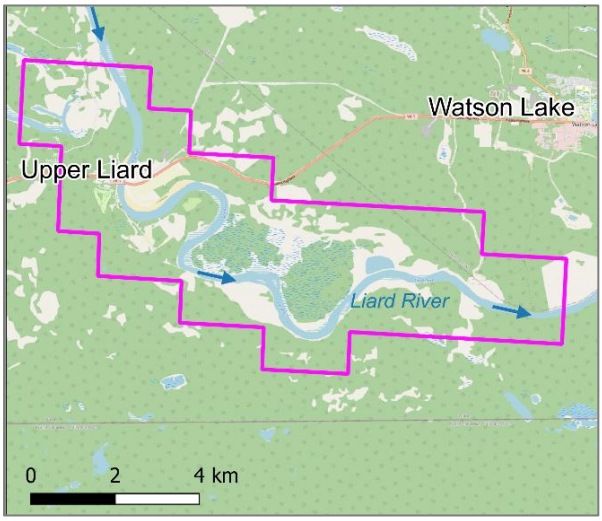
Upper Liard Flood Hazard Mapping



Mapped areas of interest *(outlined in pink) Identified with input from Government of Yukon departments and Liard First Nation staff.*

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 and funding

The Government of Yukon is developing flood maps for communities at risk to support resilience in the face of climate change.

This project was partially funded by Natural Resources Canada, who also provided technical support, through the *Flood Hazard Identification and Mapping Program*.

Study timeline

Planning for flood mapping in Upper Liard began in spring 2024. The Government of Yukon hired a consultant, AtkinsRéalis (with fieldwork support from First Kaska), to complete the study.

Here's how the work was completed:

- May 2025: AtkinsRéalis hired; site visit and knowledge holder interviews completed
- June 2025: shoreline and riverbed surveying
- Summer 2025: background and hydrologic analysis
- Fall 2025: climate change assessment; hydraulic modelling; mapping
- Winter 2026: public engagement on draft maps; preparing final deliverables.
- Spring 2026: final maps and reporting completed and shared with the public

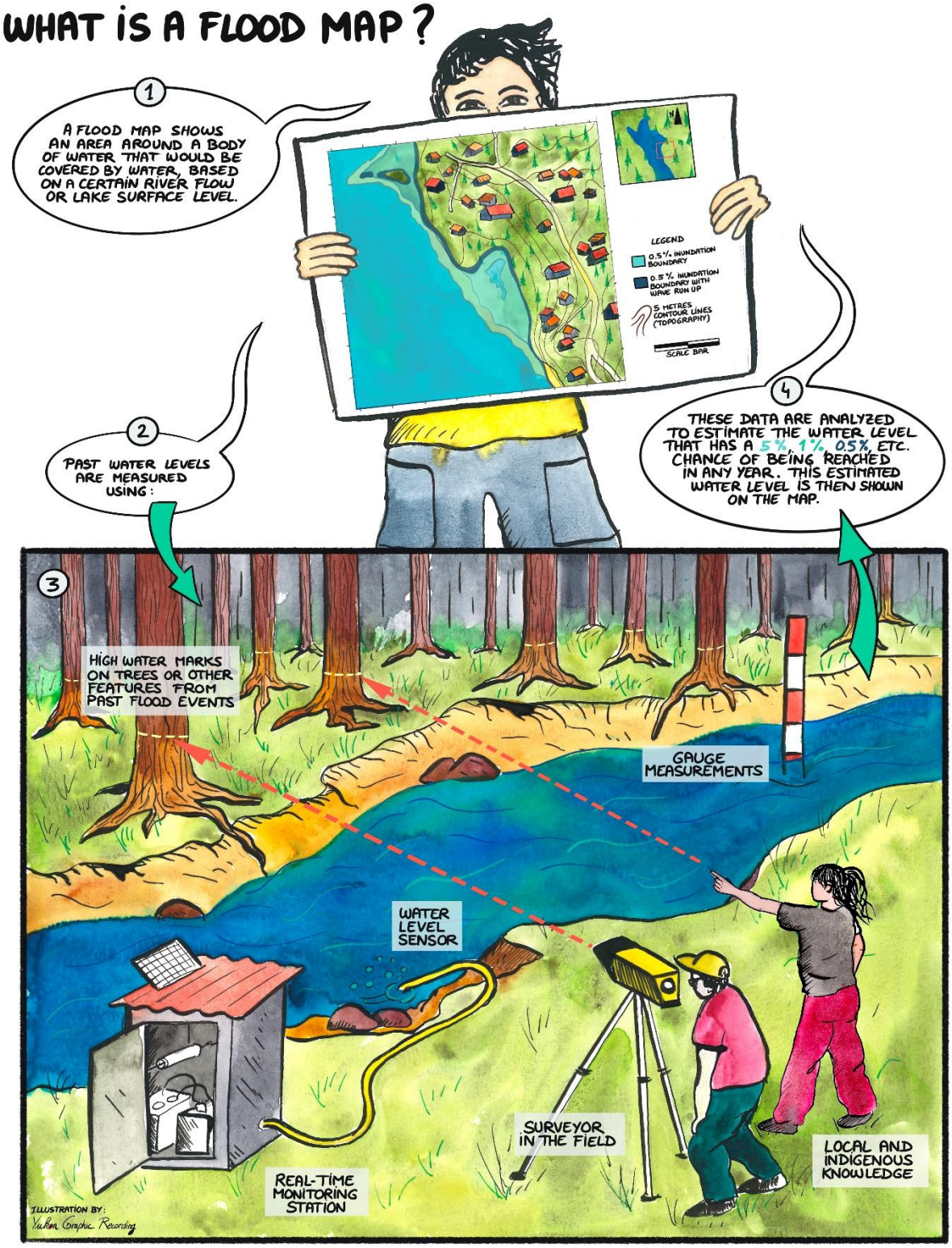
Community involvement

Community members and Liard First Nation (LFN) staff were involved in the study at various stages:

- LFN provided input into boundaries of areas to be mapped.
- LFN staff and local knowledge holders described their experiences with past and recent flooding – this input informed the river ice assessment and high-water mark documentation.
- Draft maps are being shared online and a public engagement meeting held to gather input on the results.

FOR MORE INFORMATION:
floodmapping@yukon.ca / floods.service.yukon.ca

WHAT IS A FLOOD MAP?



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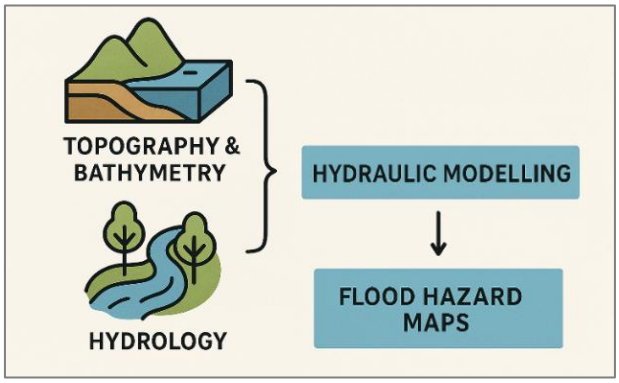
Upper Liard Study Methods

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 (describing possible flows in the river) 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.



Hydrology

What are the flood flows of the Liard River?

The severity of a flood is typically expressed as an Annual Exceedance Probability (AEP), which means the chance of that flood happening in any given year. For example, a 1% AEP flood has a 1-in-100 chance of occurring in a year. Using AEPs makes it easier to connect flood size to risk levels and planning standards.

To calculate flood flows, data from water level gauges on the Liard River and its main tributaries were analyzed. Water levels and flows at Upper Liard have been measured for more than 60 years (a relatively long record for a Yukon community).

A Flood Frequency Analysis (FFA) was conducted to determine the flood flows for various AEPs (see following page for further explanation). This method, based on historical data, gives a reliable estimate of severe flood flows, used for creating flood maps and assessing potential hazards.

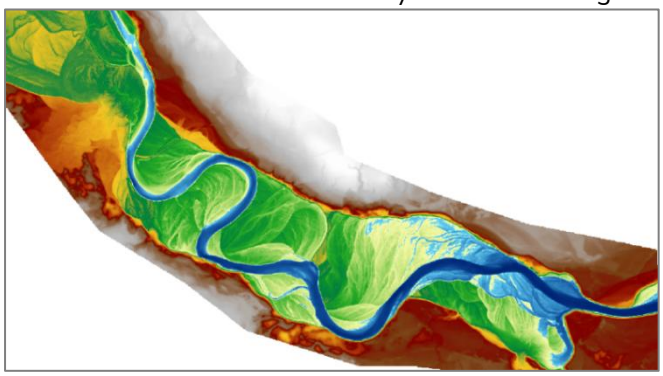
The study of historical floods and knowledge holder interviews indicated that the most severe floods on the river were caused by open-water floods, and not by ice jam or ice jam break ups. As a result, the mapping process focused on open-water conditions.

Topography and bathymetry

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

In August 2024, a contractor surveyed the land surface in the Upper Liard area using an airborne laser scan (called LiDAR).

In June 2025, AtkinsRéalis, with support from First Kaska, did another survey on the Liard River to measure the shape of the riverbed under the water. Both surveys were combined in mapping software and checked carefully for accuracy. This combined information was used as the base terrain for the hydraulic modelling.



Digital Terrain Model of the Upper Liard study area

The Liard River is moving

A specialist in river morphology studied the bank erosion around Upper Liard.

The Liard River near Upper Liard is very dynamic, with the river constantly shifting its course and eroding its banks. The assessment shows active bank erosion and floodplain changes over time.

In some places, the river has moved up to 60 metres in the past 20 years. This means areas close to the outer bends of the river face a higher risk of erosion and bank retreat.

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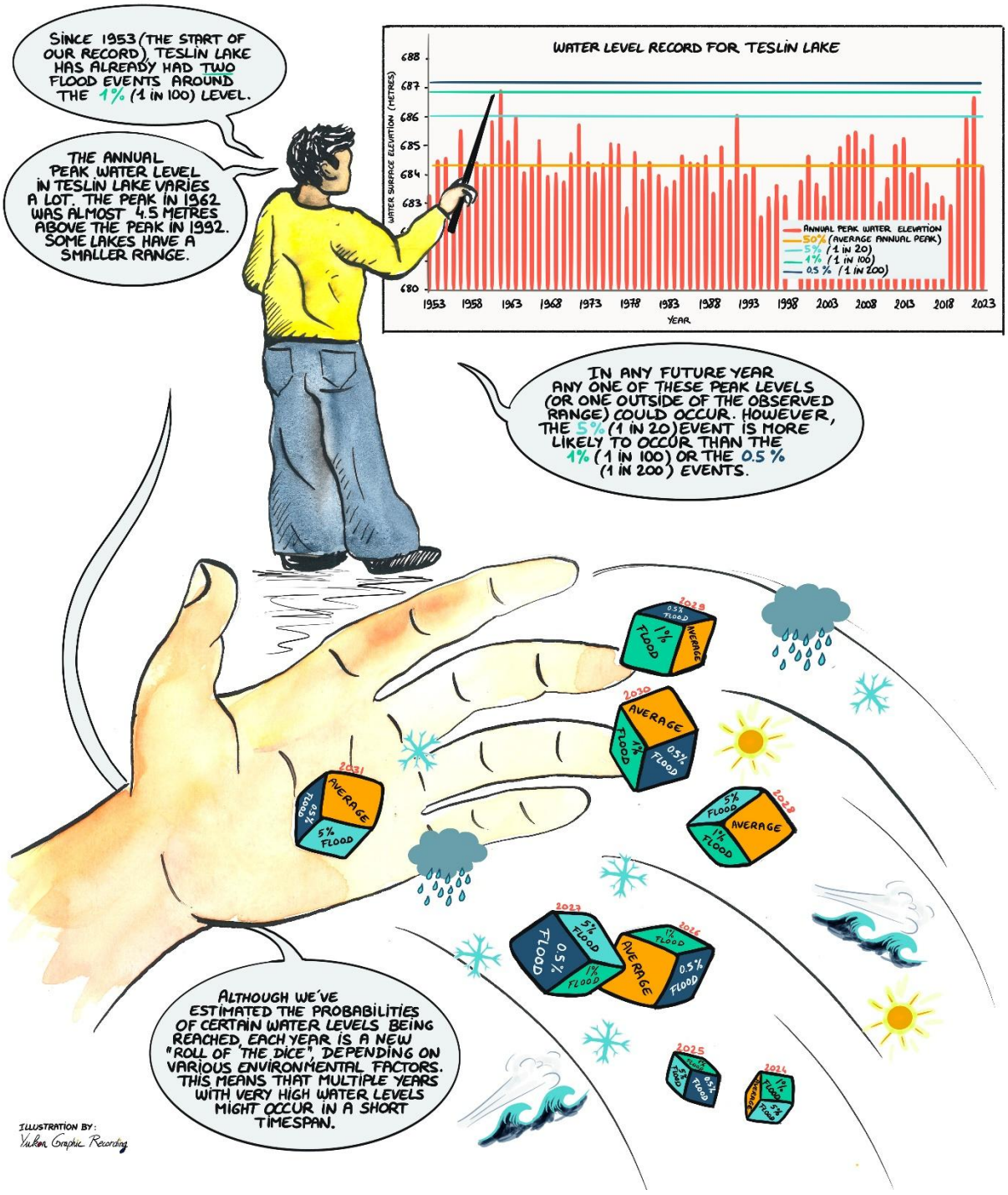
floodmapping@yukon.ca / floods.service.yukon.ca

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.



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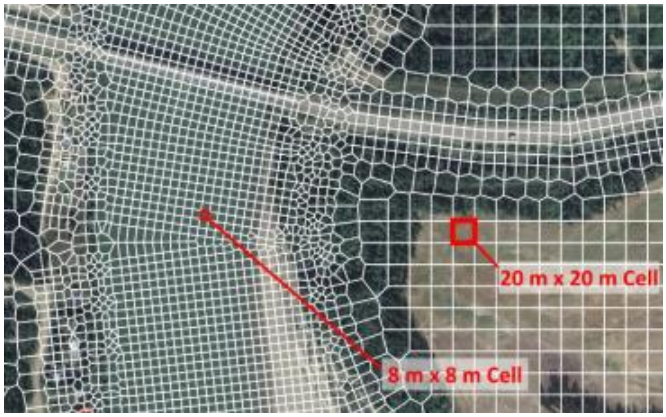
Hydraulic modelling

How high is the water in the river when flood flows?

Hydraulic modelling was done using a computer program called HEC-RAS, which simulates how water moves across land and through the river during floods. The model combines terrain data with a specified river flow to calculate water depth, speed and direction. The model produces results for where water will spread, how deep it will get and how fast it will move under different flood scenarios.

For this study, the model used design flows for three mapping scenarios based on different flood probabilities: 5% AEP, 1% AEP and 0.5% AEP.



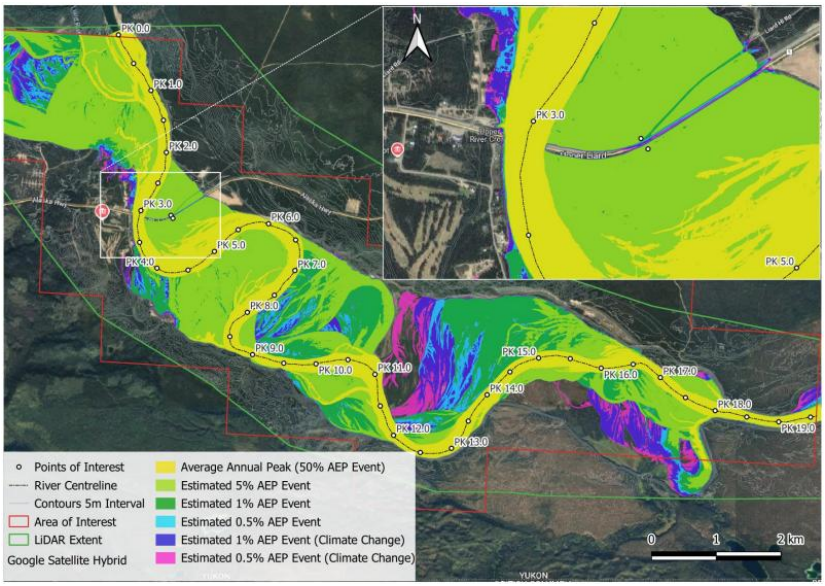
The 2-dimensional HEC-RAS model divides the river and surrounding land into small cells (a mesh). It calculates water depth, speed, and direction in each cell to predict how water moves during floods.

What about climate change?

The study also assessed how future changes to the climate could affect flooding.

Projections show that temperatures and precipitation in northern Canada and Yukon are rising. For the Liard River, this means potentially deeper snow covers, more frequent extreme rainfalls, and more severe flood events.

The future climate over the Liard River basin was modelled using the most recent climate projections. Modelling suggests peak flows may increase by more than 30% by 2100. To address the risk, two future climate scenarios were included in the hydraulic modelling and flood hazard mapping.



Inundation Map - Shows areas that would be covered by water during a flood.

Flood hazard mapping

Five flood events were mapped – the 5%, 1%, and 0.5% AEPs under current conditions, and the 1% and 0.5% AEPs under climate change conditions. These maps can be viewed on the Government of Yukon Flood Hub: floods.service.yukon.ca/pages/draft-flood-maps

This figure (left) shows a composite of these flood extents. The flood layers are placed on a satellite image, to illustrate where flooding could impact homes, roads and other infrastructure.

Some homes in Upper Liard have experienced flooding in basements and crawlspaces due to elevated groundwater levels during river flooding. This flooding mechanism is not represented on the maps.

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