Step 5 Learning Activity

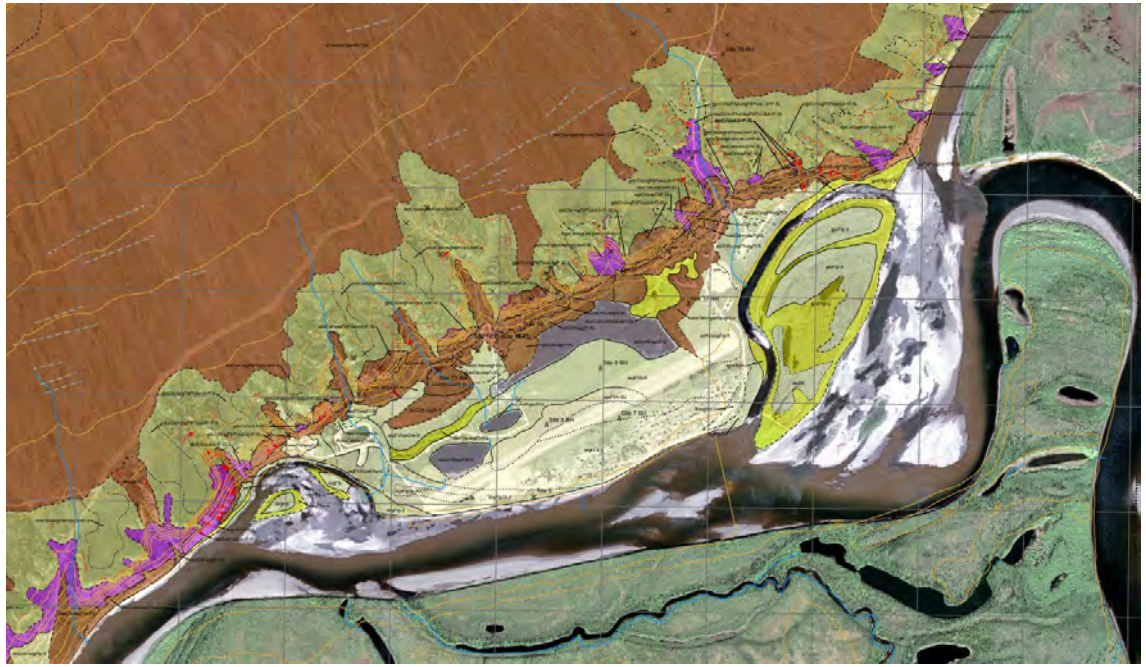
Linking Causes of Instability to Proposed Solutions

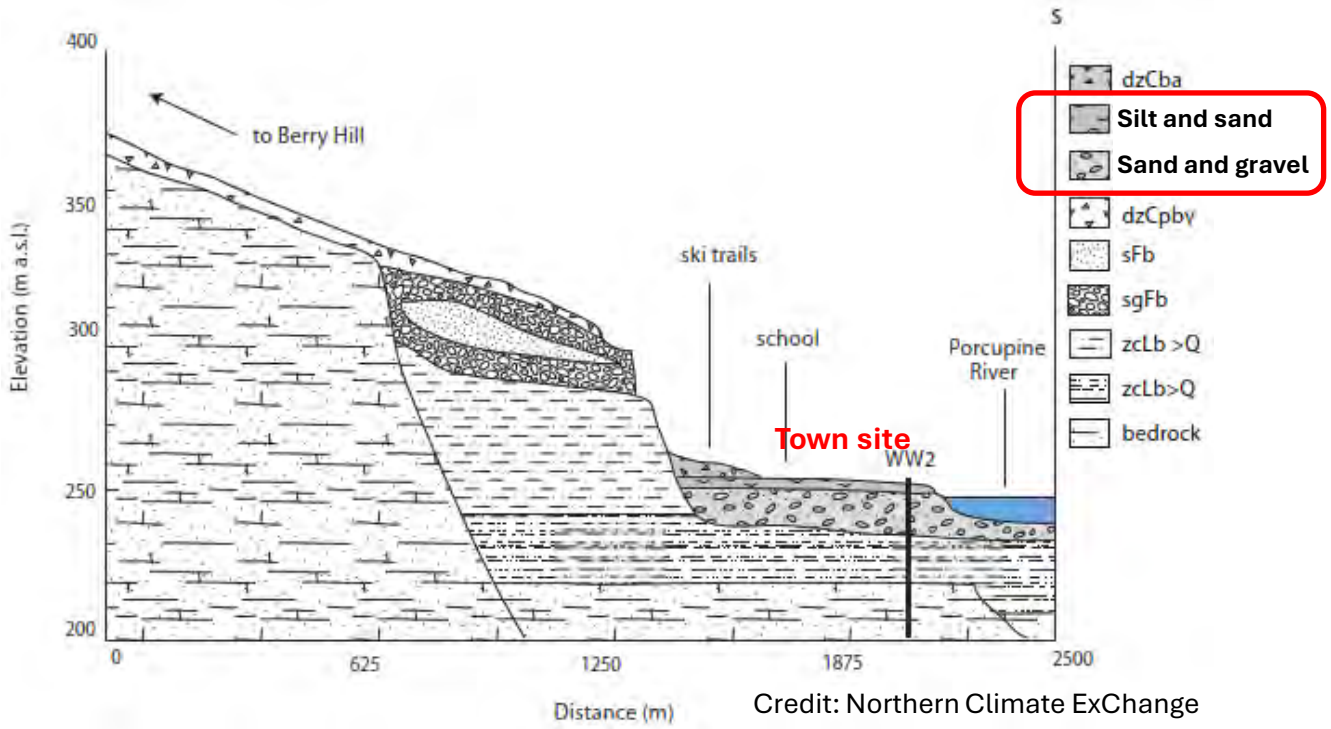
Credit: www.mountainsoftravelphotos.com

What are the soils like?

- Silt, sand and gravel along the riverbanks
- Clay along the valley walls

Credit: Kennedy (2016)

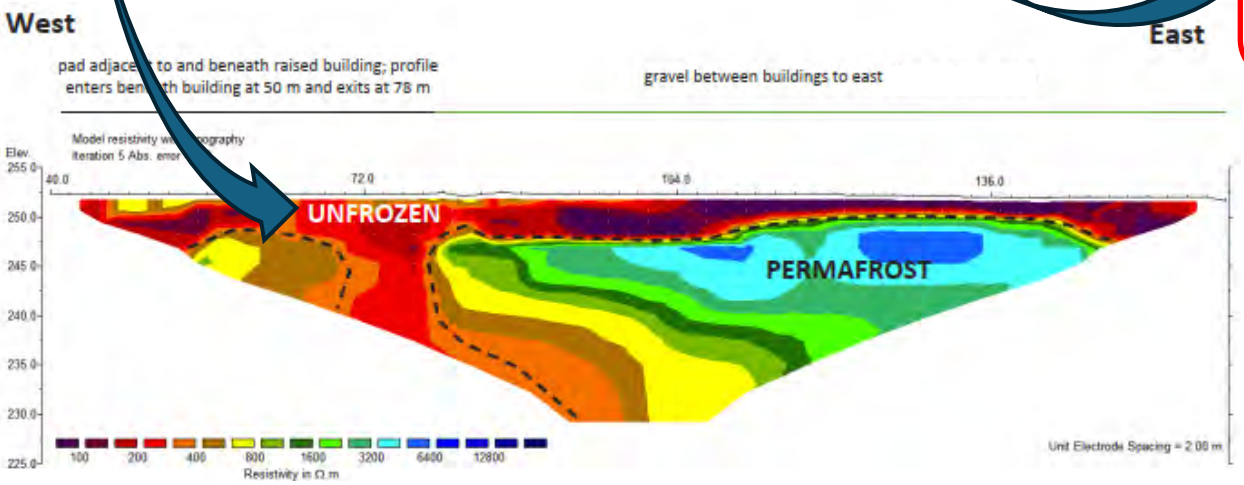




Credit: Northern Climate ExChange

What is the permafrost like?

- Discontinuous (some gaps)
- Cool to warm (-5 to -2.5°C)
- Ice-rich, especially in silty soil



BOREHOLE Site 11 BH

Location airport way and vicinity

Site name Site 11

Coordinates 7W 549898 m E 7495966 m N

Legend: Water table; Permafrost table; Thawed

Depth (cm)	Description	Grain size (%) Gravel	Sand	Mud	Loss of ignition (%)	Grav. water content (%)	Frozen bulk density	Vol. ice content (%)	Vol. excess ice (%)	Settlement potential (%) 25 KPa	75 KPa	125 KPa
0–20	decomposed organic matter with roots and rootlets											
40–60	sandy organic silt vith roots; microlenticular to lenticular cryostructures	1	53	46	13	117	1,24	73	38			
80–100	sandy organic silt with roots; lenticular to suspended cryostructure	2	73	25	30	264	1,05	83	52			
100–120	sandy organic silt with wood pieces; porous visible and crustal (around wood pieces) cryostructures											
140	silty sand with patches of organic matter; porous visible and microlenticular cryostructures	1	75	24	27	168	1,05	71	41			
160–180	sandy silt; lenticular to suspended cryostructure, ice-rich	1	43	56	9	146	1,35	87	51			
220–240	silty sand with some roots; microlenticular cryostructure	3	65	32	8	94	1,33	70	25			
260–300	silty sand with some roots; lenticular cryostructure	1	57	42	9	55	1,50	58	11			
340–360	silty sand with rootlets; porous invisible and microlenticular cryostructures with some ice lenses	0	52	48	6	57	1,56	62	10			
380–400		1	48	51	6	68	1,42	63	27			
460–480		1	62	37	5	49	1,57	56	10			

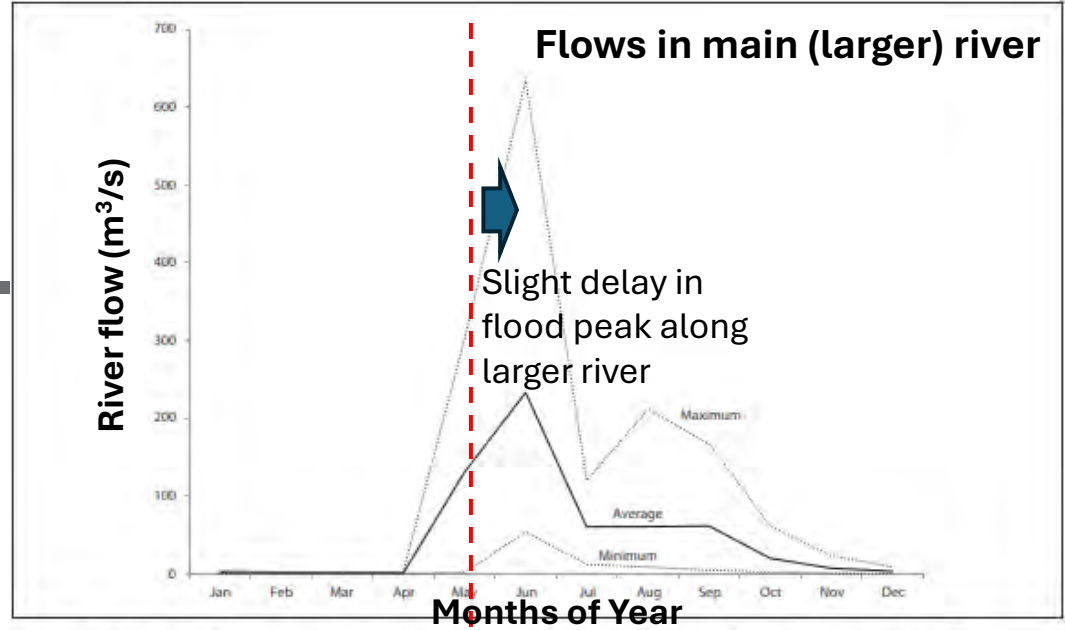
Credit: Northern Climate ExChange

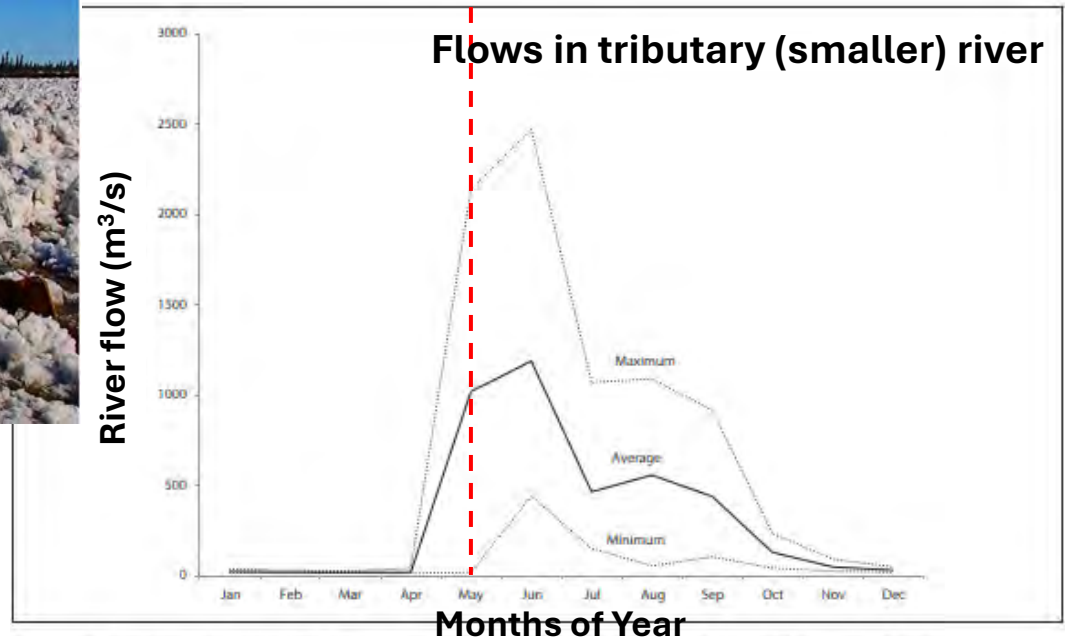
What are the flows like?

- Floods driven by spring snowmelt and ice jams
- Tributary flows peak first

Credit: nhc (2025)

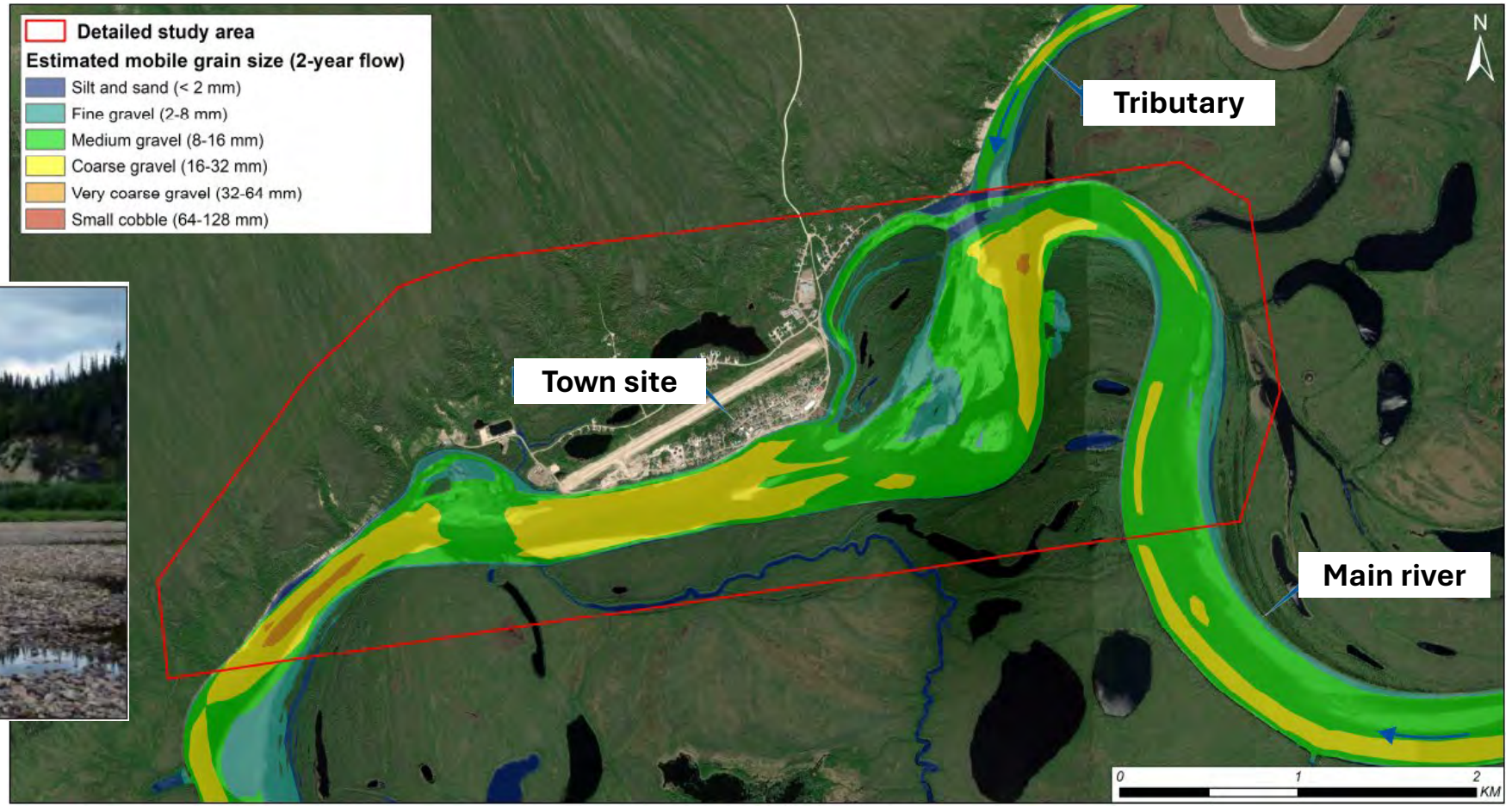
Credit: B. Turcotte





Credit: Northern Climate ExChange

Where does the river have enough energy to erode its bed and banks?

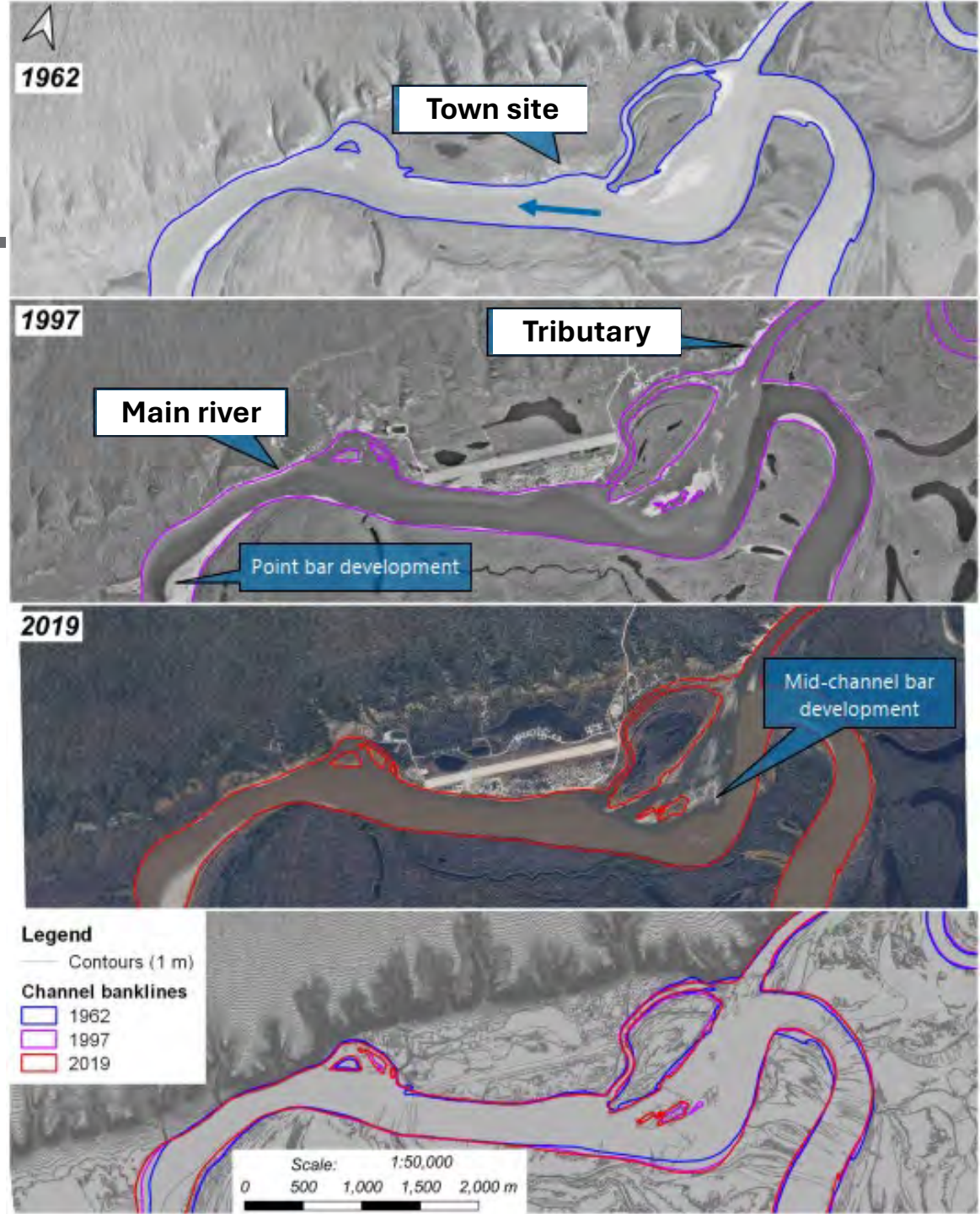


Credit: nhc (2025)

What are the riverbanks like?

Credit: nhc (2025)

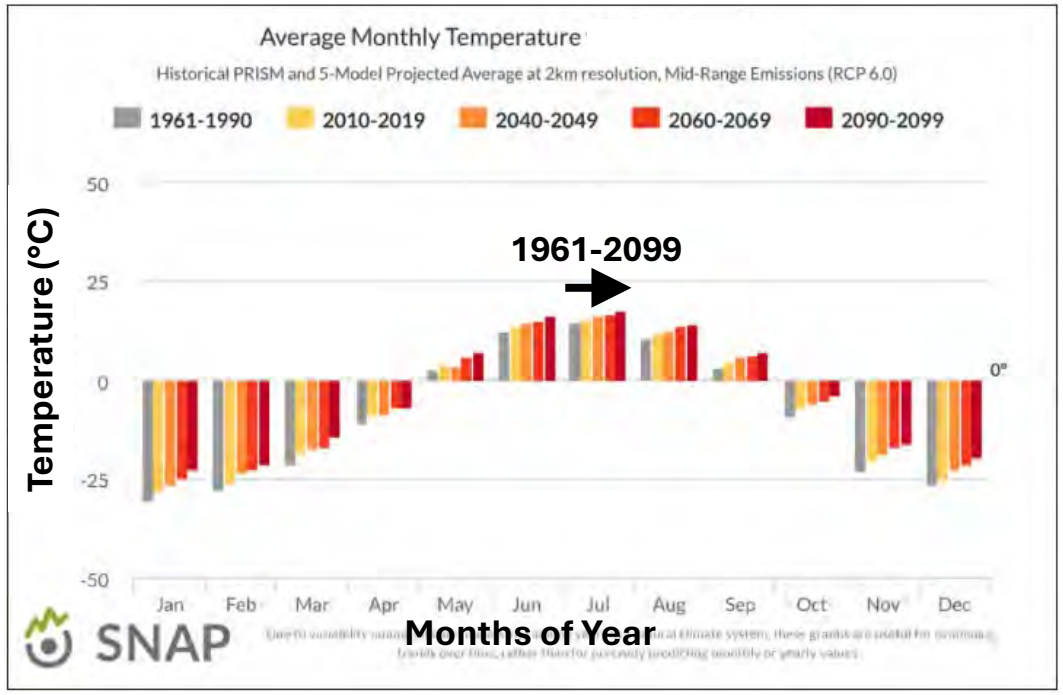
How much has the river moved, and where?



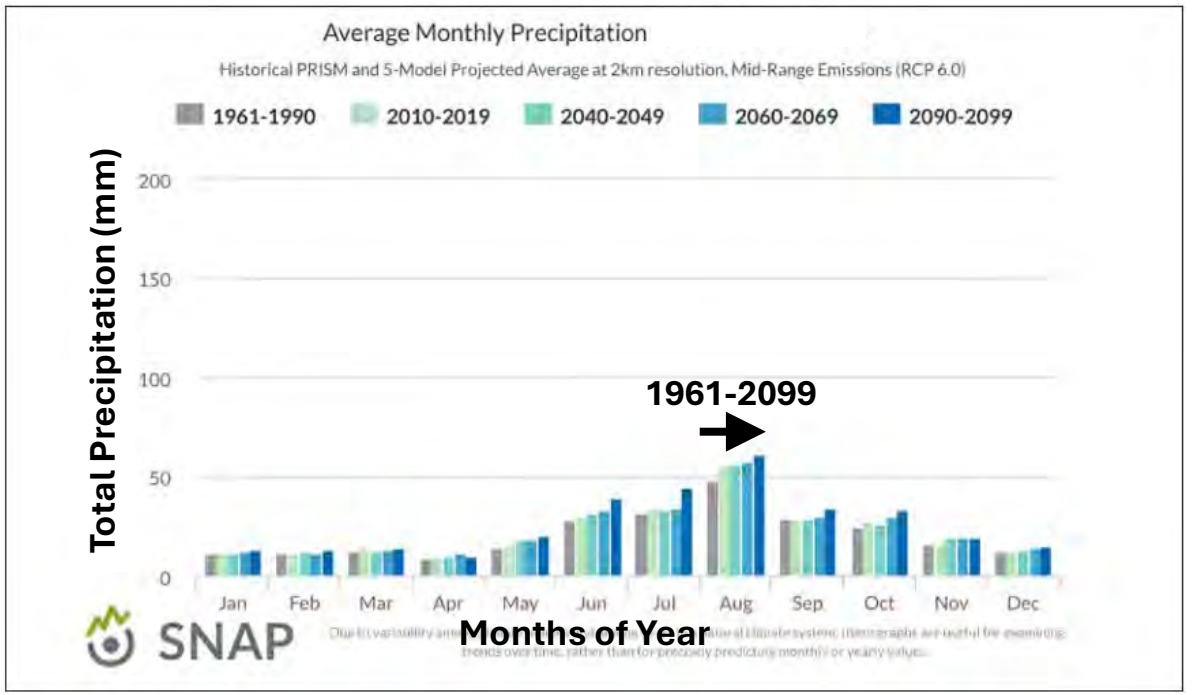
Credit: nhc (2025)

What does the future climate have in store?

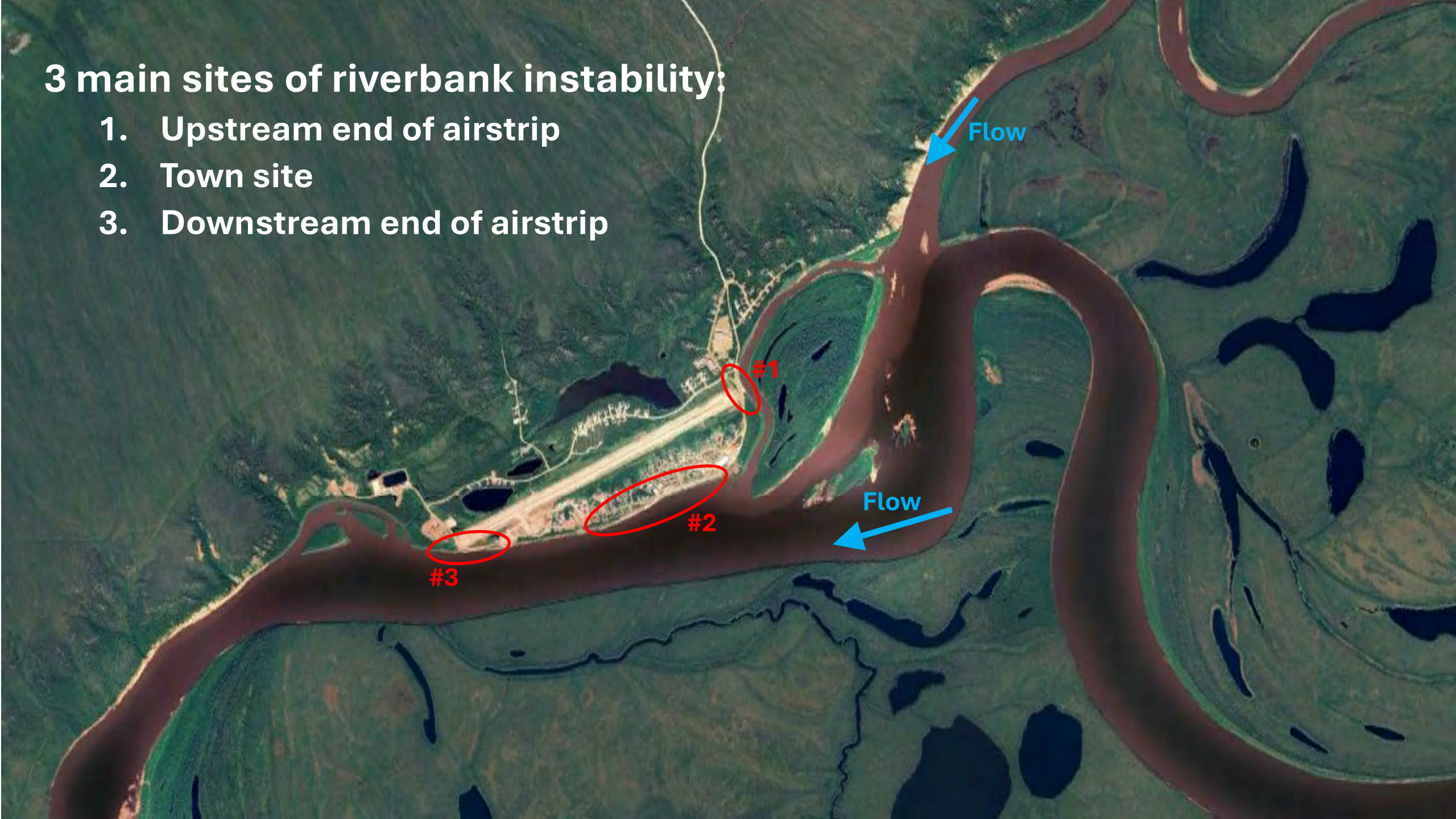
Warmer!



Wetter!



Credit: Northern Climate ExChange (2016)


3 main sites of riverbank instability:
1. Upstream end of airstrip
2. Town site
3. Downstream end of airstrip
Flow
#1
#2
Flow
#3

ACTIVITY: What should be done to reduce risks from riverbank instability?

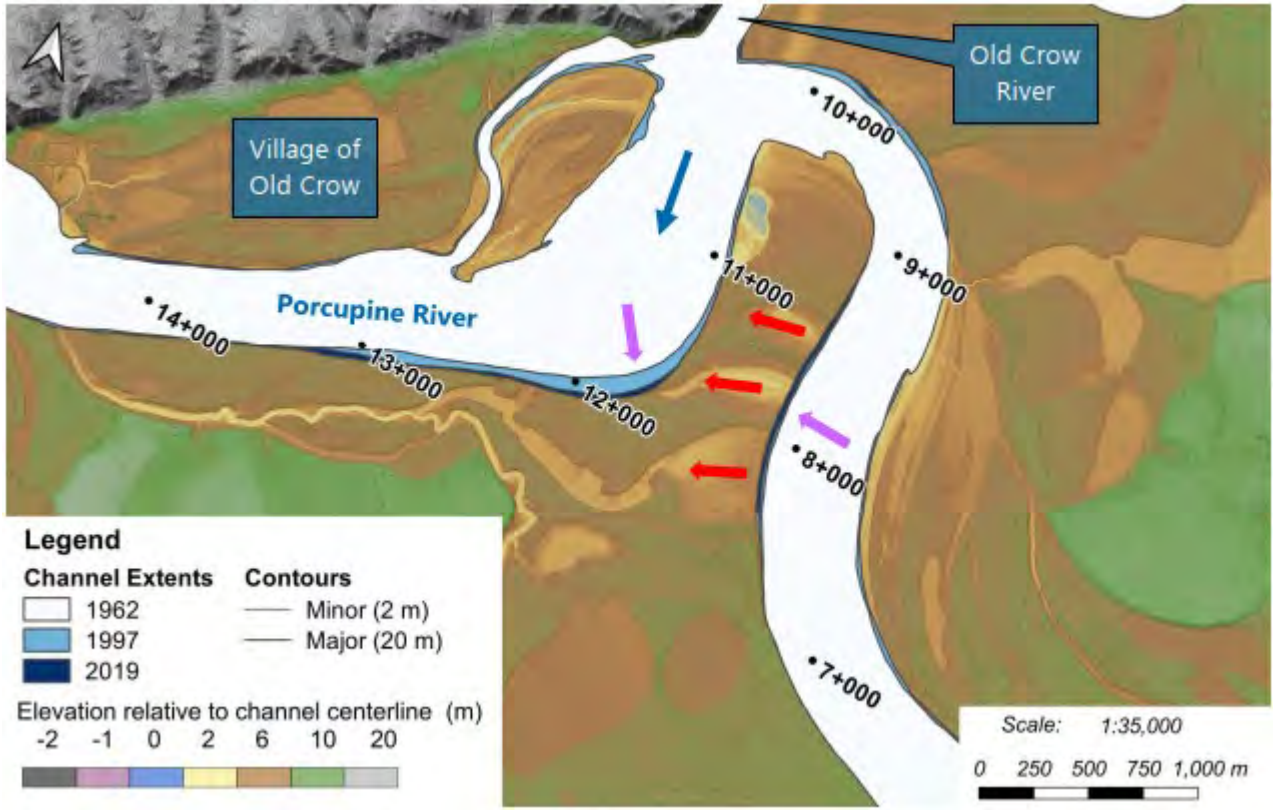
- 3 Questions:
  1. What do you think is **causing** riverbank instability at each site? Why?

  2. What **action(s)** do you think should be taken at each site? Why?
     - Consider the various *controls* (toe erosion, permafrost thaw, etc.) on riverbank instability
     - Consider *direct* (riprap, etc.) and *indirect* (channel realignment, etc.) measures
     - Consider *short-term* (<5 years) vs. *long-term* (50+ years) solutions
     - Remember actions need not be *physical* measures

  3. What **challenges** do you think the community may face, and how might they be overcome?

Inadequately sized/placed riprap along side channel

Avulsion Potential?!



Credit: nhc (2025)

Answers for Step 5 Learning Activity

Linking Causes of Instability to Proposed Solutions

NWT
RIVERBANK EROSION
WORKSHOP 2025
DEC 2-4 | CHATEAU NOVA HOTEL | YELLOWKNIFE

Old Crow, Yukon!
Old Crow River
Flow
Porcupine River
#1
#2
Flow
#3

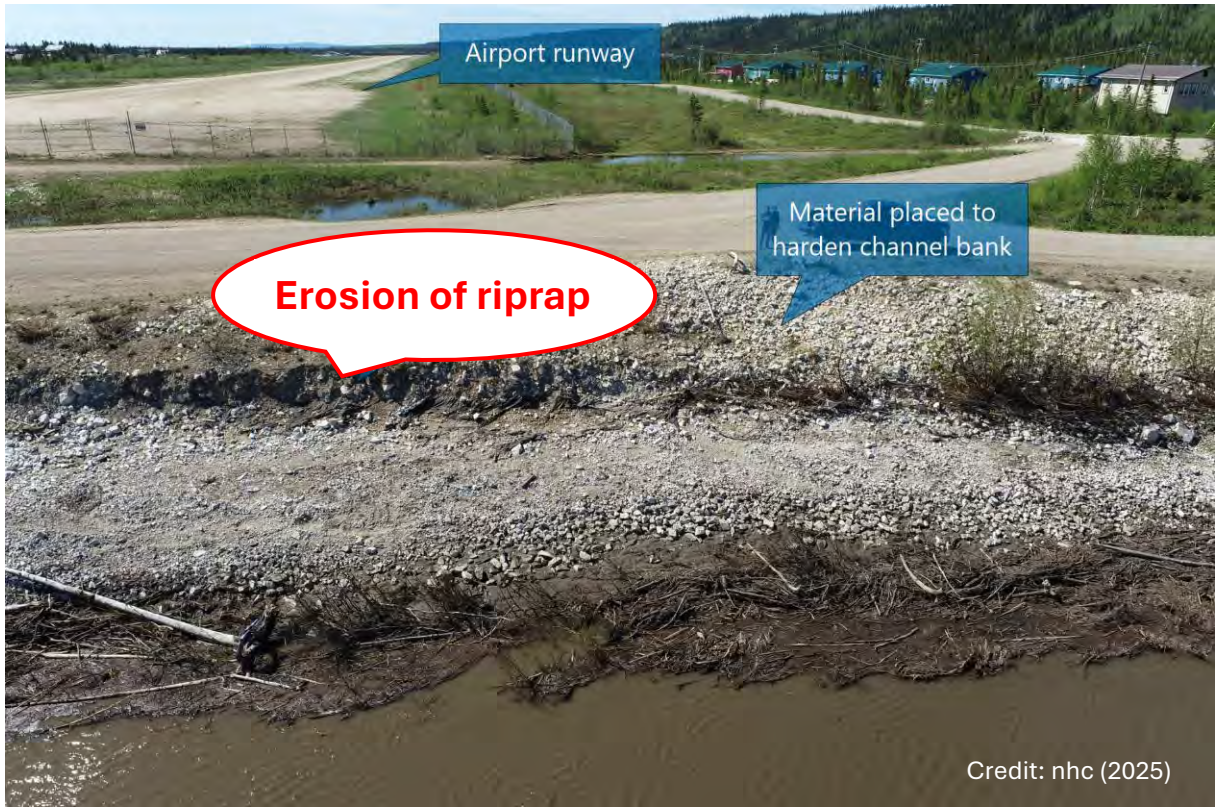
3 Questions:
1. What do you think is **causing** riverbank instability at each site? Why?
2. What **action(s)** do you think should be taken at each site? Why?
3. What **challenges** do you think the community may face, and how might they be overcome?
Old Crow River
Flow
Porcupine River
#1
#2
Flow
#3

Riprap was installed along the banks…

Credit: G. Njootli

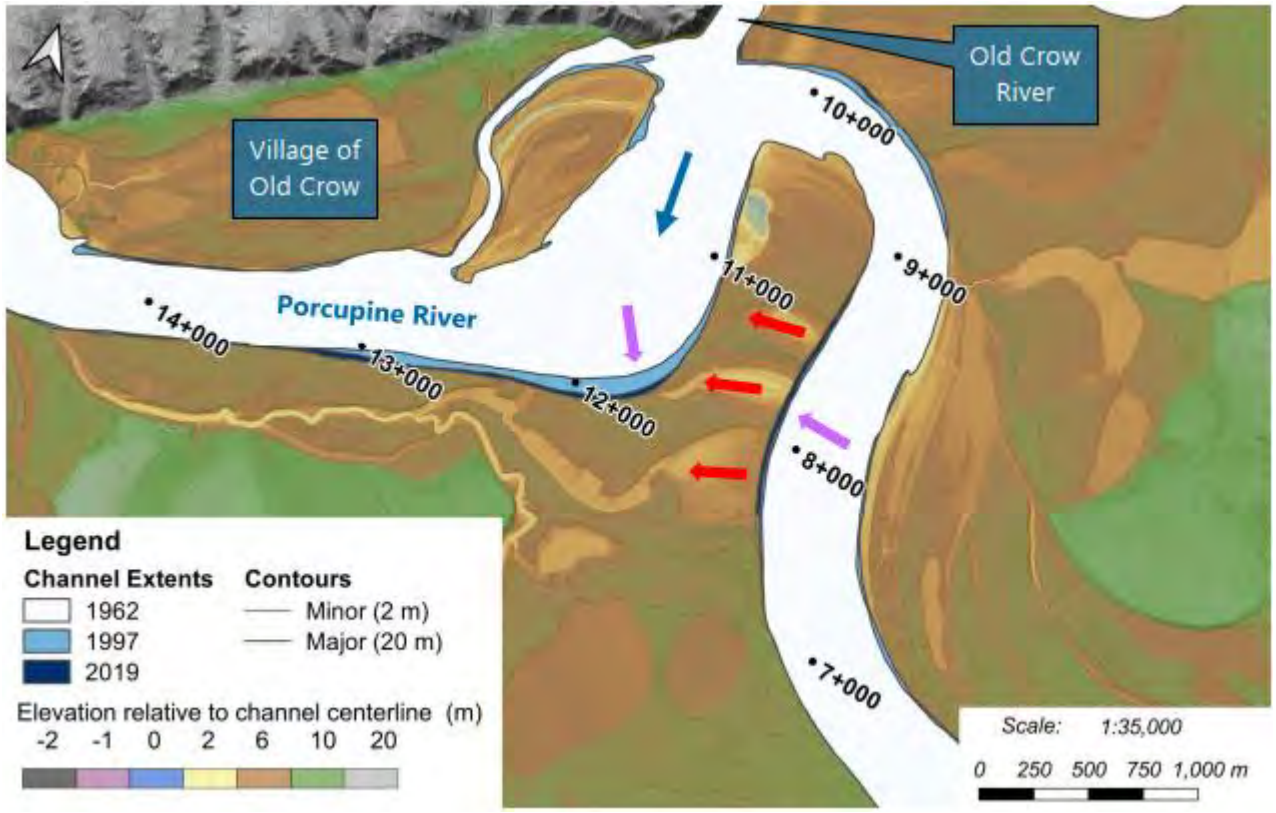
BUT!...

- It appears to be undersized (too small!)
  - Water
  - Ice
- Does it address all the causes of riverbank instability?



Sudden change of river course

Avulsion Potential?!



Credit: nhc (2025)