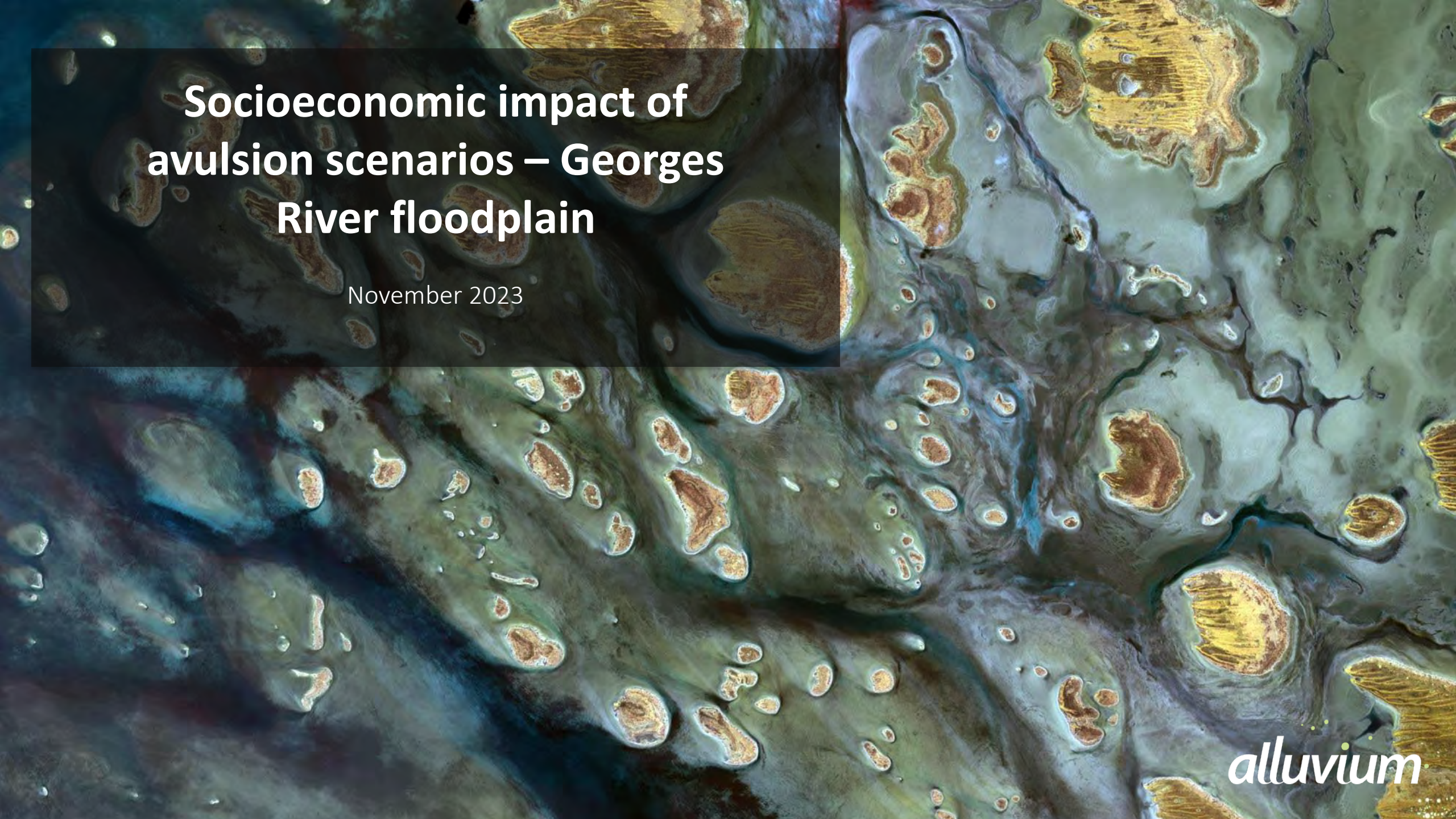

Socioeconomic impact of avulsion scenarios – Georges River floodplain

November 2023

alluvium

Acknowledgement of Country

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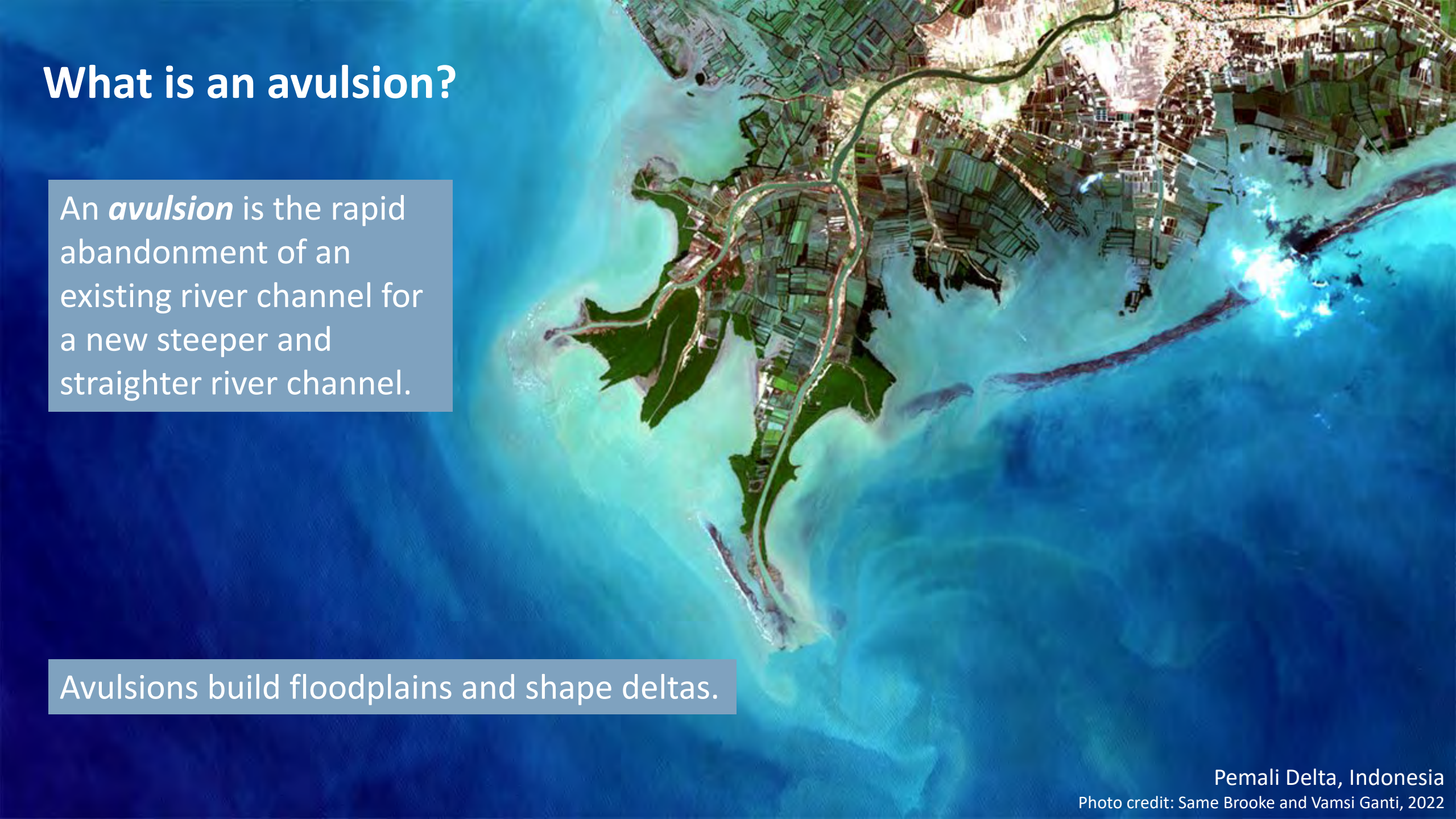
The Alluvium Group acknowledges all the Traditional Owners of the land, sea and waters where we live and work. We acknowledge their continuing connection to culture and Country and pay our respects to Elders past and present. We look forward to a reconciled and prosperous future for all.

What is an avulsion?

An ***avulsion*** is the rapid abandonment of an existing river channel for a new steeper and straighter river channel.

Avulsions build floodplains and shape deltas.



Pemali Delta, Indonesia

Photo credit: Same Brooke and Vamsi Ganti, 2022

What is an avulsion?

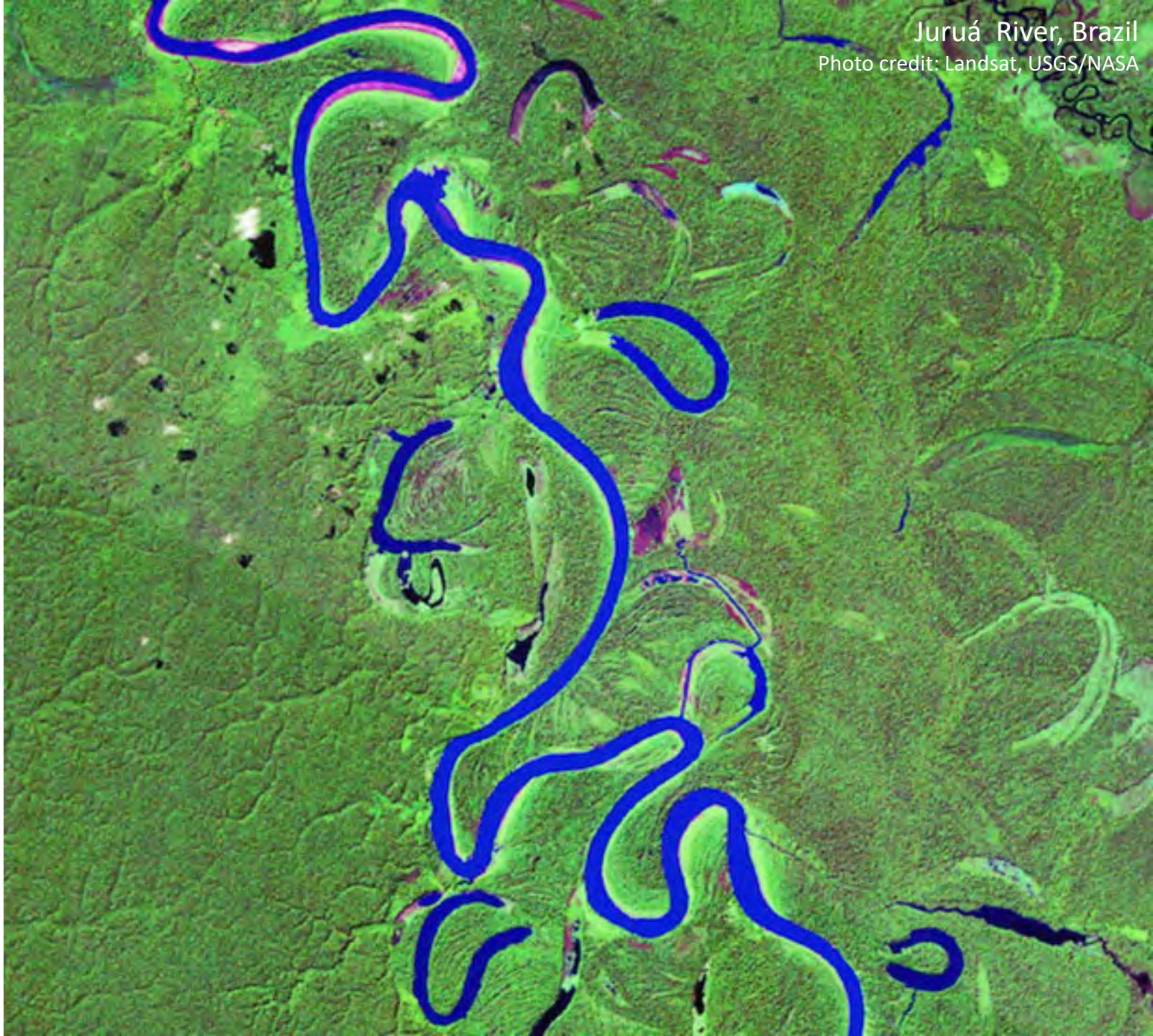
- Avulsions occur globally at all spatial scales and are common in river deltas
- Avulsions happen, and we understand the processes causing them
- Sea-level rise and excess sediment supply make avulsions more likely

What causes an avulsion?

1. Current (parent) river channel becomes hydraulically inefficient over time
   - Sediment deposition decreases the slope of the channel and raises the channel relative to the floodplain

2. Flooding (single or multiple events) carves a new channel through the floodplain

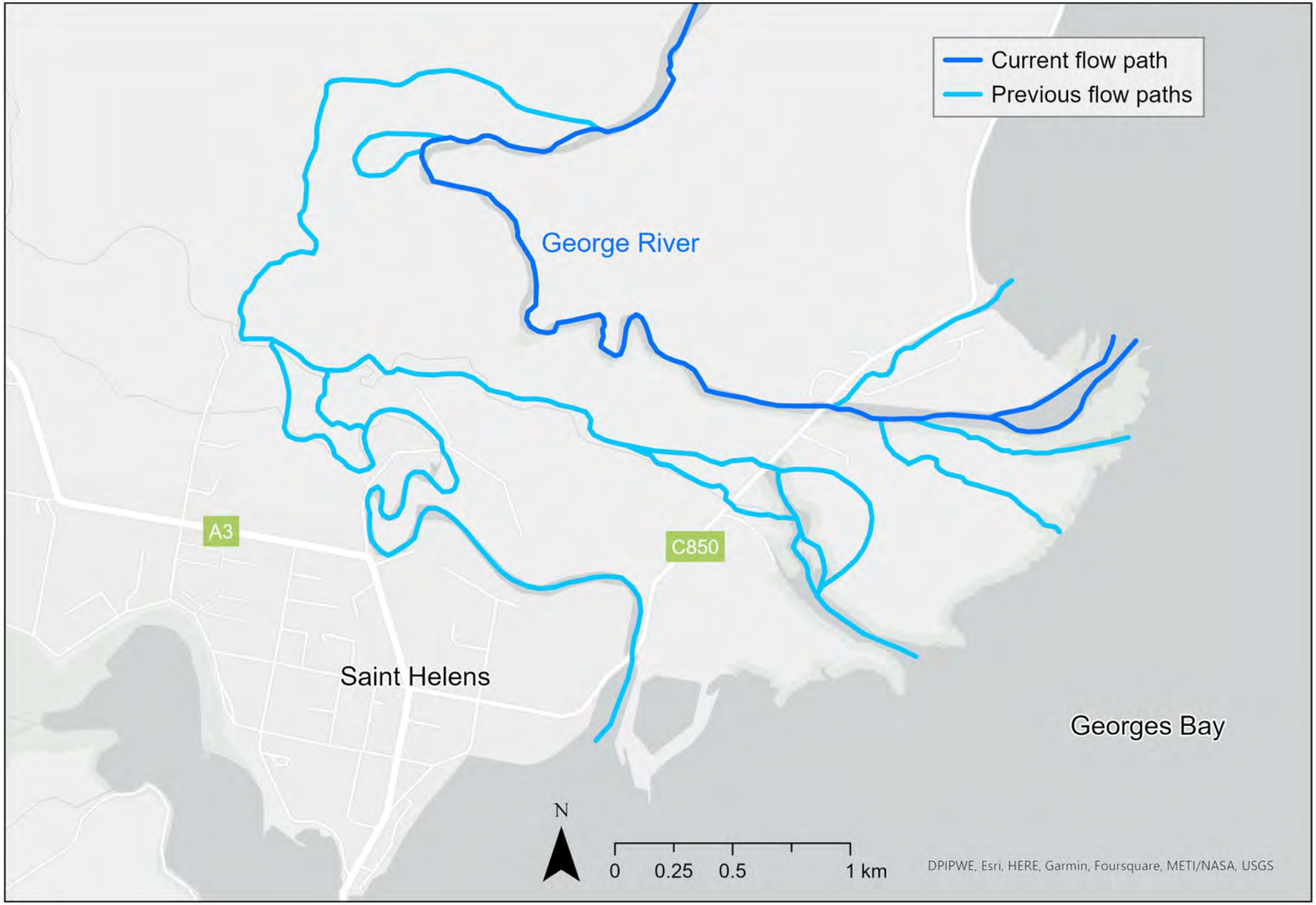
3. The new (daughter) channel is shorter, straighter, and steeper
   - The parent channel is abandoned for the more hydraulically efficient daughter channel



Juruá River, Brazil
Photo credit: Landsat, USGS/NASA

George River

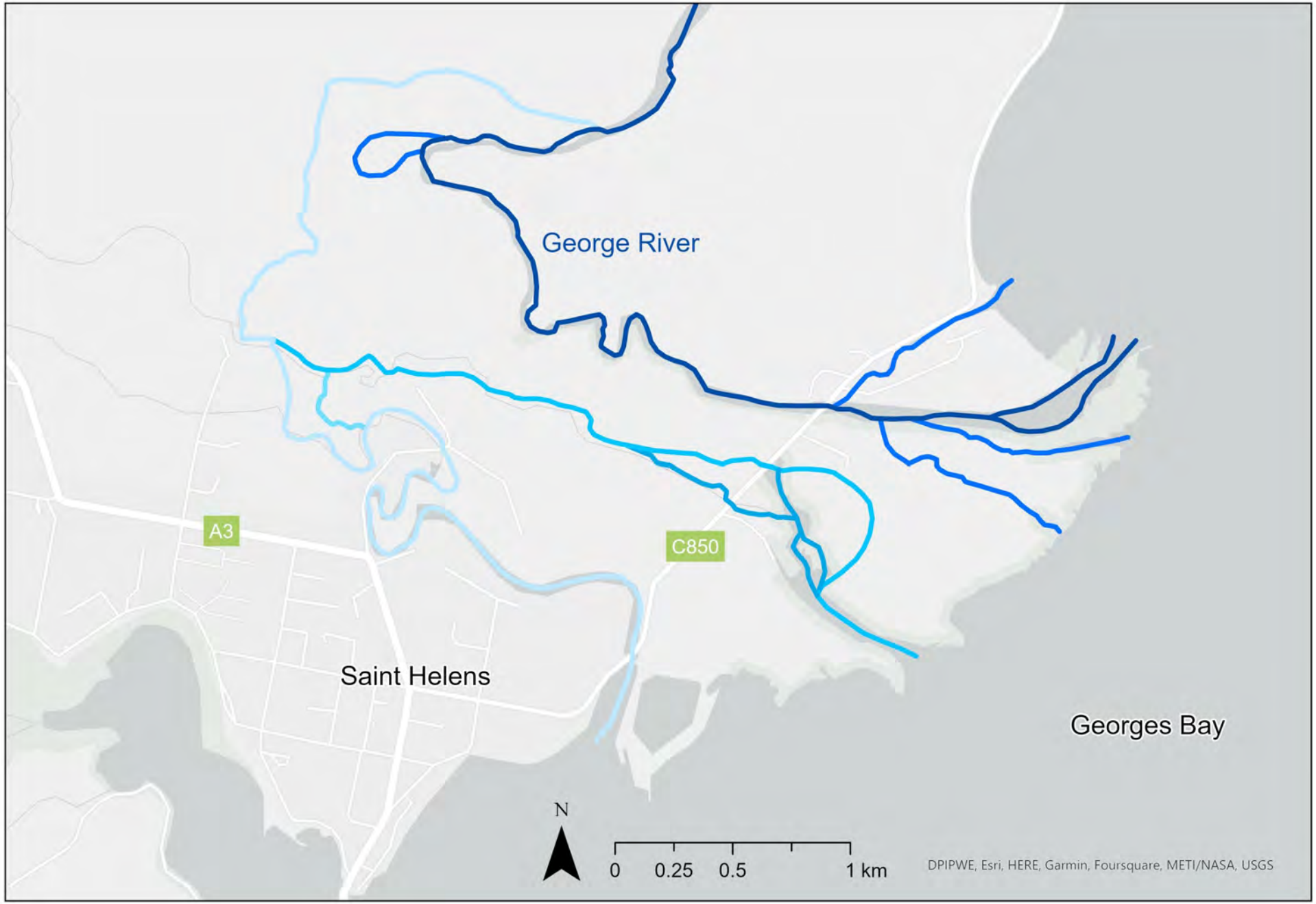
How did we get to the current flow path?



George River

We can see the George river has avulsed before:

- Older channels are longer and more meandering
- Modern channel is wider from carrying more water
- Older channels will carry water during floods

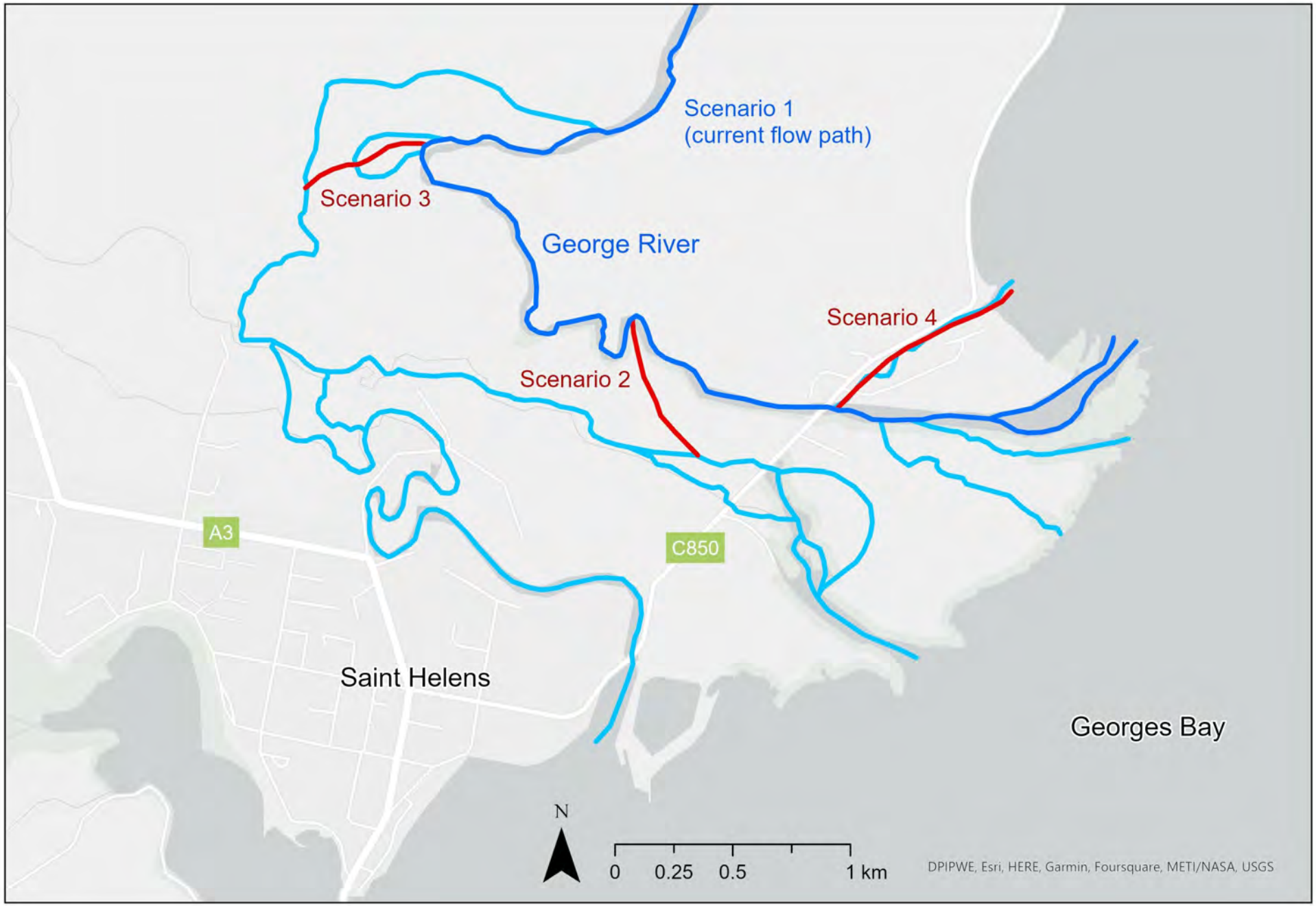


George River – likely avulsion pathways

In 2018, Water Technology conducted an assessment using:

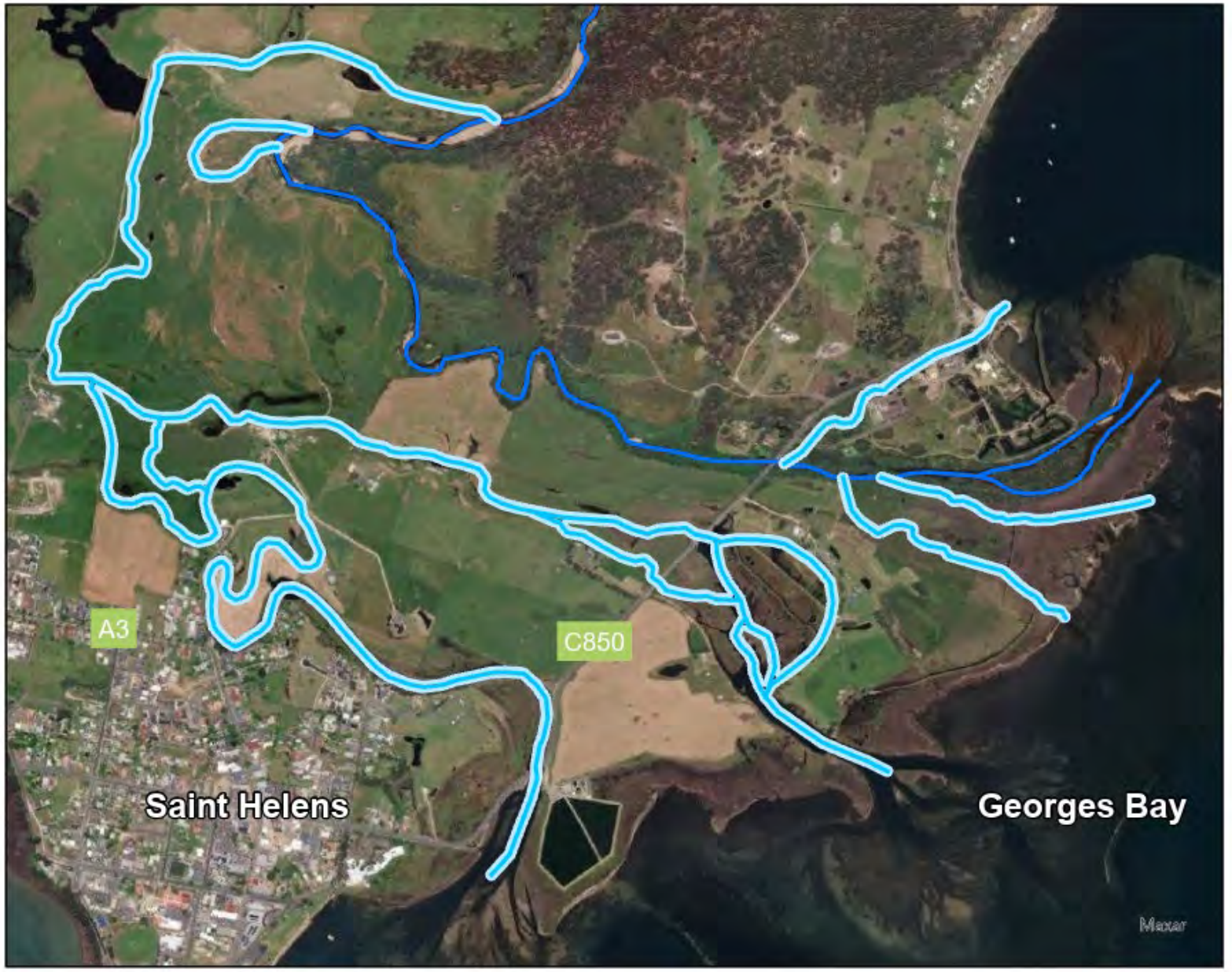
1. flood hazard mapping
2. floodplain and delta topography

to identify likely breakout points and avulsion scenarios for the Lower George River.



Consequences of avulsion

- Loss of public and private lands
- Sediment splays on properties
- Extra sediment released leading to instability in downstream reaches
- Incision and bed/bank erosion upstream of avulsion
- New discharge point into Georges Bay
- Reduced water quality in Georges Bay
- Damage to Binalong Bay Road



What would an avulsion look like…

- for the current course? (which will be abandoned)
- for the new floodplain channel? (which will be created)
- for the new course? (which will be re-occupied and enlarged)

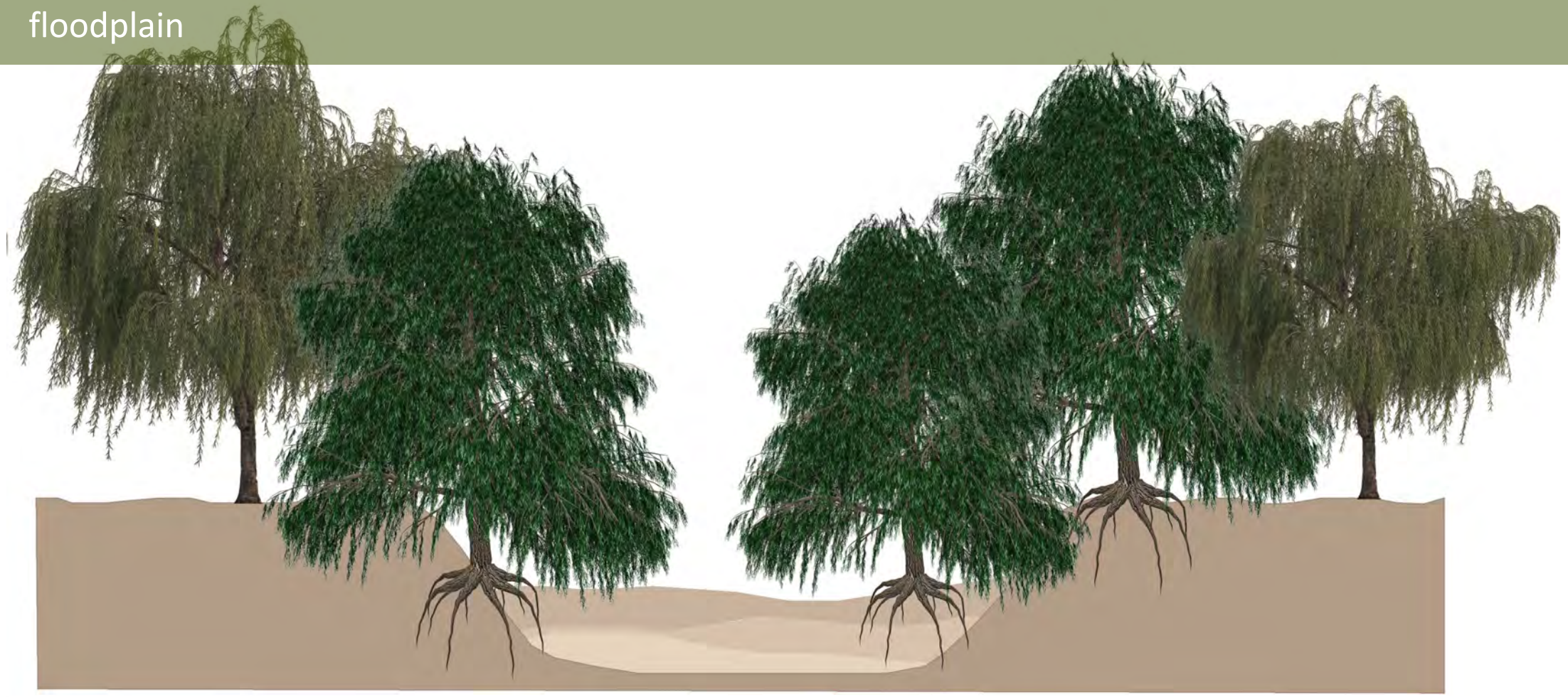
- in the short term?
- in the medium term?
- in the long term ?

Looking northerly towards Thomson R and upstream along Rainbow breakaway See TC7609

Flood flow in Rainbow Creek spilling into hole near Boundary Allots 1 and W4 Sec N Toongabbie South. See TC7821

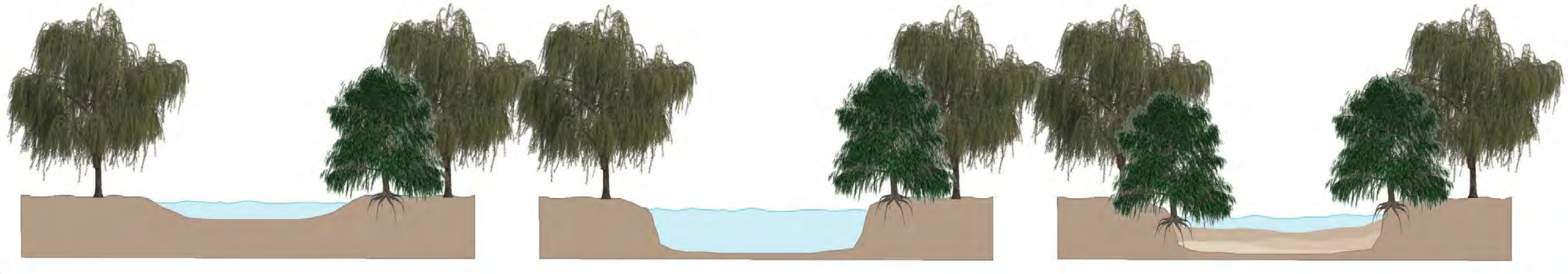
Consequences for the current course

- ***Short term:*** new breach in bank
- ***Medium term:*** increased sand accumulation, lower flows, expansion of vegetation into the riverbed
- ***Long term:*** No flow, essentially becomes one of the many former courses on the George River floodplain



Consequences for new floodplain channel

- ***Short term***: rapid deepening and some widening – erosion of bed and banks
- ***Medium term***: Continued widening, some meander bends may form
- ***Long term***: Sand begins to accumulate, channel becomes shallower – resembling the current course of the George River



New floodplain channel forms → Channel becomes deeper & wider → Sand accumulates, channel shallows

Consequences for new re-occupied course

- ***Short term***: Deepening and widening
- ***Medium term***: Continued widening, some erosion/migration of existing meander bends
  - Piers of road bridge potentially undermined
  - Some of the sediment eroded from new floodplain channel (immediately upstream) deposited in this reach
  - Assets adjacent old course undermined by bank erosion
  - Changes in flood dynamics
- ***Long term***: Sand begins to accumulate, channel becomes shallower, resembling the current course of the George River
  - Avulsion cycle begins again

George River – likely avulsion pathways

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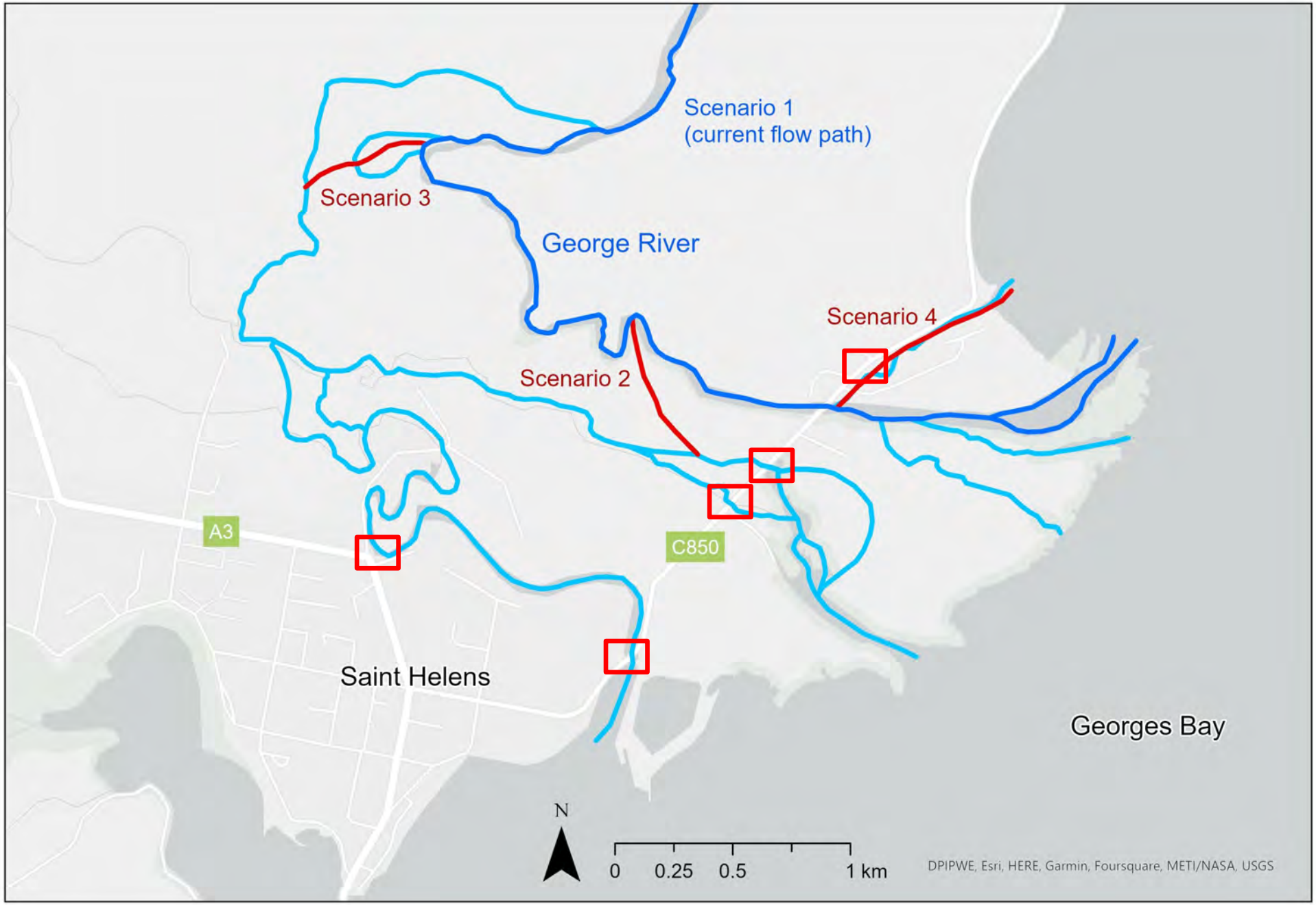

Management options – before avulsion

Do not intervene and prepare for the consequences

- Relocate assets away from the daughter channel (that will eventually widen)
- Include avulsion scenarios in asset planning (roads, stormwater, bridges)
- Establish wide and continuous native vegetation along the likely daughter channel in preparation

Photo from Polly Buchhorn

Management options- Delay or prevent the avulsion (before)

1. **Increase the hydraulic efficiency of the parent channel**:

- Replace invasive vegetation (e.g., willow) with native vegetation
- Selective removal or redistribution of channel blockages (e.g., instream wood dams)
- Remove artificial levees along channel banks that prevent sediment from being transported out of channel and onto floodplain

2. **Decrease the hydraulic efficiency of the daughter channel**:

- Armor the bed, banks, and migrating head cut of the daughter channel
- Emplace terraces confining in-channel avulsions with riparian vegetation or structural works

Management options – after avulsion

Limit development of the daughter channel

- Install flow regulators to partition flow between parent and daughter channels
- Undertake a program of grade control in the daughter channel
- Establish wide and continuous native vegetation along the daughter channel

Photo from Polly Buchhorn

Thank you

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We are passionate about the protection and restoration of waterways, catchments and water resources. We strive to make a positive difference to the world we live in.

George River – likely avulsion pathways

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