

Greenwood Flood Risk Assessment, Mapping and Mitigation Planning Study

August 9, 2022



GREENWOOD FLOOD RISK ASSESSMENT, MAPPING & MITIGATION PLANNING STUDY

In 2019, the City of Greenwood received a grant from the Community Emergency Preparedness Fund for Flood Risk Assessment, Flood Mapping and Flood Mitigation Planning.

In 2021, the City received in additional funding for the detailed design.

The final stage of the project is construction which will require funding.

This project was funded by the Province of B.C. through the Union of BC Municipalities



Greenwood Flood Mitigation

STUDY GOALS

- To assess the extent of a 1:200 year flood event
- To analyze flood risks in the study area
- To provide recommendations to prevent flooding (flood mitigation)

The Flood Risk Assessment, Mapping & Mitigation Planning study was completed in January 2021.

The study provides an understanding of the impact of future floods and the extent of the floodplain. This will enable the City to plan to protect residents and business located within the floodplain, and to provide development guidelines for setbacks from Boundary Creek, including flood construction levels.

The City will use the results of this study and input from today's session to complete the detailed design.



Greenwood Flood Mitigation

FLOODING 101

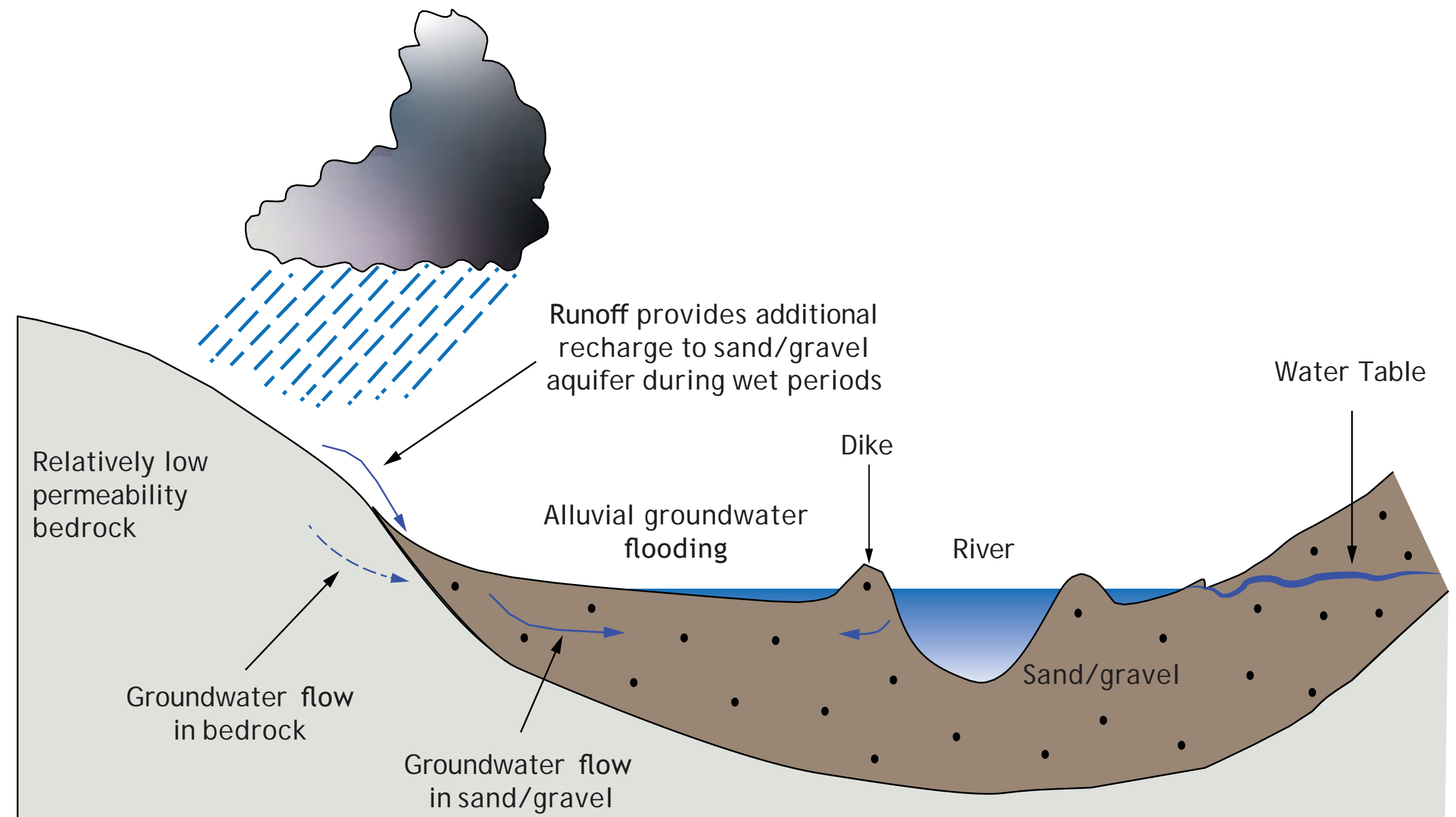
When does flooding occur?

Boundary Creek is at its highest risk of flooding during the spring when rising creek levels from snow melt are combined with spring rainfall events.

How does flooding occur?

- Groundwater flooding occurs when the ground cannot drain rising water levels, causing the water table to rise above the ground surface.
- Overland flooding occurs when water rises above the creek channel embankments and overflows into nearby land.

Greenwood has a unique flood events experiencing both overland flooding and groundwater flooding. These events typically happen in the spring and have impacted both eastern and western shores of Boundary Creek.



Greenwood Flood Mitigation

FLOODS OF 2017 AND 2018

Greenwood has a history of flood events which had increased in magnitude and frequency over the past decade.

2017

- In 2017, intense rain combined with snowmelt increased water levels in Boundary Creek flooding over the channel resulting in a series of emergency dikes being constructed by the city.

2018

- The beginning of May brought daytime temperatures of +30 degrees celsius for 7 straight days, followed by 50mm of rain.
- Snowpack in the Boundary region in May 2018 was 238% (Provincial record).
- Intense rain combined with snowmelt increased the water levels in Boundary Creek which remained inside the creek channel due to the previously constructed emergency dikes.
- On May 10, 2018, an evacuation order was issued for the City of Greenwood, Midway and Grand Forks.
- The rise in water level caused a rise in the groundwater table, which resulted in significant flooding.
- 3,000 people along 300km of river frontage were evacuated in Greenwood, Grand Forks and Midway.
- May 26 2018, the state of emergency was rescinded.



Greenwood Flood Mitigation

WHAT DID WE LOOK AT DURING THE STUDY?

Digital Elevation Model

In this study, a model is developed defining the depth of the bodies of water in the study area and the natural features of the floodplain. This information is combined to show the depth and path of water in the river and creek, and features of floodplain areas creating a three-dimensional representation of the study area.

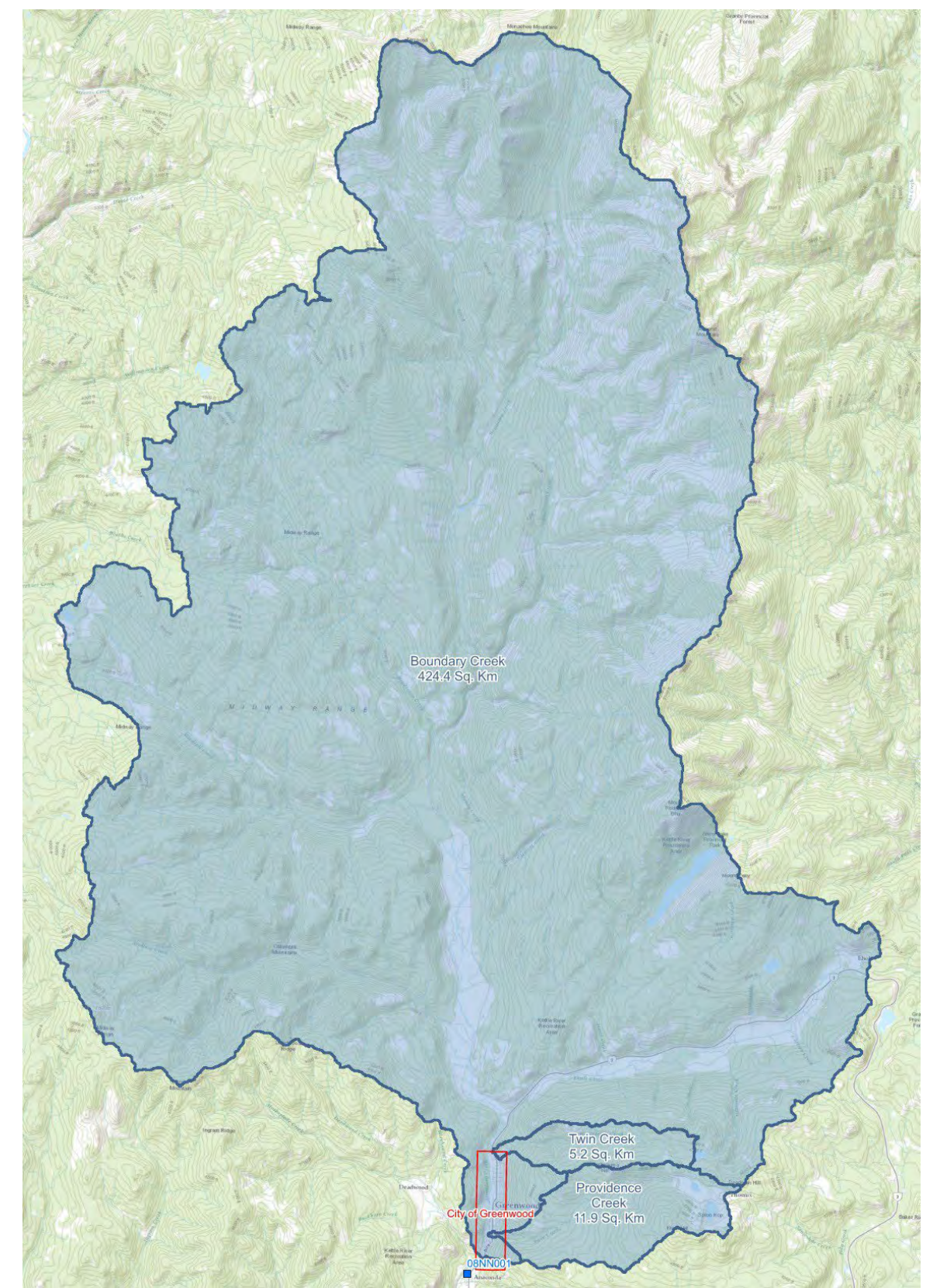
The model was created from technology including LiDAR, ariel imagery and by studying the depths and shapes of the water bodies.

- LiDAR information - collected during the low water period (April 2020), and therefore provided significant information for in-channel areas where water was not apparent.
- Aerial photograph imagery during the low water period identified major bars, bedrock outcrops, and other features that could be used to extend the LiDAR surface into the low-flow wetted sections of the stream.
- Channel bathymetric data developed from 58 channel cross sections (Boundary Creek, Providence Creek, Twin Creek), extending far enough to cover the entire floodplain boundary.

Flood Simulation

A hydraulic model of Kettle River and Boundary Creek evaluated the flow, level and velocity of water under several different flood scenarios. The results of the simulation were used to define the inundated and hazardous areas.

The model includes the geometric data of the site, hydrological characteristics of the water bodies, the land use features, as well as the encountered structures, such as bridges and culverts.



Greenwood Flood Mitigation

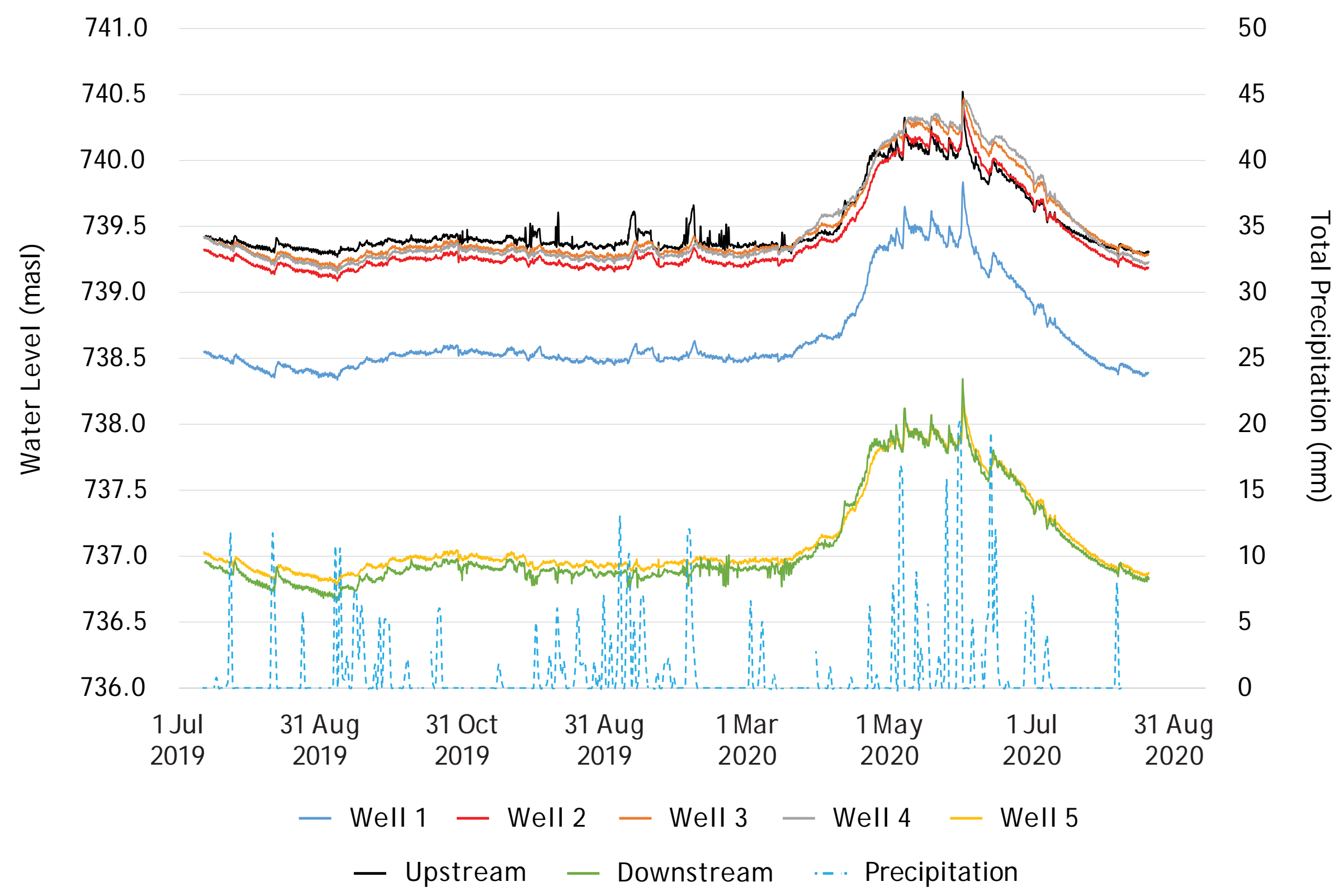
GROUNDWATER STUDY

Five groundwater monitoring wells were placed within the City's limits, and two creek level monitors on the Deadwood Street and Lousia Street Bridges.

Groundwater/creek level and water temperature data was monitored over 13 months time confirming the relationship between the Boundary Creek water elevation and the groundwater elevation.

The groundwater study confirmed that when the creek level rises, so does the groundwater table.

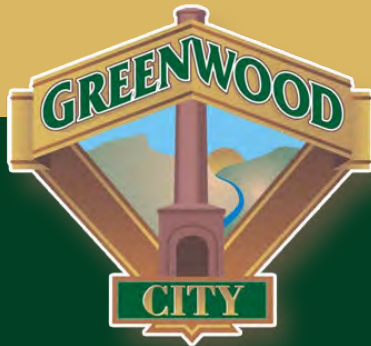
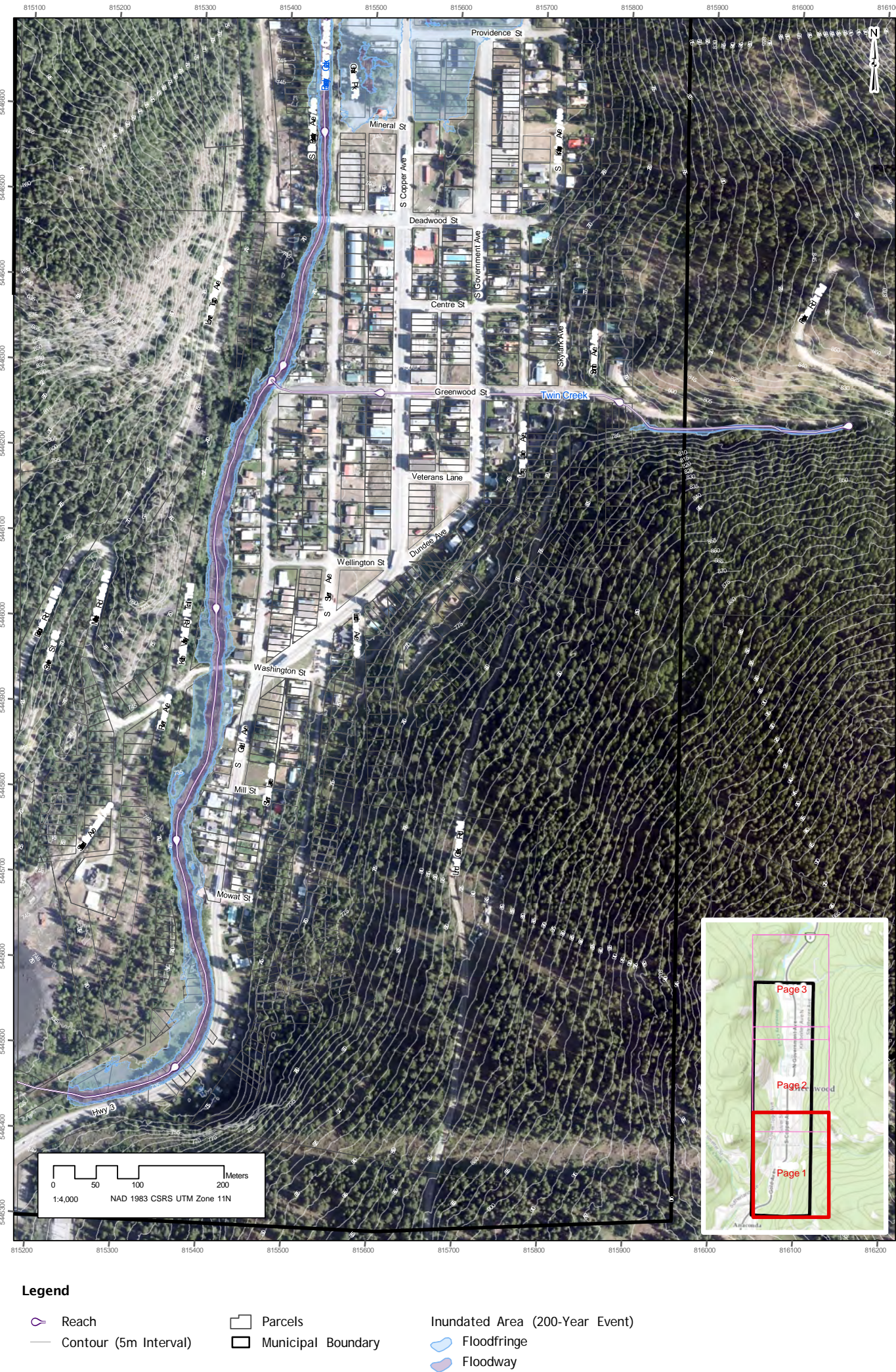
This means flood mitigation must address both overland and groundwater flooding conditions.



FLOOD SCENARIO MAP

In the 1:200-year flood scenario, Boundary Creek will overflow the banks at multiple locations along the creek with existing conditions. The following three maps show the extent of flooding, throughout the City the study predicted.

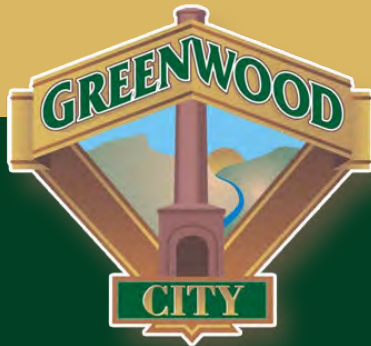
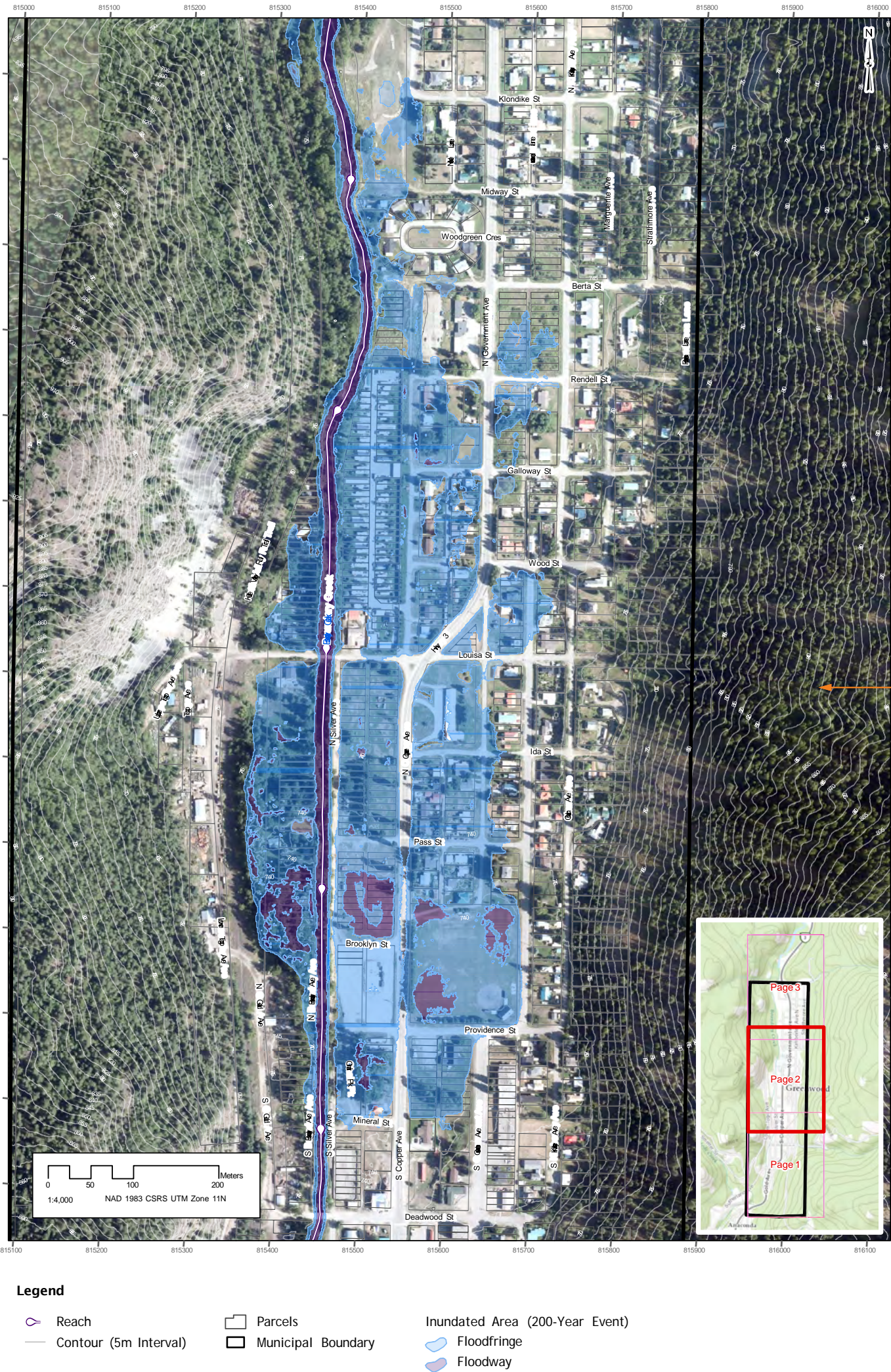
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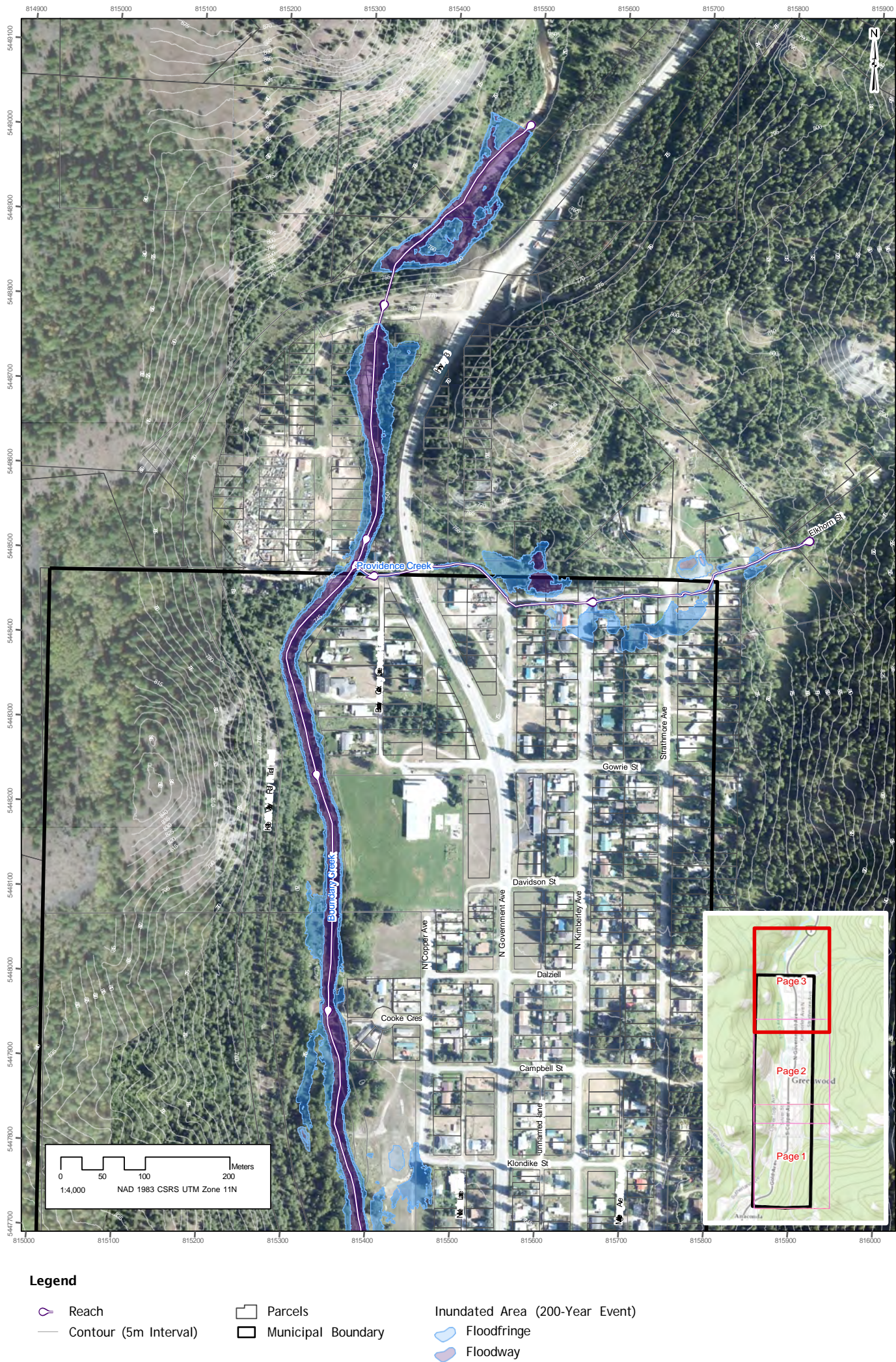
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FLOOD MITIGATION

The primary objective of flood mitigation is to prevent floodwaters from leaving the creek channel embankment and entering private/public property where there is a potential for property damage.

In this study, four flood protection options were considered to protect Greenwood from flood damage:

Dike Construction

Dike construction is the most common measure for flood protection along bodies of water. Dike construction involves building an earthen or concrete structure higher than the flood elevation along the river banks.

Dike construction will increase water elevation in the creek and provide protection from overland flooding, but increase groundwater levels and the potential for groundwater flooding.

Creek Dredging

Over the years, sediment accumulates in the creek channel which increases the water elevation. Creek dredging involves excavating material from the creek channel to increase its capacity. It was determined that dredging depths (300 mm, 600 mm, and 1,000 mm) would not prevent the water from flooding over the natural embankments.

Dike Construction and Creek Dredging

When combining dike construction with creek dredging, the water elevation in the creek will still rise during a flood event. This combined option reduces the length of dikes required, but does not protect against groundwater flooding.

RECOMMENDED OPTION:

Creek Dredging and Creek Widening

Creek dredging combined with widening prevents flooding from escaping the creek embankments and reduces the elevation of the groundwater table, which will protect the City from groundwater flooding.

This recommended option identifies dredging 1,000 mm with widening the existing channel at selected locations on the west side of Boundary Creek by approximately 1.0m.



Greenwood Flood Mitigation

WHAT'S NEXT?



Next Steps

The City has successfully completed the Flood Risk Assessment, Flood Mapping and Flood Mitigation Planning Study.

The City received funding through the Community Emergency Preparedness Fund to fund the detailed design (current). This phase will provide the detailed design and construction tender documents.

The final stage will require funding for construction.

Your feedback along with technical requirements will be considered within the final detailed design.

How to learn more?

Visit: www.greenwoodcity.com.



Greenwood Flood Mitigation