supplemented with information from different sources, such as their outdoor activities or work experience. This was especially true if participants were active in hunting, fishing, or trapping or worked for the community as part of the Public Works Department and/or Emergency Services (or similar). They understood how different parts of the ecosystem interacted and changed because of floods. They also knew where the problems were, why they happened, and how to deal with them. They wanted to share their knowledge with the flood mapping process, but they did not have a process to do that. The federal government could help communities channel all relevant flood and flood history information into the structure outlined above. This includes providing training and resources to establish and maintain an information malmanagement system designed to hold the community's Traditional Knowledge. In many cases, this may be the required first-step before Traditional Knowledge can help guide the flood mapping process in a community.

Map Media

The question of whether paper maps or digital maps are more suitable for different purposes and contexts is not easy to answer. There are advantages and disadvantages to both types of maps, and different preferences and expectations among the community members.

The benefits of paper maps were recognized by some participants. For example, paper maps are perceived as tangible and readable, which can facilitate communication and discussion in a meeting setting. Paper maps do not require any computer or internet connection to use, which can be convenient in remote areas or in case of power outage. Paper maps can also be more appealing to older generations who may not be familiar with or comfortable with digital technology. However, paper maps also have some drawbacks that limit their usefulness and relevance and these were recognized by community members. For instance, paper maps are not always accurate or up-to-date, as they may not reflect the changes in the landscape or the infrastructure over time. Paper maps are also not always accessible, as they may be hard to find, store, or transport. Paper maps have a fixed scale and resolution, which means they cannot show more or less

detail depending on the user's needs. Paper maps also have a limited amount of information that they can display, as they cannot incorporate different data layers or interactive features.

Community members that preferred digital maps and recognized several benefits. For example, digital maps are accessible and easily shared, as they can be accessed online or offline through various devices and platforms. Digital maps can also be projected on a screen or a wall, which can enhance group communication and collaboration. Digital maps allow the user to add or remove different data layers, such as infrastructure locations, topographic lines, or digital elevation models. Digital maps can also show more information than paper maps, as they can include multimedia elements such as images, videos, or audio. However, digital maps also have some drawbacks that limit their usefulness and relevance in some situations. For instance, digital maps require the availability of technology to use them, such as computers, internet connection, software, or hardware. Digital maps can also be hard to find or outdated, as they may not be updated regularly or accurately by the map providers.

Sometimes the choice between paper and digital maps depends on the situation and the purpose of the map use. Paper maps may be more useful for communicating with older people who may not be familiar with digital technology. Digital maps may be more useful for accessing and sharing information quickly and easily among different people and in different settings. A phone app or an alert system may be beneficial in some circumstances as nearly everyone has a smart phone or a similar device. Some collaboration within a given community would be beneficial to complete before determining a definitive information standard.