



Environment and
Climate Change Canada

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HYDRAULIC MODELLING TO IMPROVE HYDROMETRIC GAUGE RATING CURVE ACCURACY - PILOT

October 24, 2023

Latornell Conservation Symposium: Changing Climates – Our Watershed Moments
Watershed Management Session 2A- Stormwater and Flood Management

National Hydrological Service – Hydrology Operations East – Engineering, Technical and Data Services

Presented by Derrick Beach



Canada 

OVERVIEW OF PILOT

- Need for Project
- Model Development
- Expected Outcomes



NEED FOR PROJECT

Issue

- Conventional method of stage-discharge rating curve development may be improved with use of hydraulic modelling where typical stage-discharge relationships are difficult to obtain or do not exist

Common Causes

- Unable to obtain high flow measurements due to safety issues and/or peaky watersheds
- Hysteresis in hydrograph (channel impacts, backwater impacts/seiche).
- Complex flow conditions e.g. river confluences, low gradient rivers, reservoir/lake level effects)
- Changing channel controls

Potential Solutions

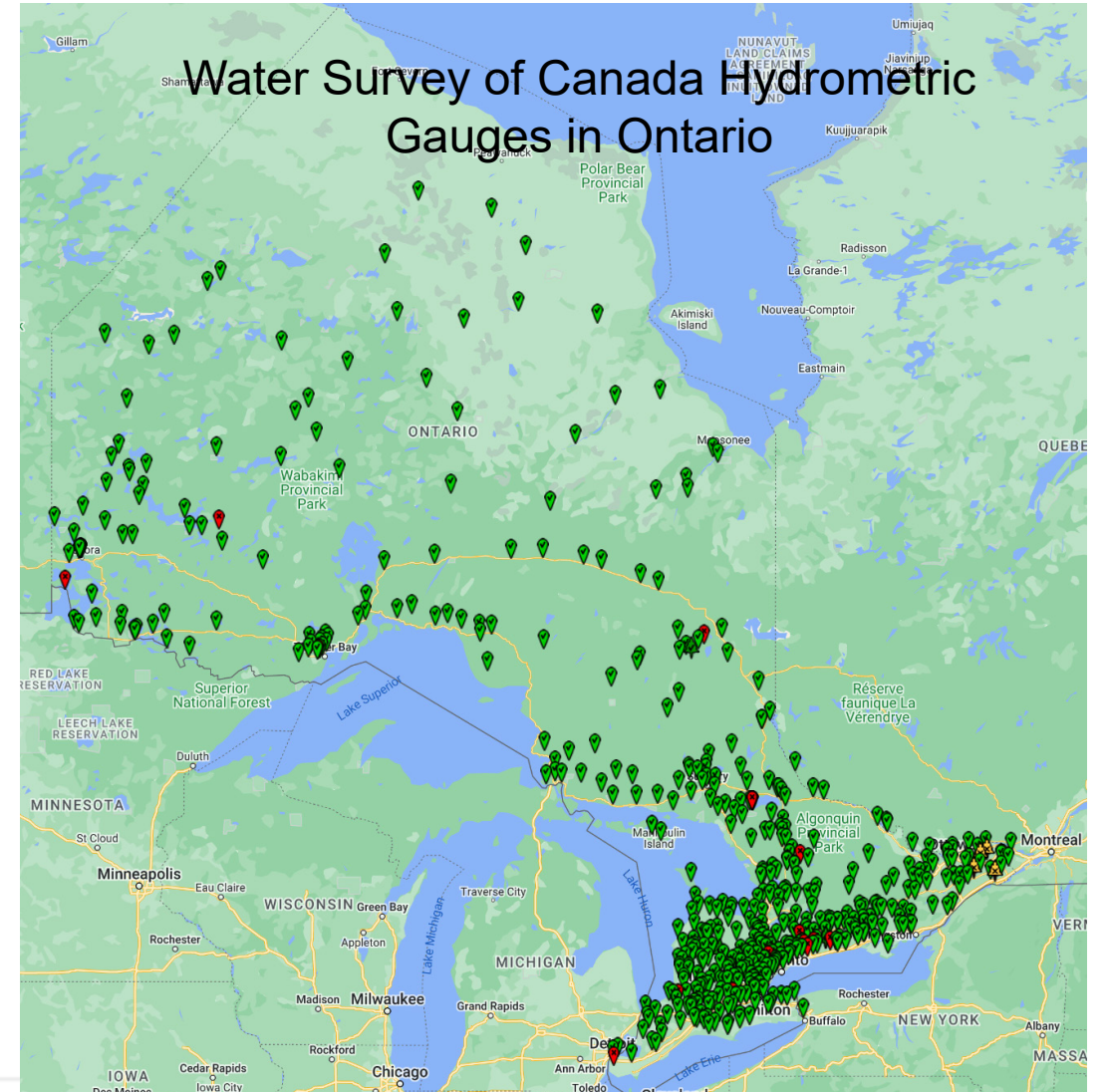
- 1-D and 2-D hydraulic modelling to estimate rating curve
- 1-D and 2-D hydraulic modelling to provide flow estimates

Funding

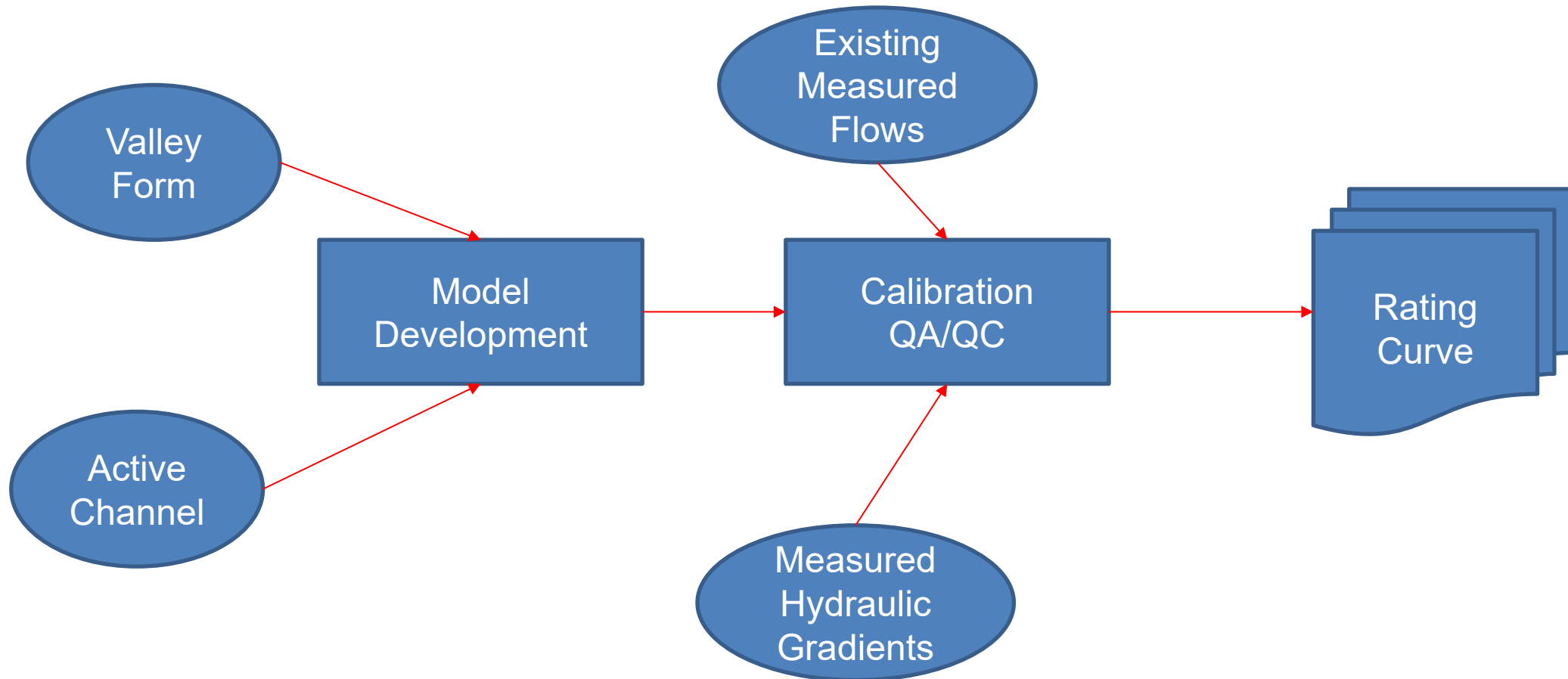
- National Hydrological Services Innovation Project
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WHAT WE ARE WORKING ON

- Identifying hydrometric stations that could benefit from alternative hydraulic methods.
- Developing methods to consider for implementation into the current Water Survey of Canada hydrometric network.



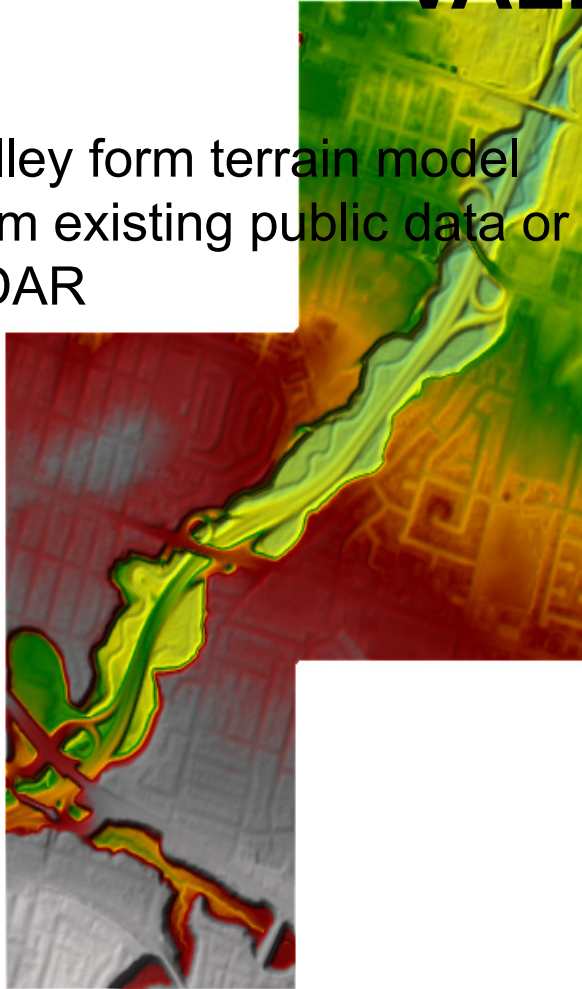
HYDRAULIC MODEL DEVELOPMENT



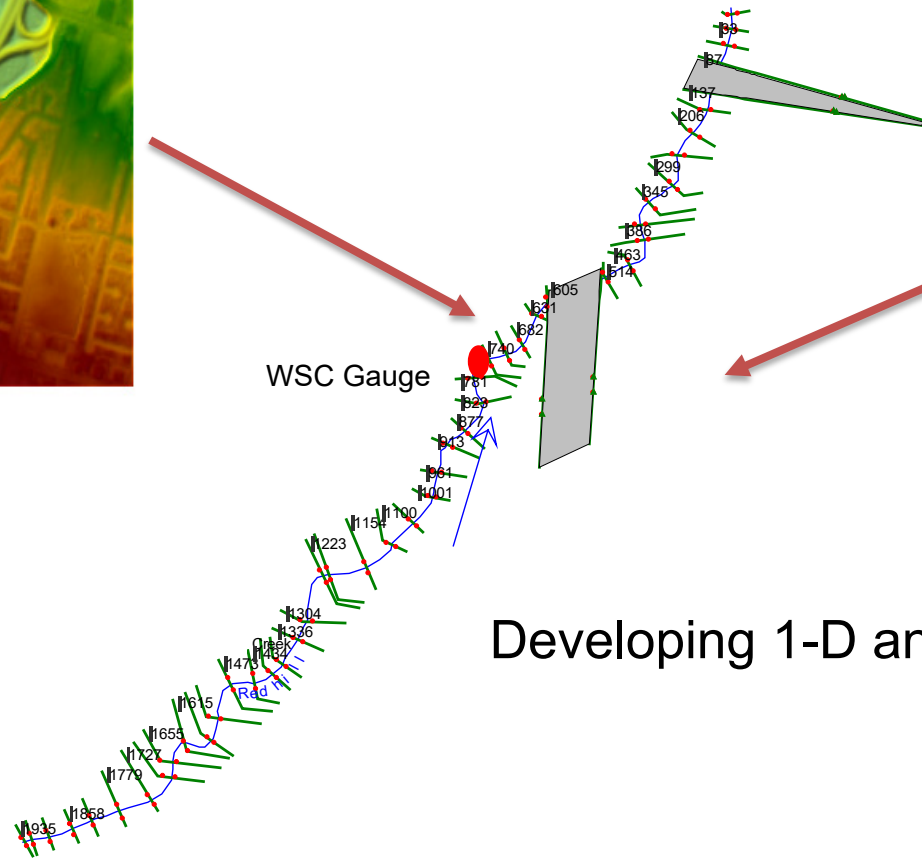
MODEL DEVELOPMENT

VALLEY FORM / ACTIVE CHANNEL

Valley form terrain model
from existing public data or
LiDAR

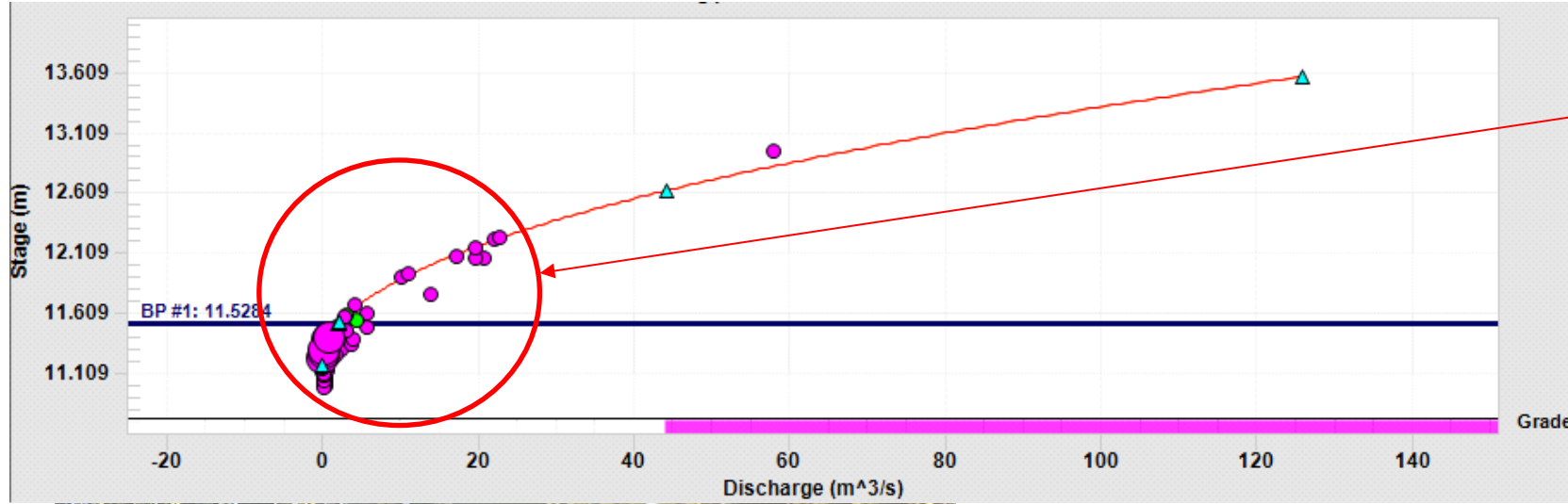


Active channel data around gauge from field survey



Developing 1-D and 2-D models

CALIBRATION – QA/QC

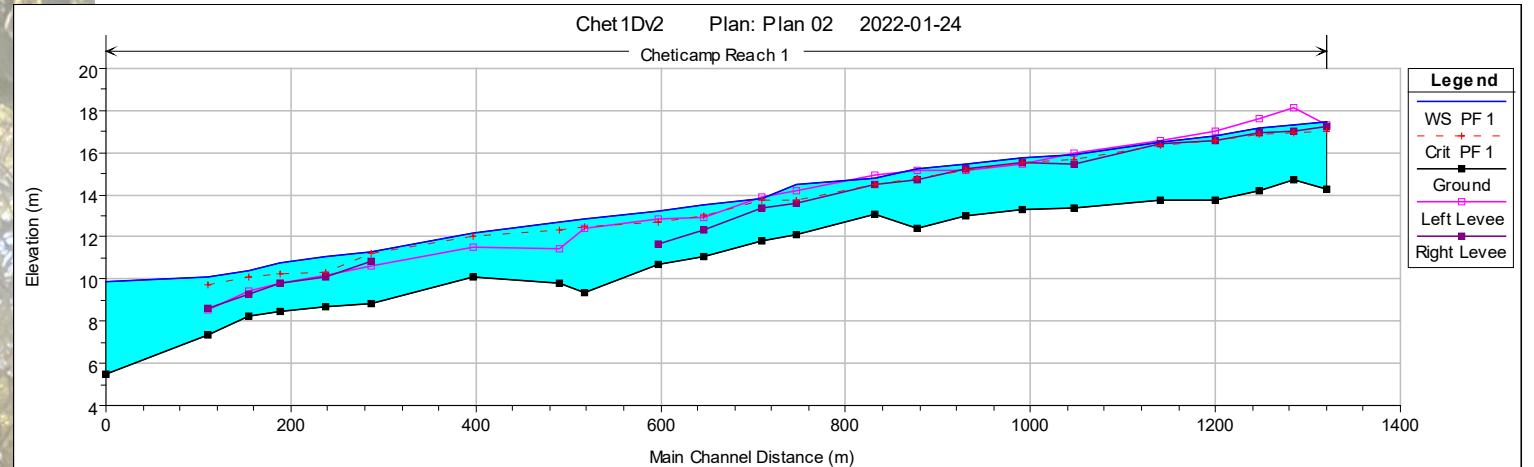


Existing measured flows where possible

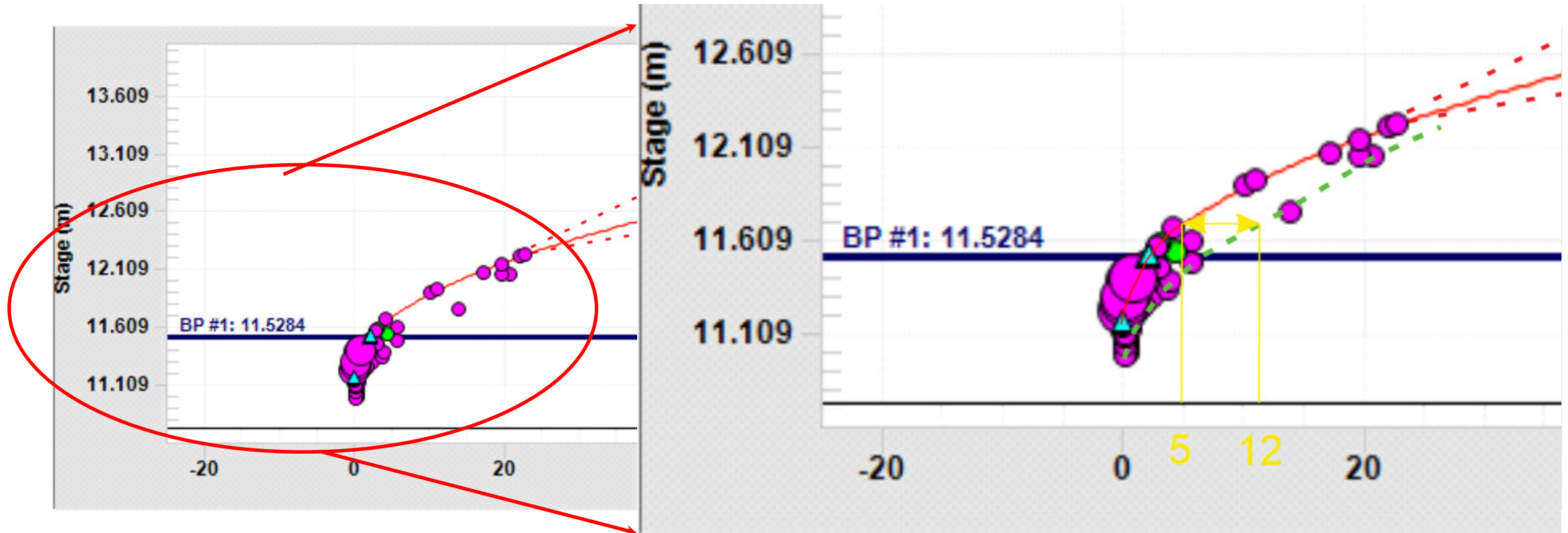
Hydraulic Gradients from continuous measured water levels



Temporary Water Level Gauge



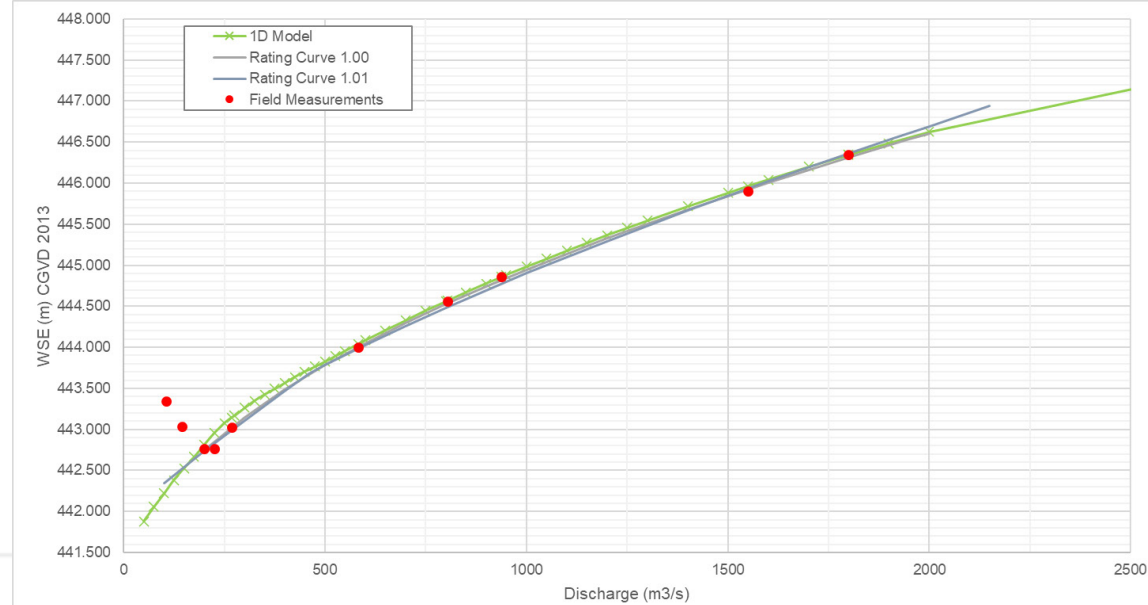
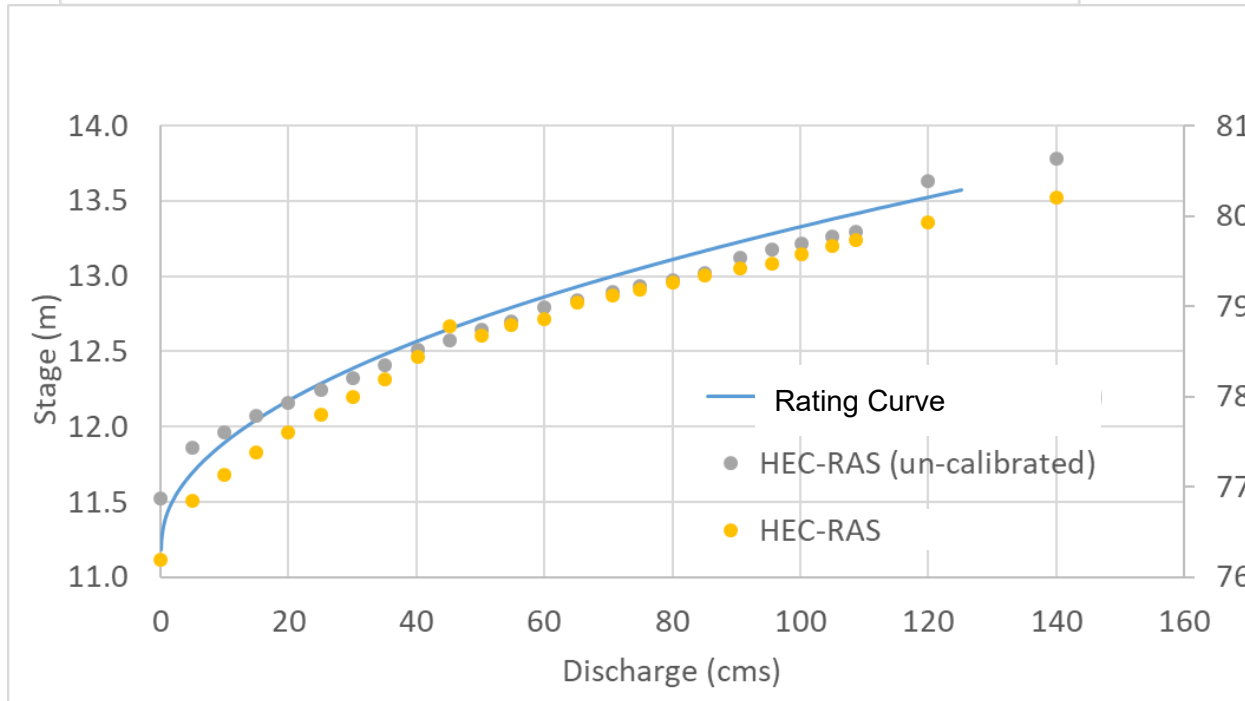
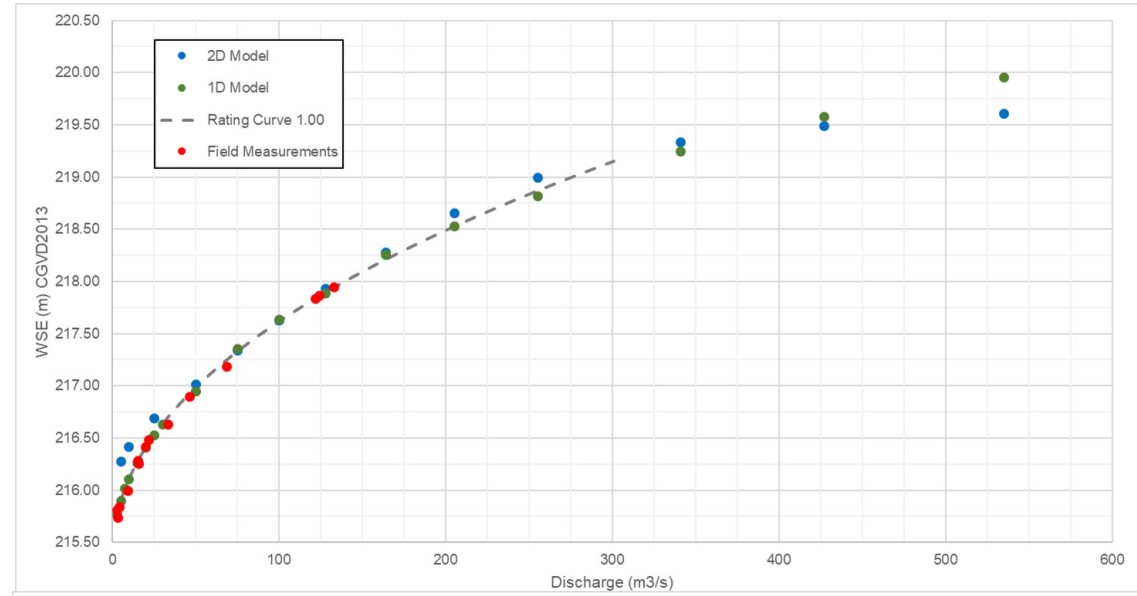
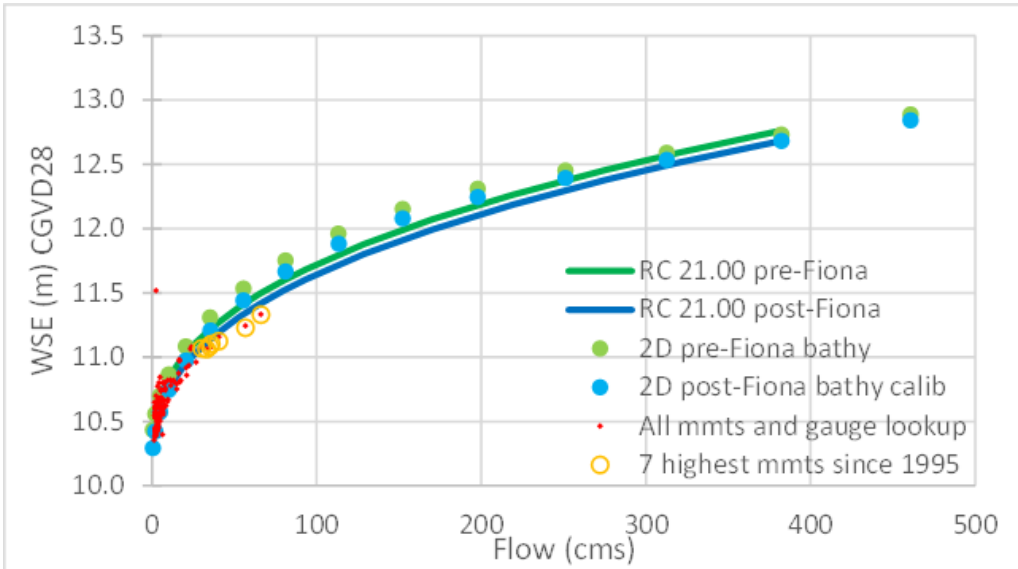
RATING CURVE EXPECTED OUTCOMES



Expected Outcomes:

- Potential to fill in parts of curve with no measurements
- Provide insight for interpretation and correction of unstable portions of rating curves

PRELIMINARY RESULTS



POTENTIAL BENEFITS

- Improved accuracy of flow estimation at high flows
 - Better differentiation of seasonal impacts, especially at low flow
 - More efficient capture of high flow events – not necessary to physically measure
 - Safety issues of measurement at high flow avoided
 - More flexibility to adapt to change – climate, land use, channel form
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ONGOING WORK

- Currently working on several sites across Canada
 - Ongoing data collection methods and modelling procedure testing
 - Target results by early 2024
 - Techniques will be considered by National Hydrological Services for future development
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QUESTIONS