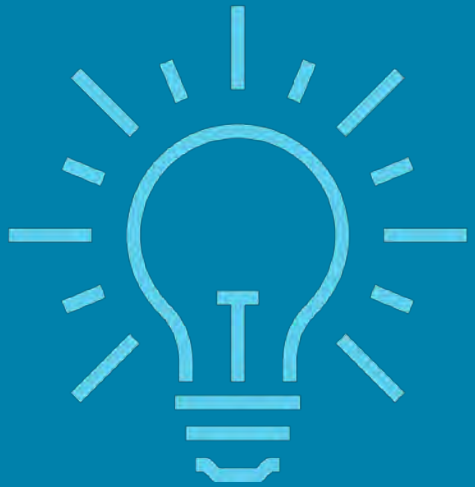
Peace River 2020 Spring Breakup



Mighty Peace Watershed Alliance AGM

Alberta Environment and Parks

August 13, 2020

Outline

1. Breakup processes and terminology
2. Spring 2020: a recipe for ice jam flooding
3. Peace River breakup: timeline and ice jam impacts

Ice front

- The most upstream edge of the intact ice cover
- As new ice comes to a stop against the leading edge of the ice cover during freeze-up, the ice front advances upstream
- During breakup, as thermal and mechanical processes melt and break up the ice cover, the ice front retreats downstream

Breakup process: Brash ice

- Ice accumulation of floating fragments not more than 2 meters across; the wreckage of other forms of ice (IAHR 1980).
- A product of thermal breakup drivers

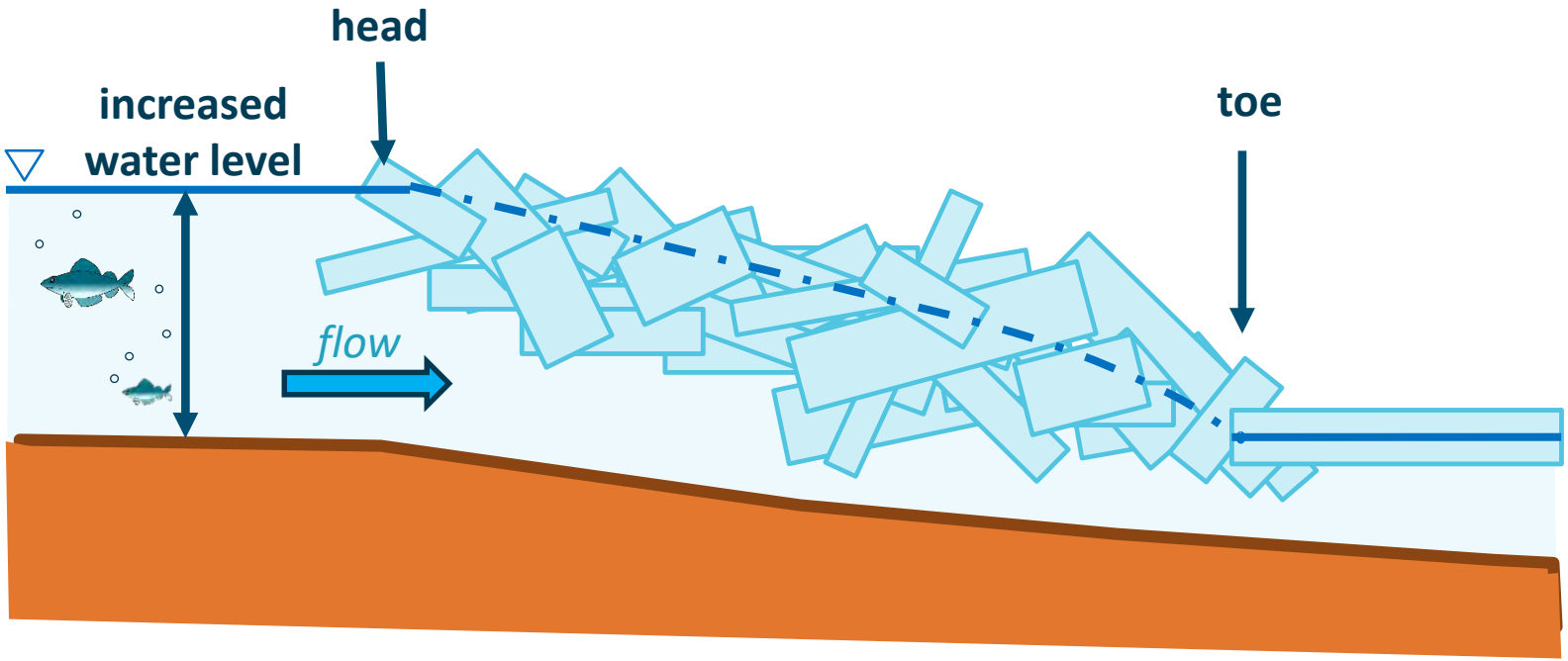
Breakup process: Ice run

- Flow of ice in a river. An ice run may be light or heavy and may consist of frazil, anchor or sheet ice (IAHR 1980).
- A product of dynamic breakup drivers

Breakup process: Ice jam

- An accumulation of ice at a given location which, in a river, restricts the flow of water (IAHR 1980).
- Ice jams may cause a rapid rise local water levels.
- Although unpredictable, ice jams tend to form more frequently in certain locations (slope reductions, channel constrictions, tight bends).

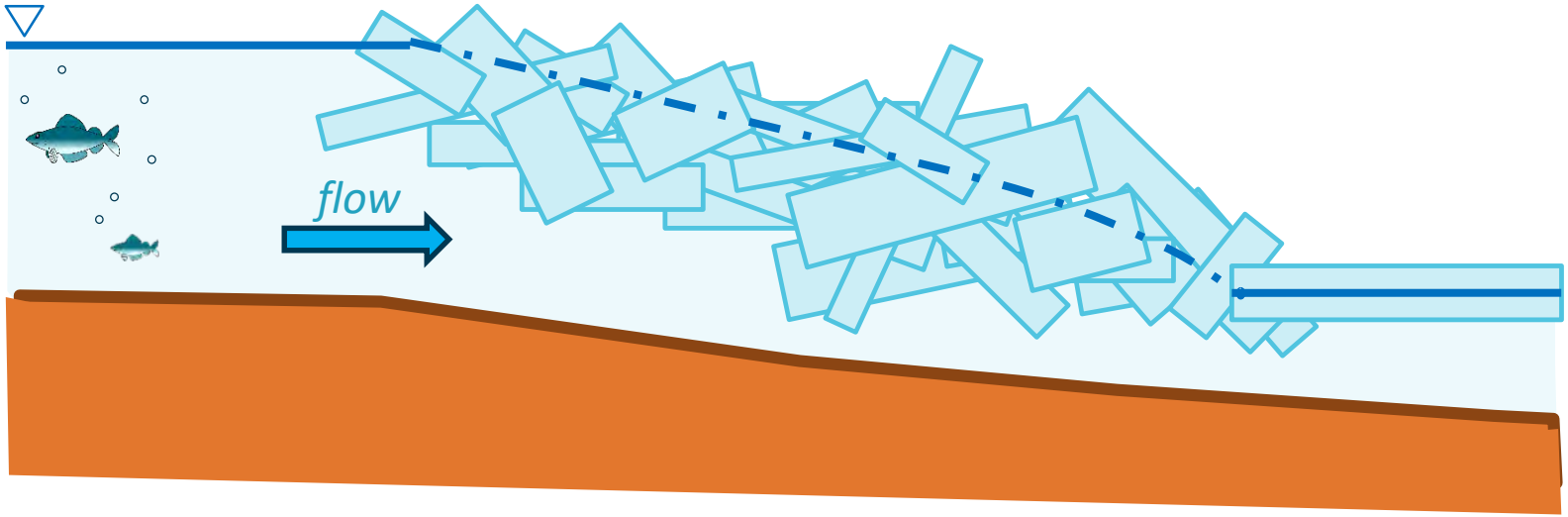
Ice jam cross section



Ice jam cross section

driving forces = resisting forces

(flow, gravity) *(ice strength, friction, intact ice)*



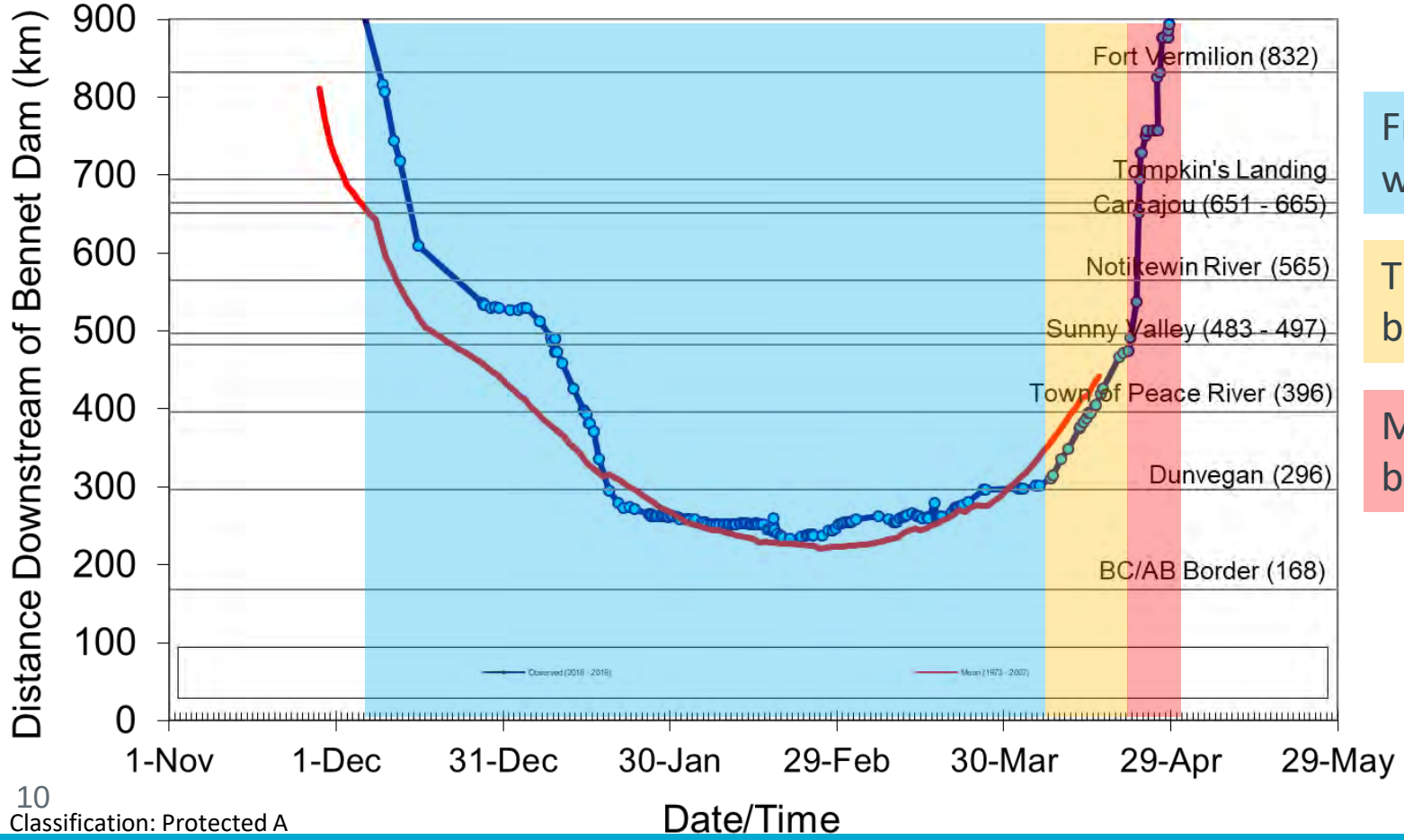
Thermal Breakup

- Thermal processes (air temperature, radiation, water temperature) dominate
- Ice cover melts slowly in place, river conditions are relatively stable

Mechanical Breakup

- Mechanical processes (flow rates, water levels) progress more rapidly than thermal processes
- Characterized by ice runs and jams, moving ice maintains much of its strength
- Water levels may change suddenly and unpredictably

Observed Peace River Ice Front Locations 2019-2020



Freeze-up and winter period

Thermal breakup

Mechanical breakup

Recipe for flooding: Spring 2020

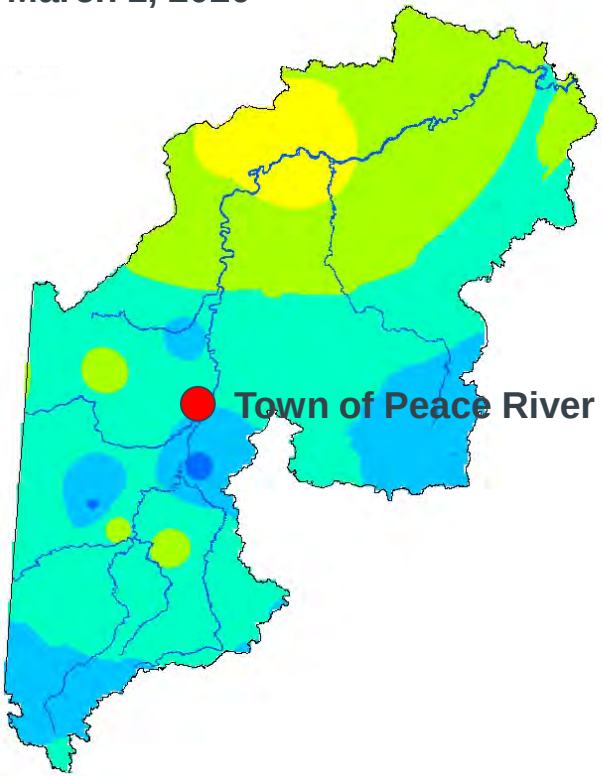
1. Above average early spring snowpack in the Peace River basin
2. A cold, wet spring adds to the snowpack, and prevents gradual melting
3. Ice covers on the Peace and Smoky Rivers remains strong, intact and un-degraded
4. Rapid warming in late spring causes a rapid melt of the above average snowpack – particularly in the Smoky Basin
5. Large ice jams and ice runs in the Smoky Basin kick off a dynamic breakup of the Peace River. A cascade of ice jams travels down the Peace River, flooding communities along the northern reaches of the river

Snow surveys – March 2020 vs April 2020

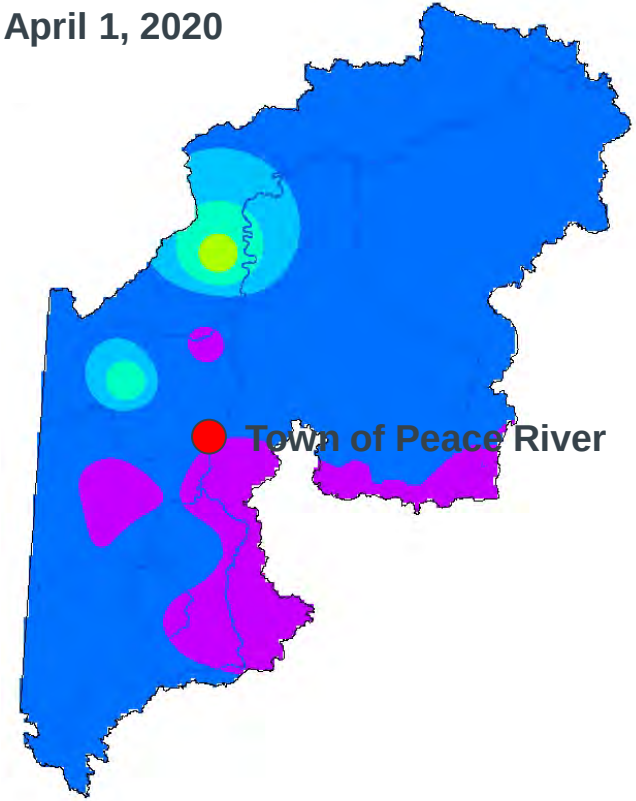
Percent of average Snow Water Equivalent

- < 50%
- 50% - 70%
- 70% - 90%
- 90% - 110%
- 110% - 130 %
- 130 % - 150%
- 150% - 200%
- 200% - 300%
- 300% - 400%
- > 400%

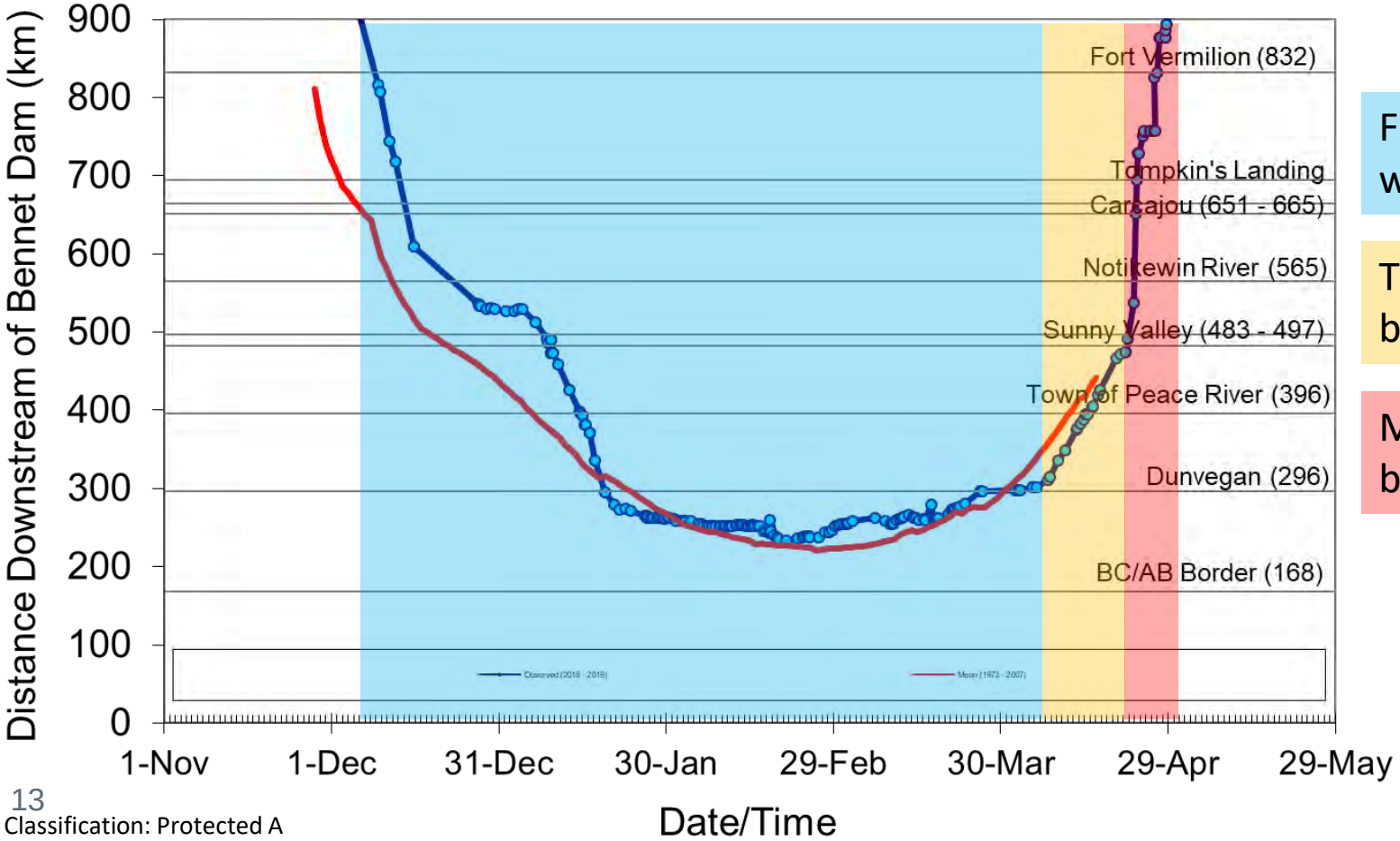
March 1, 2020



April 1, 2020



Observed Peace River Ice Front Locations 2019-2020



Freeze-up and winter period

Thermal breakup

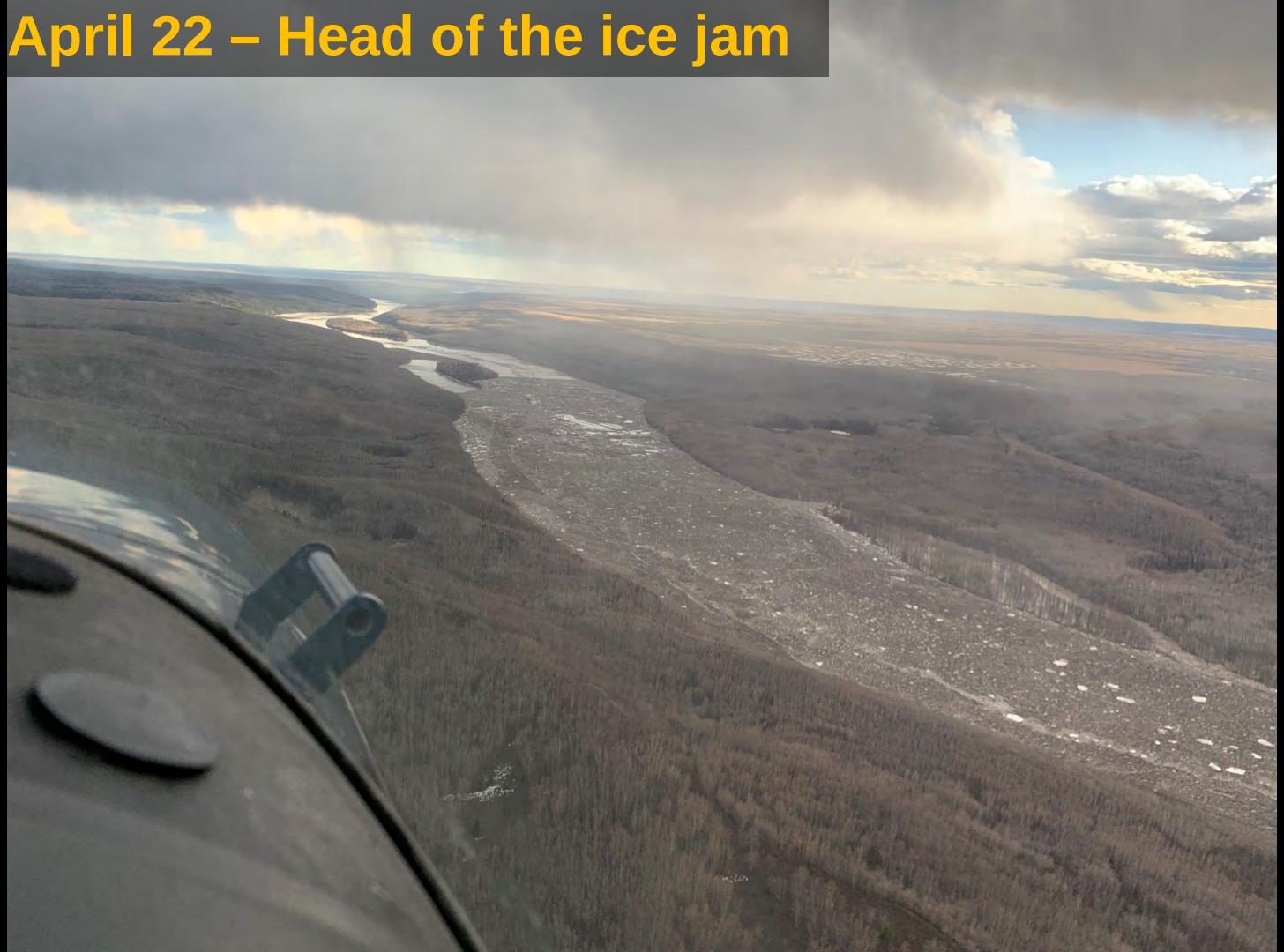
Mechanical breakup


Peace River
April 20, 2020
High Level
John D'Or Prairie
Fort Vermilion
Fort Vermilion gauge
Vermilion Chutes
La Crete Intake
Paddle Prairie
Tompkins Landing
Buffalo Head Prairie
Keg River
Carcajou gauge
Intact ice cover
Manning
Kulyna flats
Sunny Valley gauge
North Star
Peerless Lake
Red Earth Creek
Cadotte Lake
ALBERTA
Little Buffalo
Peace River
Peace River gauge
Fairview
Grimshaw
Nampa
Ice jams
Atikameg
Falher
Watino gauge
McLennan
High Prairie
Landsat / Copernicus


Peace River
April 22, 2020
High Level
John D'Or Prairie
Fort Vermilion
Fort Vermilion gauge
Vermilion Chutes
La Crete Intake
Paddle Prairie
Tompkins Landing
Buffalo Head Prairie
Keg River
Carcajou gauge
Intact ice cover
Ice jam
Manning
Kulyna flats
Sunny Valley gauge
North Star
Peerless Lake
Red Earth Creek
Cadotte Lake
ALBERTA
Little Buffalo
Peace River
Peace River gauge
Fairview
Grimshaw
Nampa
Atikameg
Falher
Watino gauge
McLennan
High Prairie
Landsat / Copernicus

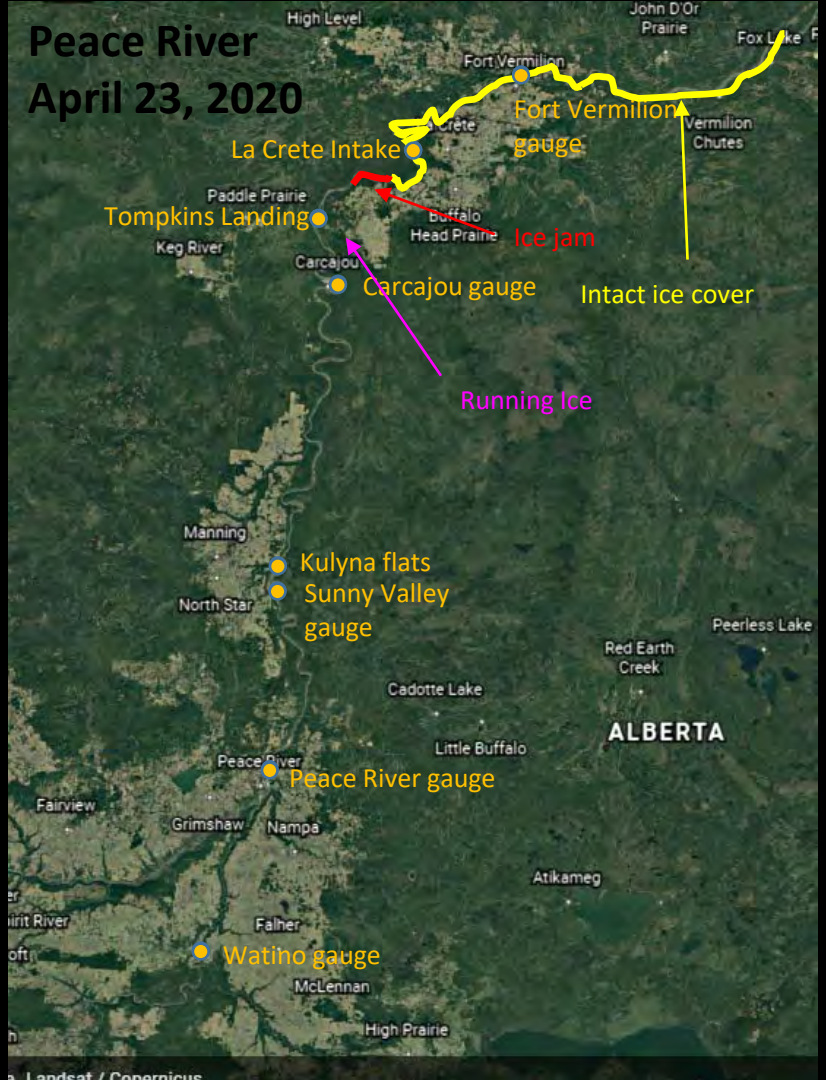
April 22 – Tompkins Landing

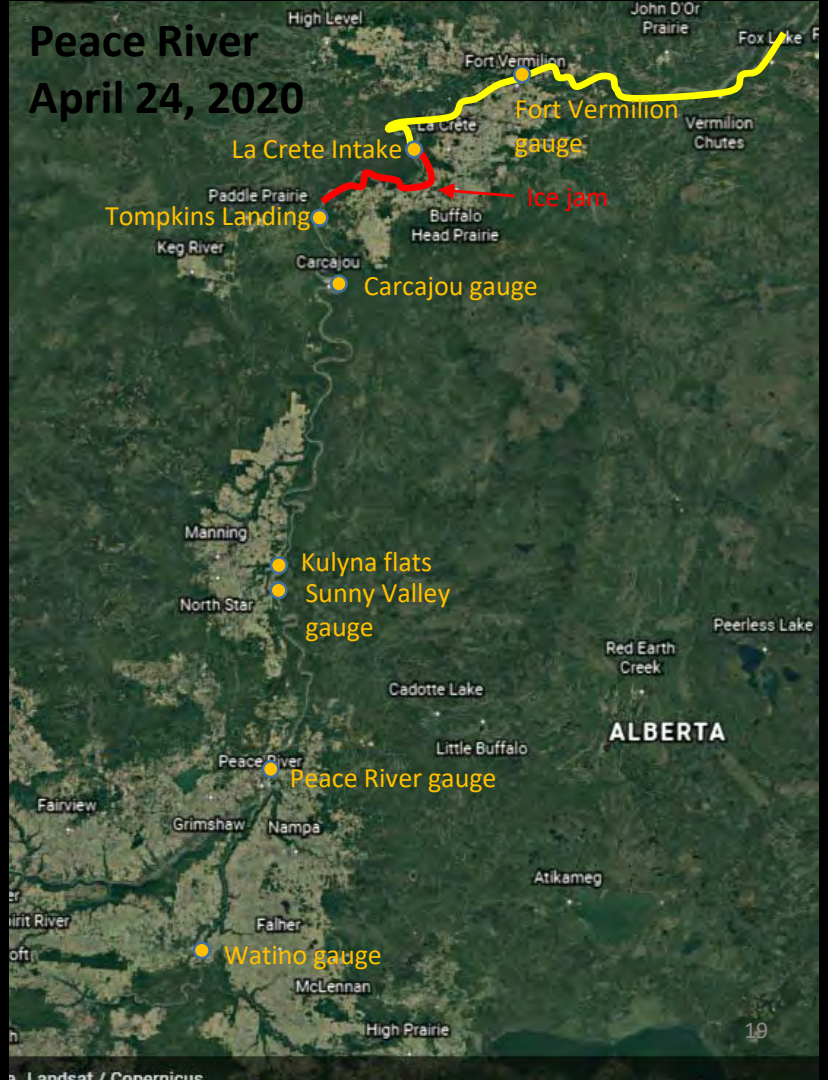
April 22 – Head of the ice jam



April 22 – Kulyna Flats

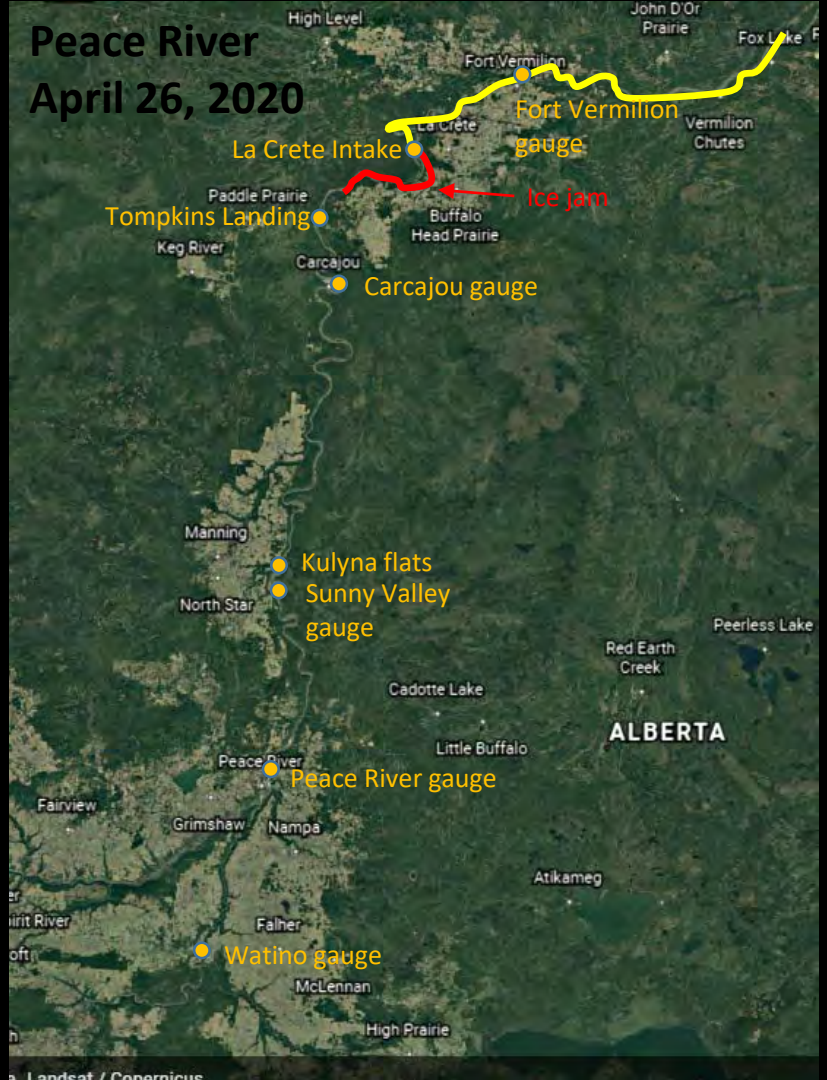
April 22 – Kulyna Flats

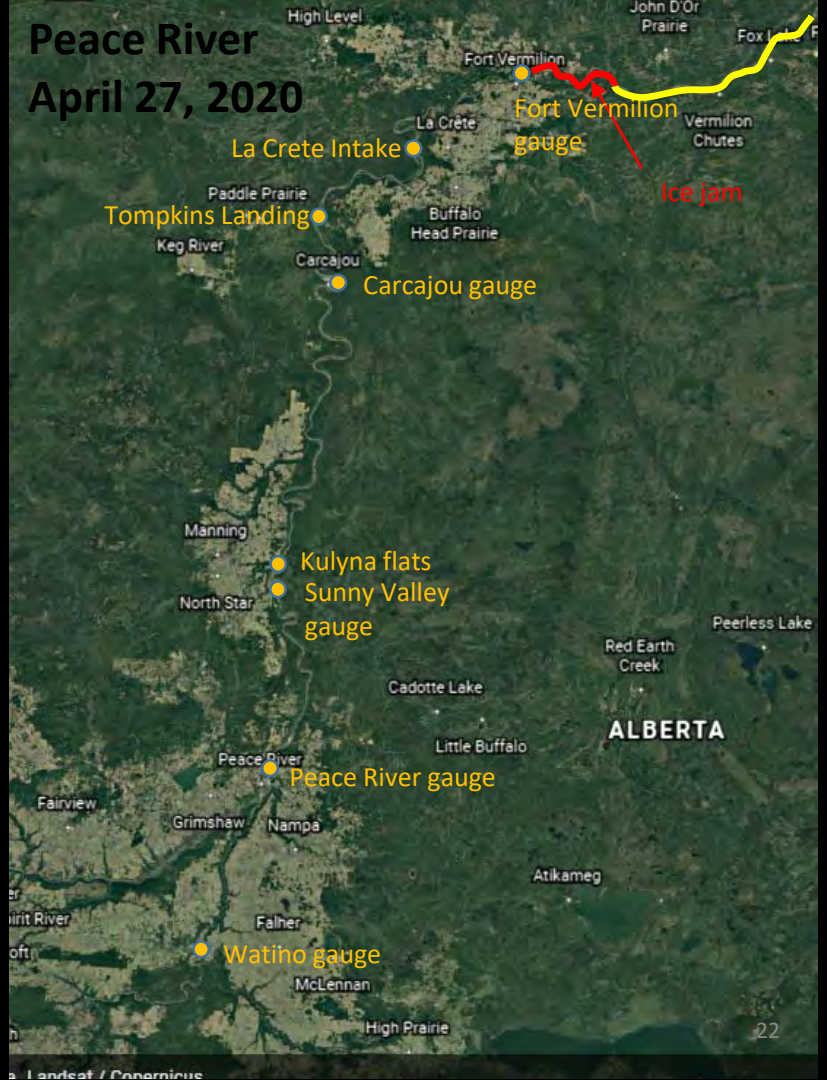

Peace River
April 23, 2020
High Level
John D'Or Prairie
Fort Vermilion
Fort Vermilion gauge
Vermilion Chutes
La Crete Intake
Paddle Prairie
Tompkins Landing
Buffalo Head Prairie
Ice jam
Keg River
Carcajou
Carcajou gauge
Intact ice cover
Running Ice
Manning
Kulyna flats
Sunny Valley gauge
North Star
Peerless Lake
Red Earth Creek
Cadotte Lake
ALBERTA
Little Buffalo
Peace River
Peace River gauge
Fairview
Grimshaw
Nampa
Atikameg
Falher
Watino gauge
McLennan
High Prairie


Peace River
April 24, 2020
High Level
John D'Or Prairie
Fort Vermilion
Fort Vermilion gauge
Vermilion Chutes
La Crete Intake
Paddle Prairie
Tompkins Landing
Ice jam
Buffalo Head Prairie
Keg River
Carcajou
Carcajou gauge
Manning
Kulyna flats
Sunny Valley gauge
North Star
Peerless Lake
Red Earth Creek
Cadotte Lake
ALBERTA
Little Buffalo
Peace River
Peace River gauge
Fairview
Grimshaw
Nampa
Atikameg
Falher
Watino gauge
McLennan
High Prairie

April 23 – Tompkins Landing

April 23 – Carcajou


Peace River
April 26, 2020
High Level
John D'Or Prairie
Fox Lake
Fort Vermilion
Fort Vermilion gauge
La Crete
Vermilion Chutes
La Crete Intake
Ice jam
Paddle Prairie
Tompkins Landing
Buffalo Head Prairie
Keg River
Carcajou
Carcajou gauge
Manning
Kulyna flats
Sunny Valley gauge
North Star
Peerless Lake
Red Earth Creek
Cadotte Lake
ALBERTA
Little Buffalo
Peace River
Peace River gauge
Fairview
Grimshaw
Nampa
Atikameg
Falher
Watino gauge
McLennan
High Prairie
Landsat / Copernicus


Peace River
April 27, 2020
High Level
John D'Or Prairie
Fort Vermilion
Fort Vermilion gauge
La Crete
Vermilion Chutes
La Crete Intake
Ice jam
Paddle Prairie
Tompkins Landing
Buffalo Head Prairie
Keg River
Carcajou
Carcajou gauge
Manning
Kulyna flats
Sunny Valley gauge
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Peace River gauge
Fairview
Grimshaw
Nampa
Atikameg
Falher
Watino gauge
McLennan
High Prairie
Landsat / Copernicus

April 27 – Fort Vermilion

April 27 – Fort Vermilion: River Road

April 28 – North Vermilion / Buttertown

April 28 – Fort Vermilion: Airport

April 28 – Fort Vermilion: East end

April 28 – Fort Vermilion: River Road

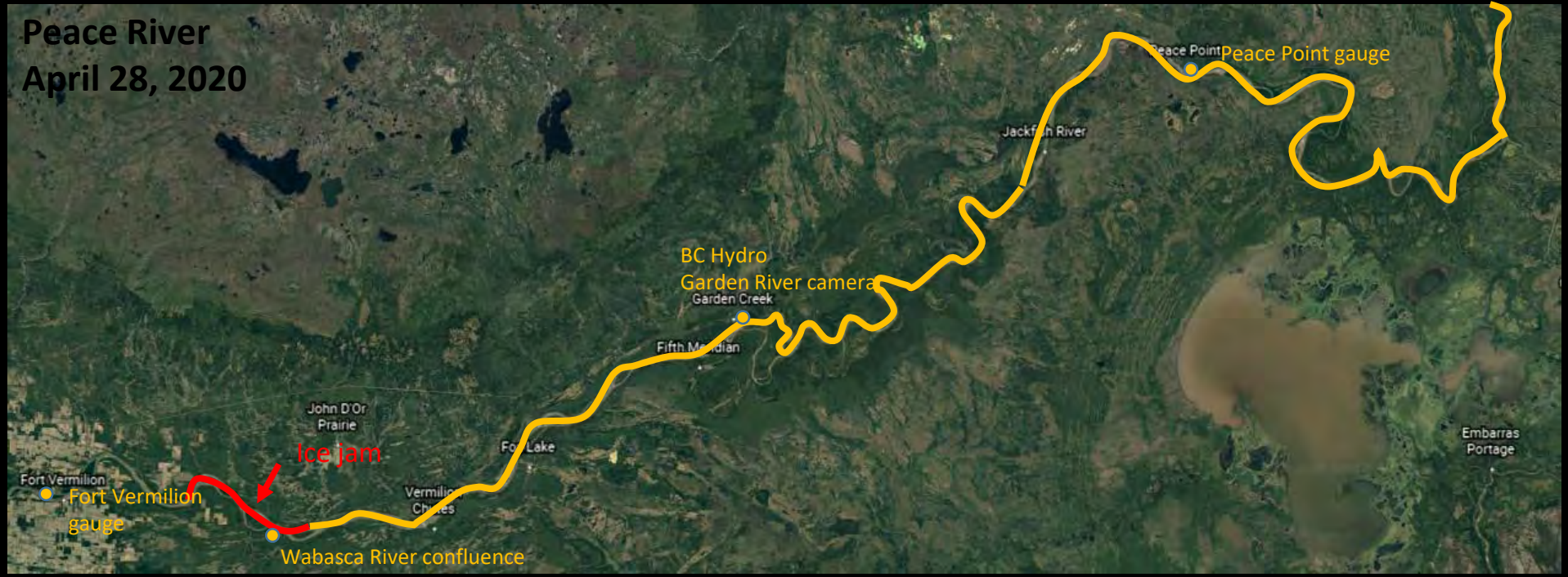
April 28 – Beaver Ranch

April 28 – Beaver Ranch

April 29 – River Road

April 29 – River Road

April 30 – River Road


Peace River
April 28, 2020
Peace Point
Peace Point gauge
Jackfish River
BC Hydro
Garden River camera
Garden Creek
Fifth Meridian
John D'Or
Prairie
Ice jam
Lake
Embarras
Portage
Fort Vermilion
Fort Vermilion
gauge
Wabasca River confluence

May 3 – Peace Point

Photo: Tom Carter - Water Survey of Canada

May 3 – Peace Point

Photo: Tom Carter - Water Survey of Canada

A few takeaways

- The type of breakup (mechanically or thermally driven) and resulting ice processes are the product of a number of weather driven factors
  - Snowpack
  - Ice strength and ice front position
  - Air temperature
  - Soil moisture
- For the Peace River, conditions throughout the year (not just spring) contribute to the severity of breakup
- 2020 breakup flooding was an extreme event caused by a ‘perfect storm’ combination of these weather driven factors

Thank you

Peace River ice reports and conditions are posted throughout the winter at rivers.alberta.ca and on the Alberta Rivers mobile application.