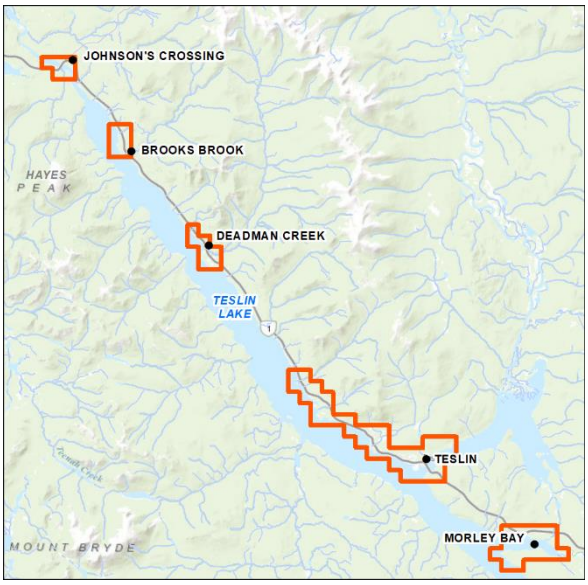
Teslin flood hazard mapping



Areas of interest to be mapped *(outlined in orange) – these areas were identified with input from Government of Yukon departments, Teslin Tlingit Council, and the Village of Teslin.*

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 during floods of different severity. 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

Mapping for communities at risk of flooding was established as an action in *Our Clean Future - a* Yukon strategy for climate change, energy and a green economy. Natural Resources Canada is supporting this work through the *Flood Hazard Identification and Mapping Program*.

Mapping study overview

Planning for flood mapping in Teslin began in December 2022. The study was completed by a consultant, WSP, hired by the Government of Yukon, with input from the Teslin Tlingit Council and the Village of Teslin.

Flood mapping study schedule

Below is the timeline for the study:

- May 2023**:** start of consultant contract and site visit.
- Summer-fall 2023: shoreline and aerial surveying, bathymetric river survey, high water mark surveys, background analysis.
- Winter 2023-2024: modelling and mapping.
- Spring 2024: engagement on draft maps.
- Summer 2024: preparing final maps.
- Fall 2024: final maps and reporting completed and shared with the public.

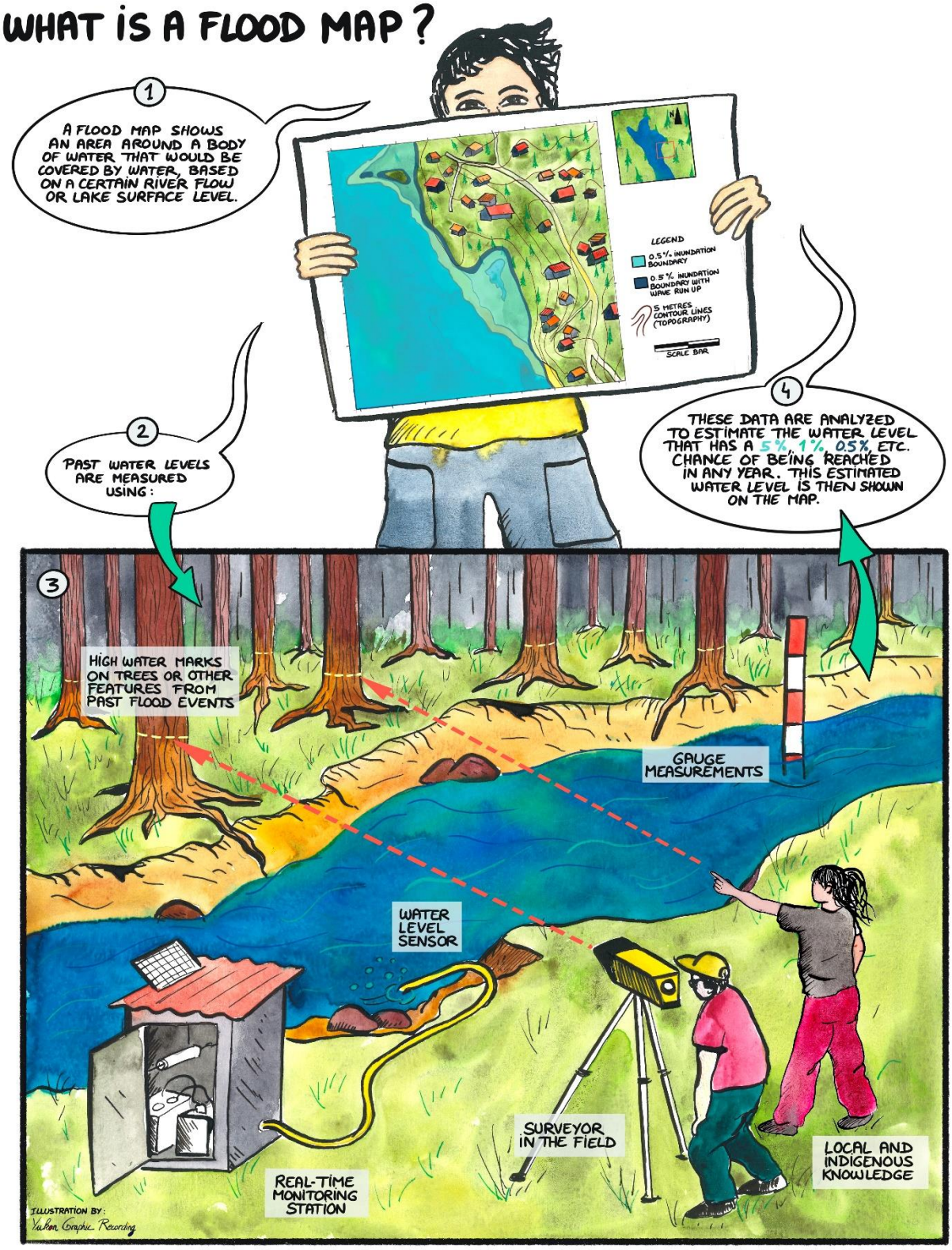
Community involvement

Community members were involved in the study at various stages:

- The study consultant, supported by Deisleen Development Corporation, engaged local knowledge holders on their experiences with past and recent flooding – this input informed the flood history documentation for the study.
- Draft maps were shared (online and at an open house) to provide an opportunity for comments.

FOR MORE INFORMATION:
FloodMapping@yukon.ca / flood-atlas.service.yukon.ca

WHAT IS A FLOOD MAP?



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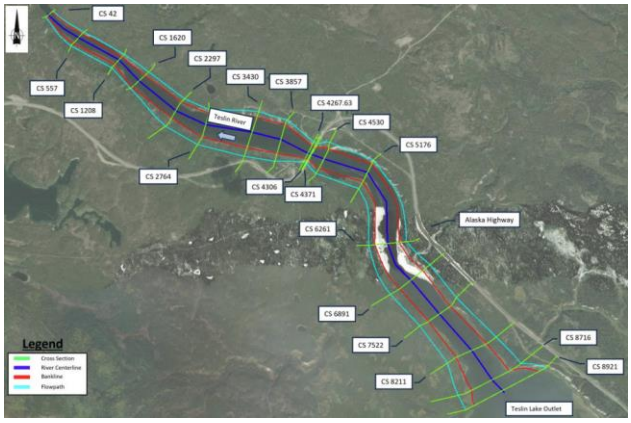
Site visits

Representatives from the Government of Yukon, WSP, Teslin Tlingit Council, and the Village of Teslin visited the areas of interest during spring 2023. This visit provided the opportunity for the project team to become familiar with the study area, areas that were flooded or at risk of flooding in 2022, and to understand the flood response activities for that flood. The visit also allowed the attendees to highlight any high water marks from recent flood events.

Johnson's Crossing boat launch (2022 Flood)



River cross-sections around Johnson's Crossing surveyed to inform hydraulic modelling

Topography & bathymetry

What is the shape of the land surrounding and underneath the water?

Hydraulic models and flood maps require high-accuracy survey and base data. Topography was surveyed using aerial LiDAR and ground-based survey methods. Bathymetry (the shape of the ground under the water) was also measured from a boat at sections of the lake shoreline and river channel. Data was also gathered on bridges, culverts, and berms in the study areas.

What is LiDAR?

LiDAR stands for **Li**ght **D**etection **a**nd **R**anging and is a method for measuring three-dimensional information about the ground surface. LiDAR data is collected by airplane, and is processed to remove vegetation and structures, resulting in a representation of the bare earth surface.

Teslin (2022 Flood)

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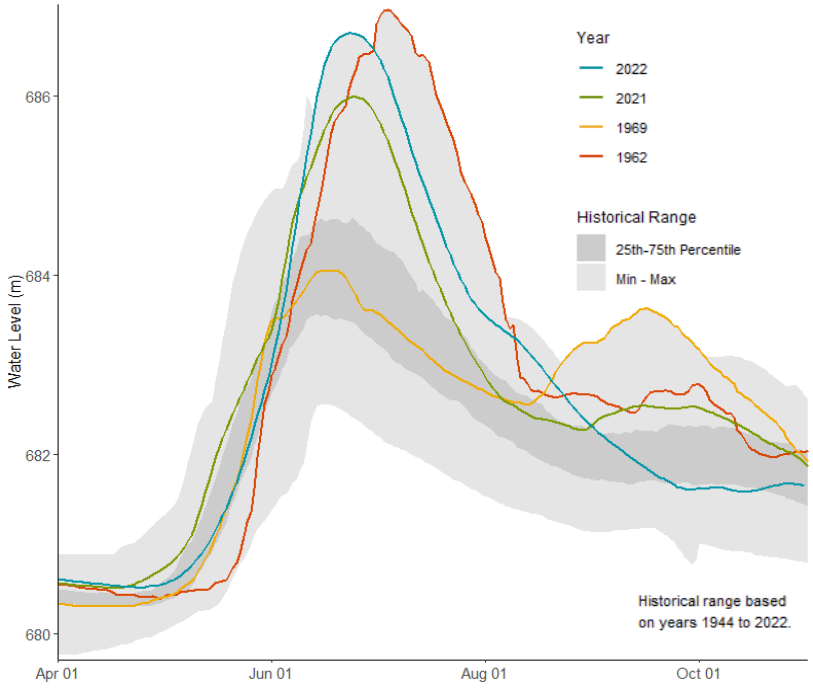
Flooding processes

What are the factors contributing to flooding in the study area?

Water levels on Teslin Lake and Teslin River at Johnson's Crossing generally reach their peak around the end of June. A second, lower peak can also occur following extensive rain periods in the fall.

The 2022 flood provides a good example of the processes that contribute to flooding in this lake/river system. In 2022, a heavy snowpack had developed during the winter. Cooler spring temperatures delayed snowmelt and sudden warming later in the spring resulted in large inflows and high lake levels. The Teslin River is the outlet of Teslin Lake, and the flows are directly correlated with Teslin Lake levels (i.e. high lake levels result in high river flows). Flooding on the lake can also be worsened by both wind setup and wave runup, both of which were considered in the estimation of flood levels.

Historical water level records – Teslin Lake at Teslin



Wind & wave effects during flooding

Wind Setup occurs when sustained winds blow along the long direction of a lake, and push water towards the downwind side of the lake.

Wave Runup occurs when waves generated by the wind travel up the shoreline slope as they break.

Understanding AEPs & return periods

An **annual exceedance probability** (AEP) describes how likely a given lake level is to occur or be exceeded within a single year. A return period is a different way of expressing the same thing. For example, the 1% AEP has a 1-in-100 chance of occurring or being exceeded in any given year – the same as a 1:100-year event.

The process for determining the levels for each AEP is described in the following pages.

Hydrology

What are the flood levels for the lake and the flood flows for the river?

Determining the magnitude of a flood event starts with an assessment of the river flows or lake levels recorded at specific locations. A statistical analysis called a flood frequency analysis for both the lake and river locations provides lake level and river flow estimates for a range of events.

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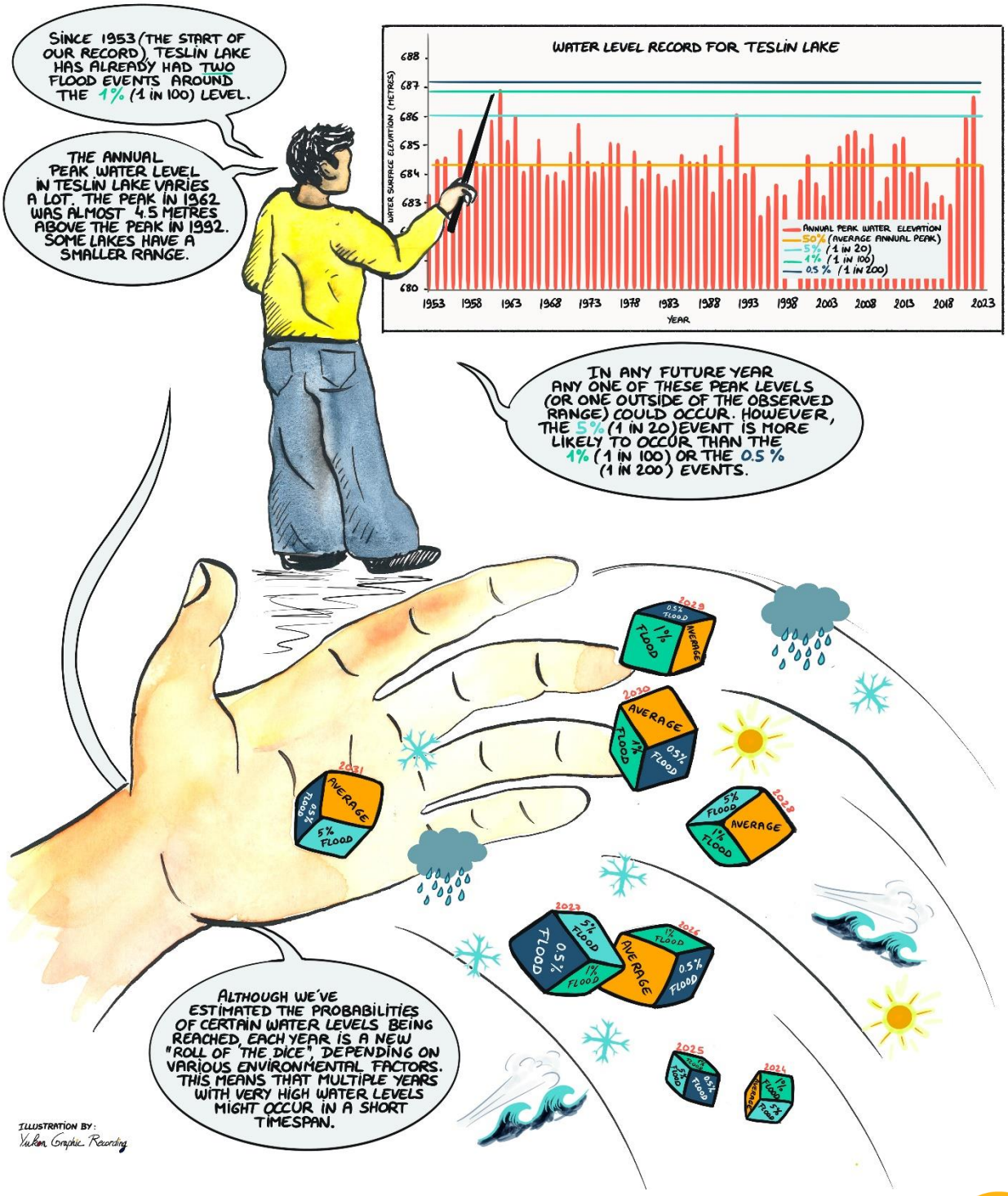
UNDERSTANDING FLOOD PROBABILITIES

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.



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Hydraulic modelling

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

A hydraulic model was created to simulate open water flood levels within the river portion of the study area. This step included flood history documentation, calibration of the model to previous floods and surveyed high water marks, and development of flood profiles for the different open water floods.

What about changes to land & climate?

Flood probabilities are defined based on historical records, but future conditions may vary from those in the past. The project looked at changes to land cover – including potential future changes to vegetation type and forest fires – and determined that it was unlikely that these changes would increase flood flows.

The potential effects of climate change were assessed. There is a lot of uncertainty about future conditions and the resulting impact on flooding. Global climate modelling and Yukon-based research suggests that, on average, more precipitation and warmer temperatures are likely. An increase in lake inflows, informed by these data sources, was modelled to consider how future flood probabilities may differ from present day.

Flood hazard map for the 5% AEP on Teslin Lake (inundation in light blue and potential wave runup in dark blue)

Flood hazard mapping

Flood hazard maps show what areas will be inundated during different sized floods. This study produced maps for the 5%, 1%, and 0.5% probability events under current conditions, and the 5% and 0.5% probability events under climate change conditions. For lake areas, the maps also include additional inundation that may occur due to wind and wave effects.

Where berms have been constructed, the maps show inundation that would have occur without the berm while also highlighting areas protected by the berm. The maps do not show what would be protected if additional temporary measures were implemented around or on top of the berms.

Engagement & final products

Draft flood maps were reviewed with community members in June 2024, with feedback integrated into the final maps. Feedback identified a location where an existing culvert was not represented on the draft maps. It was also suggested that adding local street names would improve the maps.

Final flood maps, the technical report, and a What We Heard report are available online in the Government of Yukon's Flood Atlas: flood-atlas.service.yukon.ca

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