

Mayo Flood Hazard Mapping

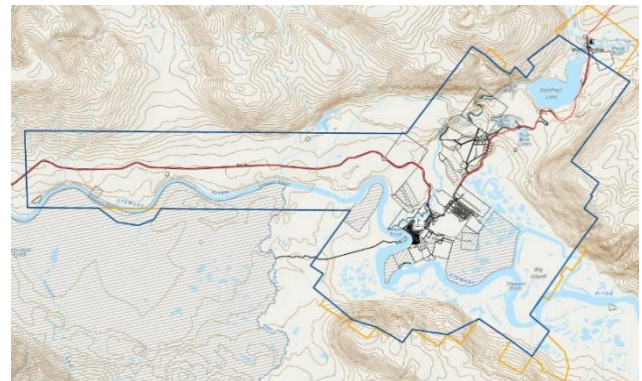
What are flood maps and why are they useful?

Flood maps are prepared by engineers and show an area that may be covered by water or where water reached during a past flood event. These maps describe the level of flood hazard in different areas of a community.

The information produced through flood mapping studies can be used in the design of mitigation measures, emergency preparation and community development planning. Final flood maps are publicly available for use by community members and all levels of government.

Mandate & funding

The Government of Yukon is developing flood maps for communities at risk to support resilience in the face of climate change. Natural Resources Canada is financially supporting this work through the Flood Hazard Identification and Mapping Program.



Mapped areas of interest (outlined in blue) – Identified with input from Government of Yukon departments and First Nation of Na-Cho Nyäk Dun staff.

Study timeline

Planning for flood mapping in Mayo began in spring 2024. The Government of Yukon hired a consultant, KGS Group to complete the study. First Nation of Na-Cho Nyäk Dun staff supported the field work. Here's how the work was completed:

- **Fall 2024:** start of consultant contract, engagement planning, review of previous work, site visit
- **Summer 2025:** shoreline and bathymetric (river bottom) surveying, high water mark surveying,
- **Fall/Winter 2025:** data analysis, modelling and mapping
- **Spring 2026:** open house and online engagement on draft maps, preparing final maps
- **Summer 2026:** final maps and report published

Community involvement

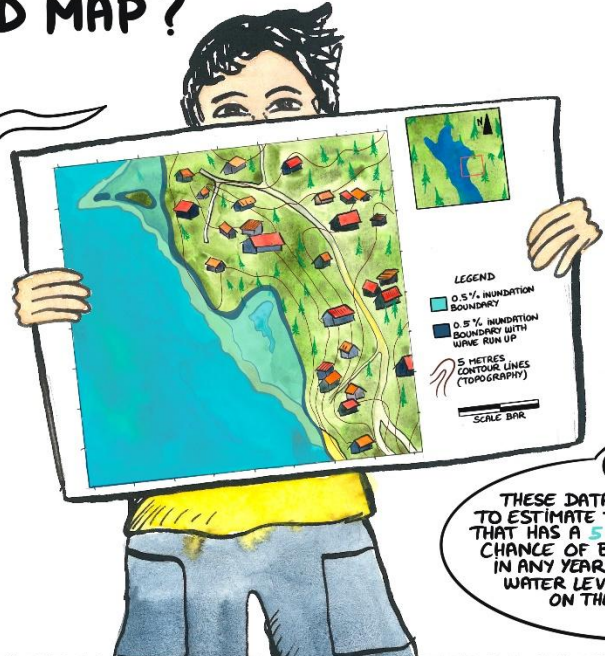
Community members and First Nation of Na-Cho Nyäk Dun (FNNND) staff were involved in the study at various stages:

- FNNND provided input into boundaries of areas to be mapped
- Knowledge holder engagement in May 2025 provided input for the analysis
- FNNND staff supported historical flood documentation and field surveys
- Draft maps are being shared online, and a public engagement meeting will be held (in-person and online) to gather input on the results



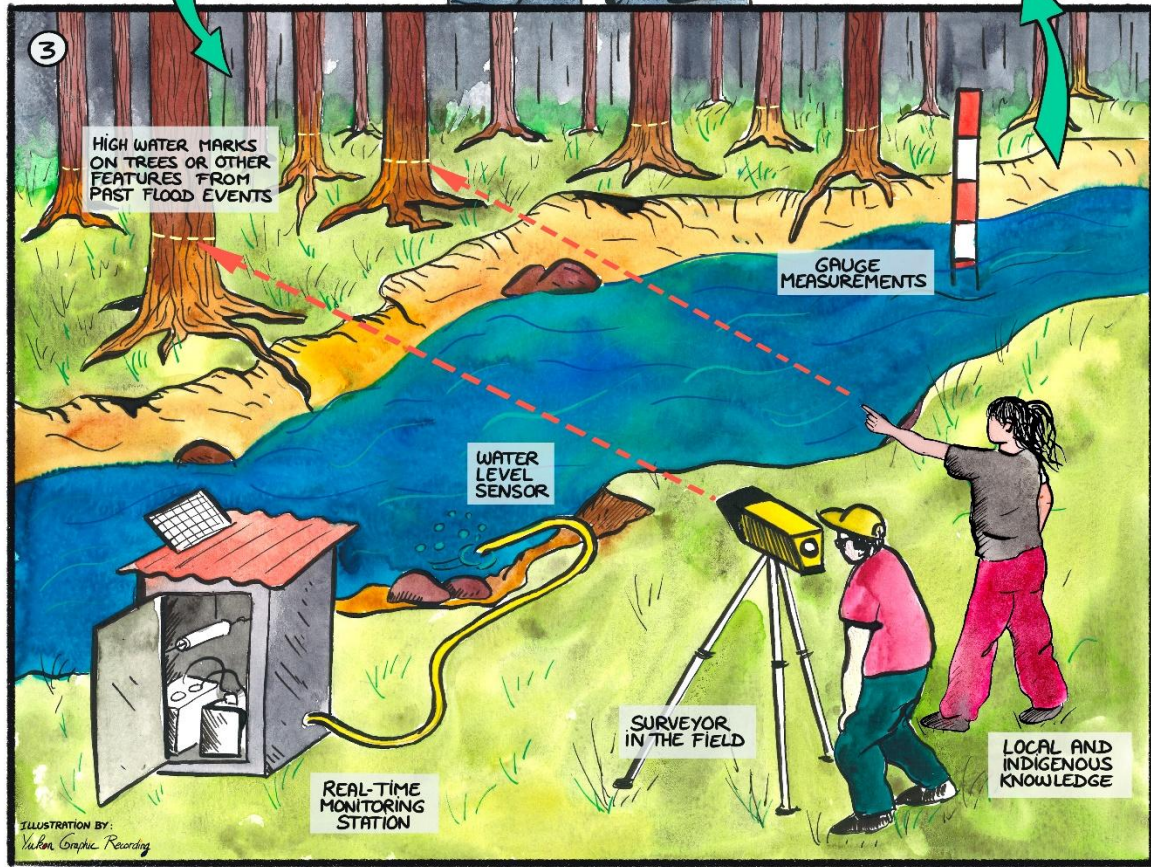
WHAT IS A FLOOD MAP?

1
A FLOOD MAP SHOWS AN AREA AROUND A BODY OF WATER THAT WOULD BE COVERED BY WATER, BASED ON A CERTAIN RIVER FLOW OR LAKE SURFACE LEVEL.



2
PAST WATER LEVELS ARE MEASURED USING:

4
THESE DATA ARE ANALYZED TO ESTIMATE THE WATER LEVEL THAT HAS A 5%, 1%, 0.5%, ETC. CHANCE OF BEING REACHED IN ANY YEAR. THIS ESTIMATED WATER LEVEL IS THEN SHOWN ON THE MAP.



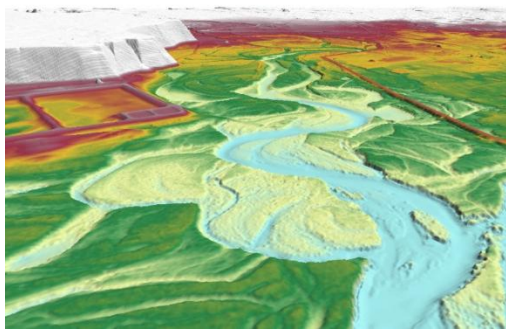
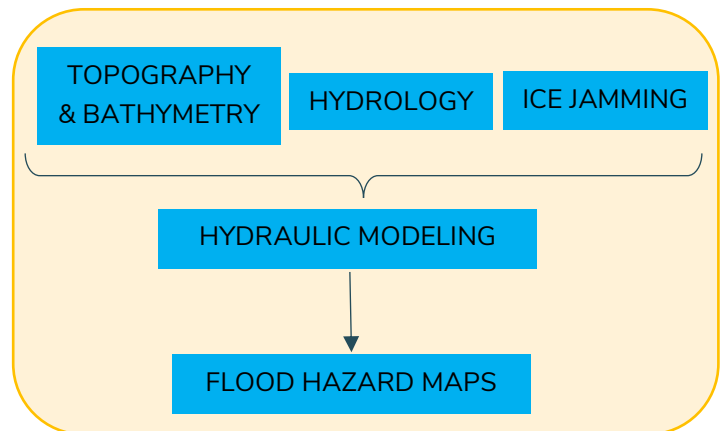
FOR MORE INFORMATION:

floodmapping@yukon.ca / floods.service.yukon.ca



Making a flood map

To make a flood map, topographic and bathymetric data (describing the shape of the land and riverbed) are combined with hydrology data (flows in the river) and ice jam details (where applicable) in a process called hydraulic modelling. The hydraulic model estimates how high the water could rise and how far flooding could spread for different river flows. These water levels and flood areas are then presented on the flood maps.



Integrated bathymetry & topography

Topography and bathymetry

What is the shape of the land around and under the rivers?

LiDAR data for the topography (areas above water) was surveyed by a contractor in 2021, 2022 and 2025.

Bathymetry (areas below water) were surveyed in summer 2025. The surveyed bathymetry and cross-sections were integrated with the LiDAR data, providing the terrain input for the hydraulic modelling.

Hydrology

What are the flood flows of the rivers?

Statistical analysis was used to estimate flood magnitudes on the Mayo and Stewart rivers using Water Survey of Canada river data and Yukon Energy Corporation operational records. Flooding in the study area can result from ice jams or open water conditions. Using this information, the likelihood of various peak river flows was calculated during three periods: freeze-up (November to December), breakup (late April to early May), and open water (late May to October). These “annual exceedance probability” (AEP) flows show the chance that a certain flow or water level will be reached or exceeded in any given year.

What about land & climate changes?

Historical records may not reflect the full potential for future flood events. The project considered potential changes to land cover (forest fire, permafrost, vegetation) and climate (temperature and precipitation patterns and extremes) between now and 2100.

Land cover changes were determined to have a potential for increasing flood flows. Climate change effects are also anticipated to increase flood flows. Additional flood scenarios were modelled to reflect potential changes to flows under future climate and land cover conditions. These scenarios considered a 30% increase to the Mayo River and Stewart River flows.

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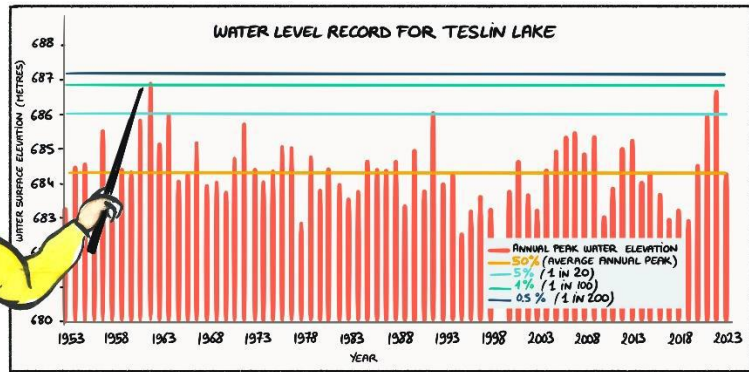


UNDERSTANDING FLOOD PROBABILITIES

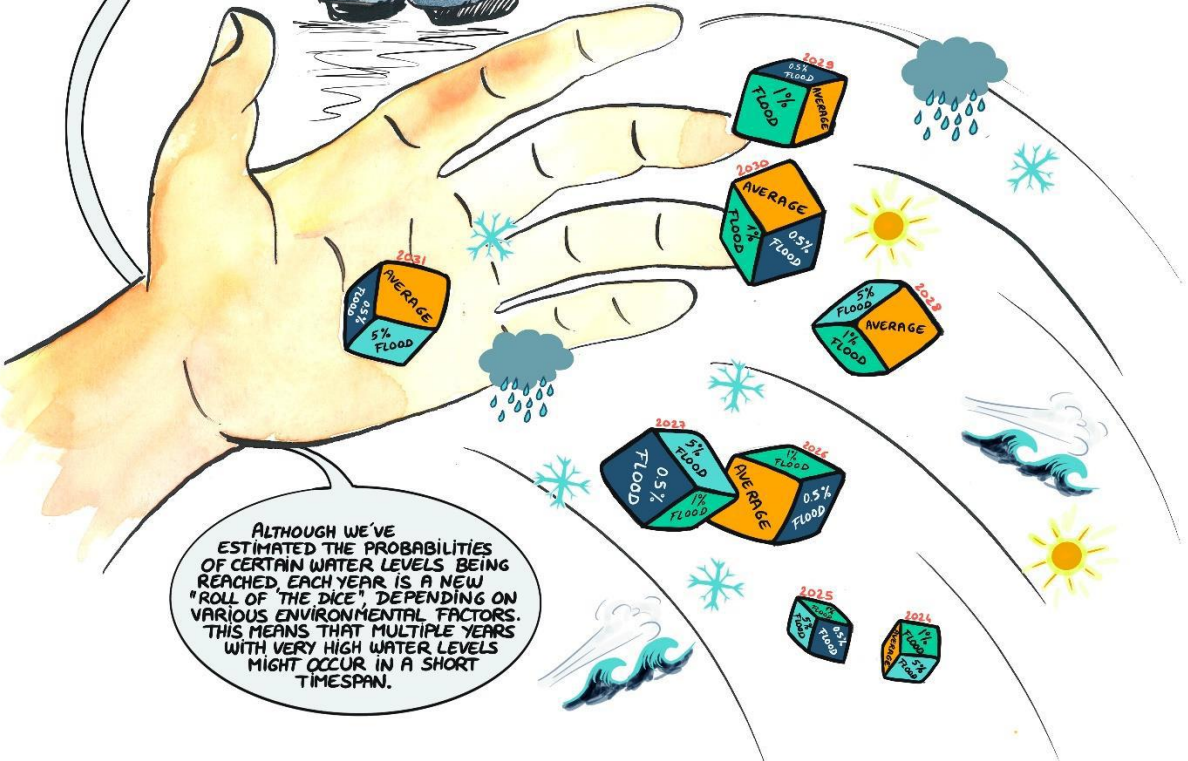
THE LIKELIHOOD OF THE WATER REACHING OR EXCEEDING A CERTAIN LEVEL IN ANY YEAR CAN BE DESCRIBED AS A PERCENT PROBABILITY. THESE PROBABILITIES ARE CALCULATED BASED ON RECORDS OF THE PEAK LEVEL REACHED IN PAST YEARS. LEARN MORE ABOUT FLOOD PROBABILITIES BELOW THROUGH THE EXAMPLE OF PAST FLOODING IN TESLIN.

SINCE 1953 (THE START OF OUR RECORD), TESLIN LAKE HAS ALREADY HAD TWO FLOOD EVENTS AROUND THE 1% (1 IN 100) LEVEL.

THE ANNUAL PEAK WATER LEVEL IN TESLIN LAKE VARIES A LOT. THE PEAK IN 1962 WAS ALMOST 4.5 METRES ABOVE THE PEAK IN 1992. SOME LAKES HAVE A SMALLER RANGE.



IN ANY FUTURE YEAR ANY ONE OF THESE PEAK LEVELS (OR ONE OUTSIDE OF THE OBSERVED RANGE) COULD OCCUR. HOWEVER, THE 5% (1 IN 20) EVENT IS MORE LIKELY TO OCCUR THAN THE 1% (1 IN 100) OR THE 0.5% (1 IN 200) EVENTS.



ALTHOUGH WE'VE ESTIMATED THE PROBABILITIES OF CERTAIN WATER LEVELS BEING REACHED, EACH YEAR IS A NEW "ROLL OF THE DICE" DEPENDING ON VARIOUS ENVIRONMENTAL FACTORS. THIS MEANS THAT MULTIPLE YEARS WITH VERY HIGH WATER LEVELS MIGHT OCCUR IN A SHORT TIMESPAN.



Ice Jamming

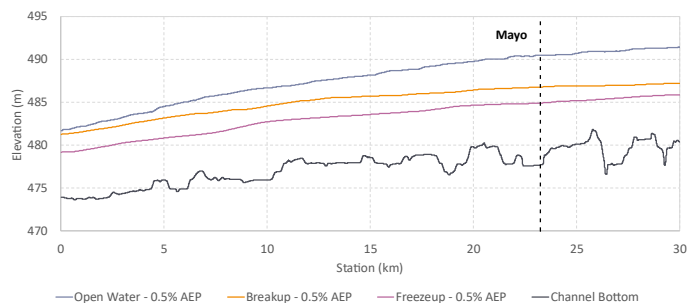
Where do ice jams start and over what length of the river do they occur?

Ice jam flooding in the Mayo area has mainly occurred on the Mayo River, most recently in 2015. This study used hydraulic modelling and statistical analysis to estimate potential ice jam water levels. Both breakup and freeze-up conditions were assessed, with freeze-up identified as the controlling scenario. Ice jam conditions were also reviewed for the Stewart River, but flooding from ice jams has not been documented as an issue in the study area.

Hydraulic modelling

How high is the water in the river when flooding occurs?

Hydraulic modelling software was used to simulate water levels for different flood events. The foundation of the model was the terrain (topography and bathymetry). Open water AEP flows were used to estimate open water flood extents. Breakup and freeze-up AEP flows were used to simulate ice jams to estimate breakup and freeze-up related flood levels and extents. Hydraulic modelling was completed for the 5% AEP, 1% AEP, 0.5% AEP, and 0.5% AEP + climate change scenarios.



Profile (side view) of Stewart River showing open water model results (in blue) compared to ice jamming (in orange and purple)

Flood hazard maps



Composite flood map for a land cover / climate change scenario at the community of Mayo

For open water conditions, a composite flood map was developed for the Mayo and Stewart rivers by combining the modelled flood extents for each river. A probability of each flood event is specified (e.g. 5%, 1%, or 0.5%).

A separate set of maps was developed for freeze-up ice jam conditions on the Mayo River. Due to the significant uncertainty as a result of limited ice-affected flood level records, probabilities for those floods are described qualitatively (e.g. “low probability”, “extreme low probability”).

The public can access the full set of flood maps for review and comment at the following link:

<https://floods.service.yukon.ca/pages/draft-flood-maps>

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