

The Plight of the Foothills-fed Canterbury Braided Rivers

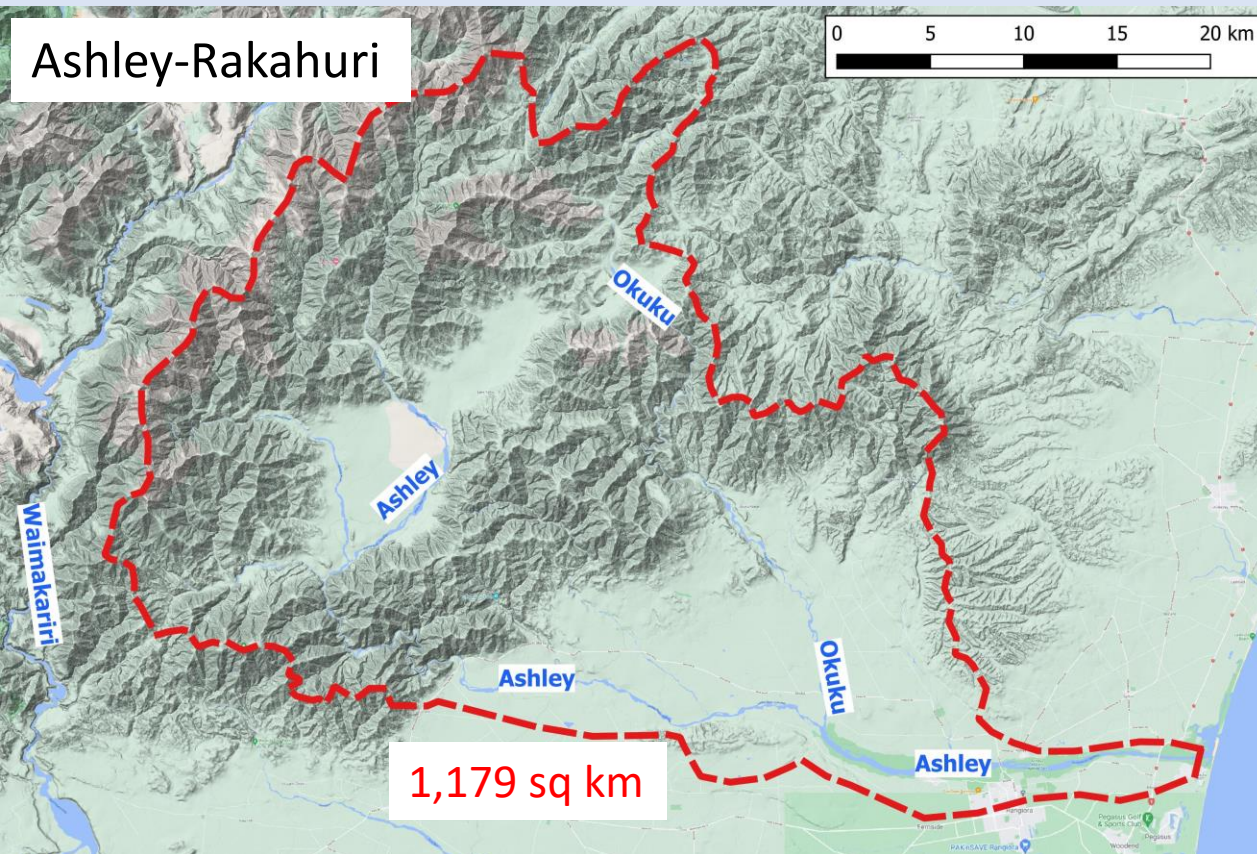
Today, however, most gravel-bed rivers (internationally) bear little resemblance to their highly dynamic natural state due to anthropogenic modifications, and most braided rivers have been converted to incised single-thread channels.

Tockner et al., 2006.
Ecology of Braided Rivers

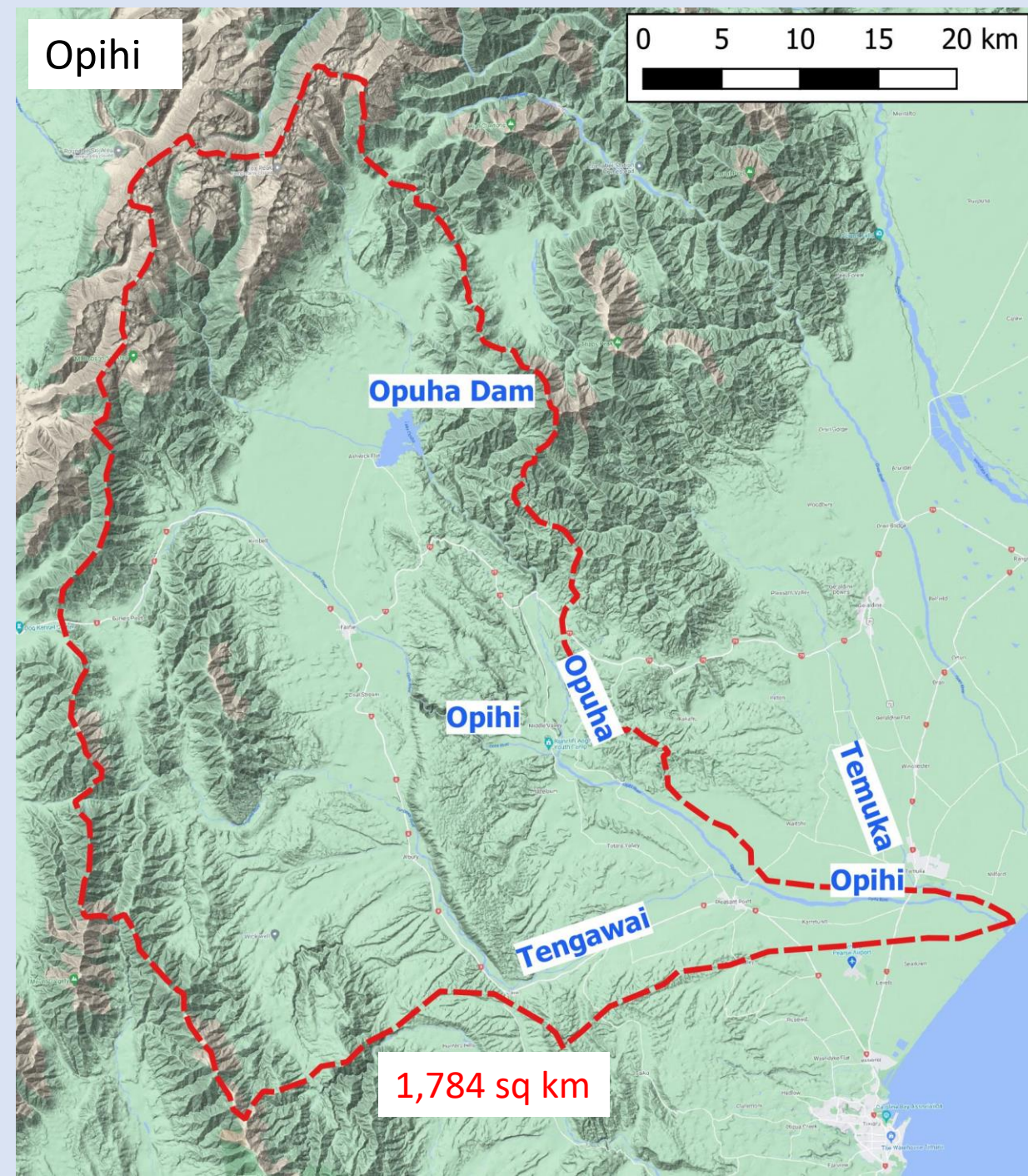


Ashley River, July 2020 - not a natural landscape

Grant Davey



Ashley and Opihi – very similar foothills-fed rivers. Minus Temuka tributary, Opihi still has larger catchment. The lower few tens of kilometres run through a plain



Braided river specialists – birds that depend to some extent on these rivers for breeding. They are what is unique about the New Zealand braided rivers and some of them are genuinely threatened



Wrybill, nationally vulnerable, 5,000 – 5,500



Black-fronted tern, nationally endangered, 5,000 – 10,000



Black-billed gull, nationally critical, >60,000 breeding pairs



Banded dotterel, nationally vulnerable, 5,000 – 20,000?



Pied oystercatcher, declining, >100,000



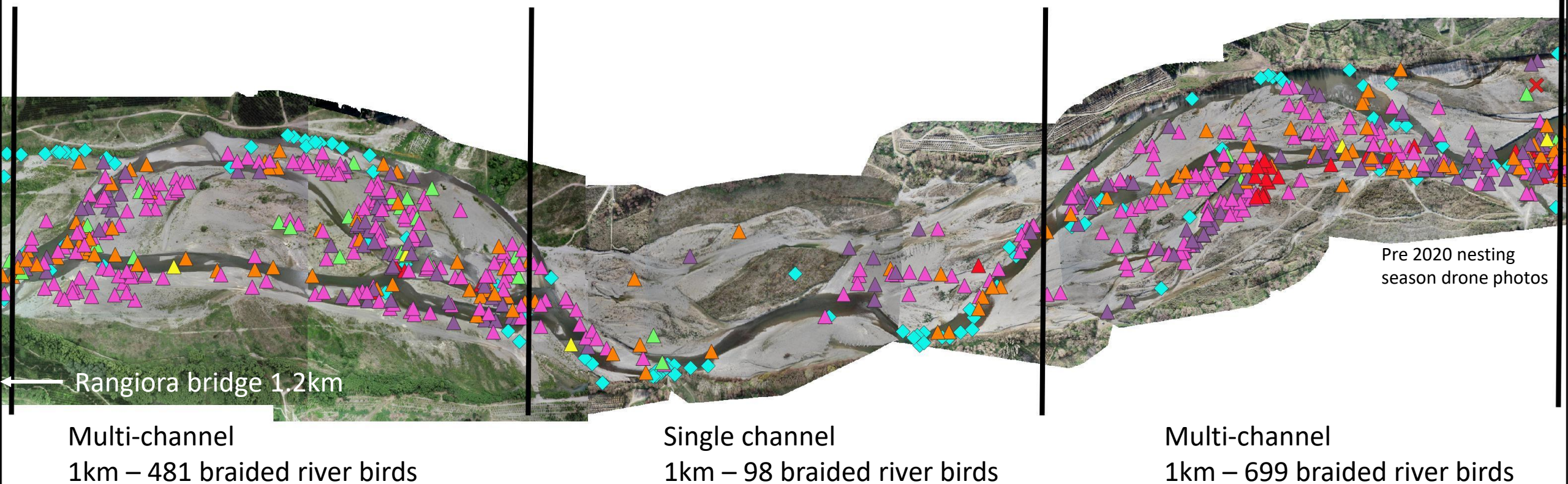
Pied stilt, not threatened, 30,000?

Combined results from 20 weekly bird surveys – Ashley River Cones Rd to SH1 (July 20 – Feb 21):

- **Braided river birds are 5 to 6 times more likely to be in multi-braid sections of river for nesting and feeding**
- Islands with bare gravel are necessary for nesting
- Braided river birds avoid tree-clad margins
- Other water birds - ducks, paradise ducks, shags and herons prefer vegetated margins

Bird Observations

- ▲ Wrybill
- ▲ Black-fronted Tern
- ▲ Black-billed Gull
- ▲ Banded Dotterel
- ▲ Pied Stilt
- ▲ Pied Oystercatcher
- ◆ Water Birds



Opihi River

International literature says braided rivers are being damaged due to:

Restrictions of rivers by:

- Stopbanks
- Tree planting and other stabilizations of the banks and berms
- Uncontrolled expansion of weeds on the fairways

Deepening of the channels by:

- Excessive gravel extraction

The effects of dams and excessive water abstraction

- Less sediment leads to channelization. Character of sediment changes
- Lower flood magnitude, more weeds result

Opihi river works objectives (SCCB & ECan) included:

- *“Straighten and constrict the channel to concentrate flow and scour gravel during floods and transport gravel to the sea..”*
- *“Encourage gravel extraction to increase fairway capacity...”*
- *“Decrease the supply of bed material with extensive tree planting and rock works along the main rivers and tributaries; and with gully planting, drop structures and gravel traps to control erosion and reduce supply to the lower river system (in the 1970s).”*
- *“Clear the fairway of vegetation to increase hydraulic efficiency and to reduce sediment trapping.”*

Result:

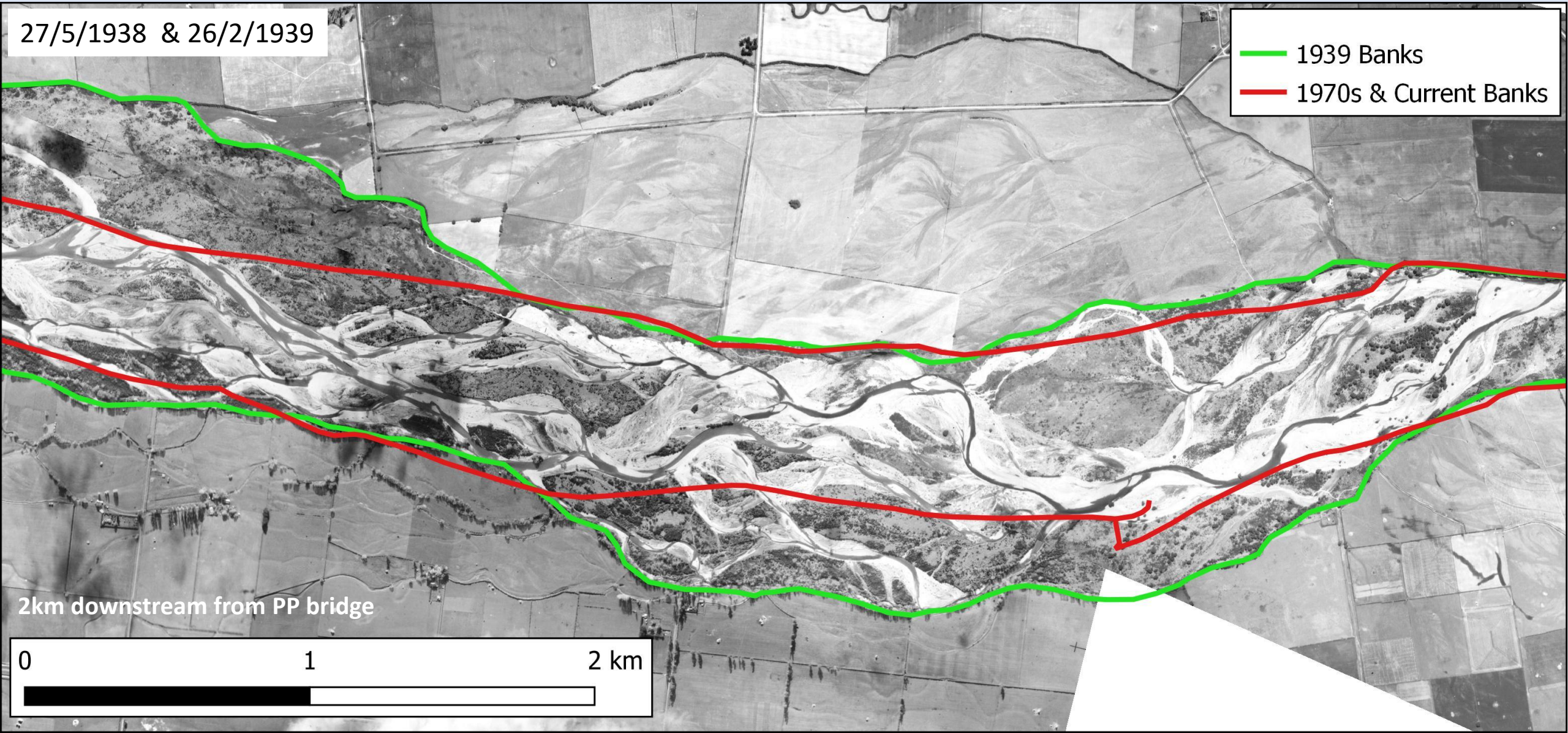
*“In the upper plains below the Opihi Gorge the river flows in a progressively shallowing trench; with a natural braided pattern that has been **confined with bank protection and now flows in a sinuous, generally single thread pattern**”*

ECan report 2005 – U05/31

A guaranteed recipe for destruction of a braided river

Opihi River 1938/9

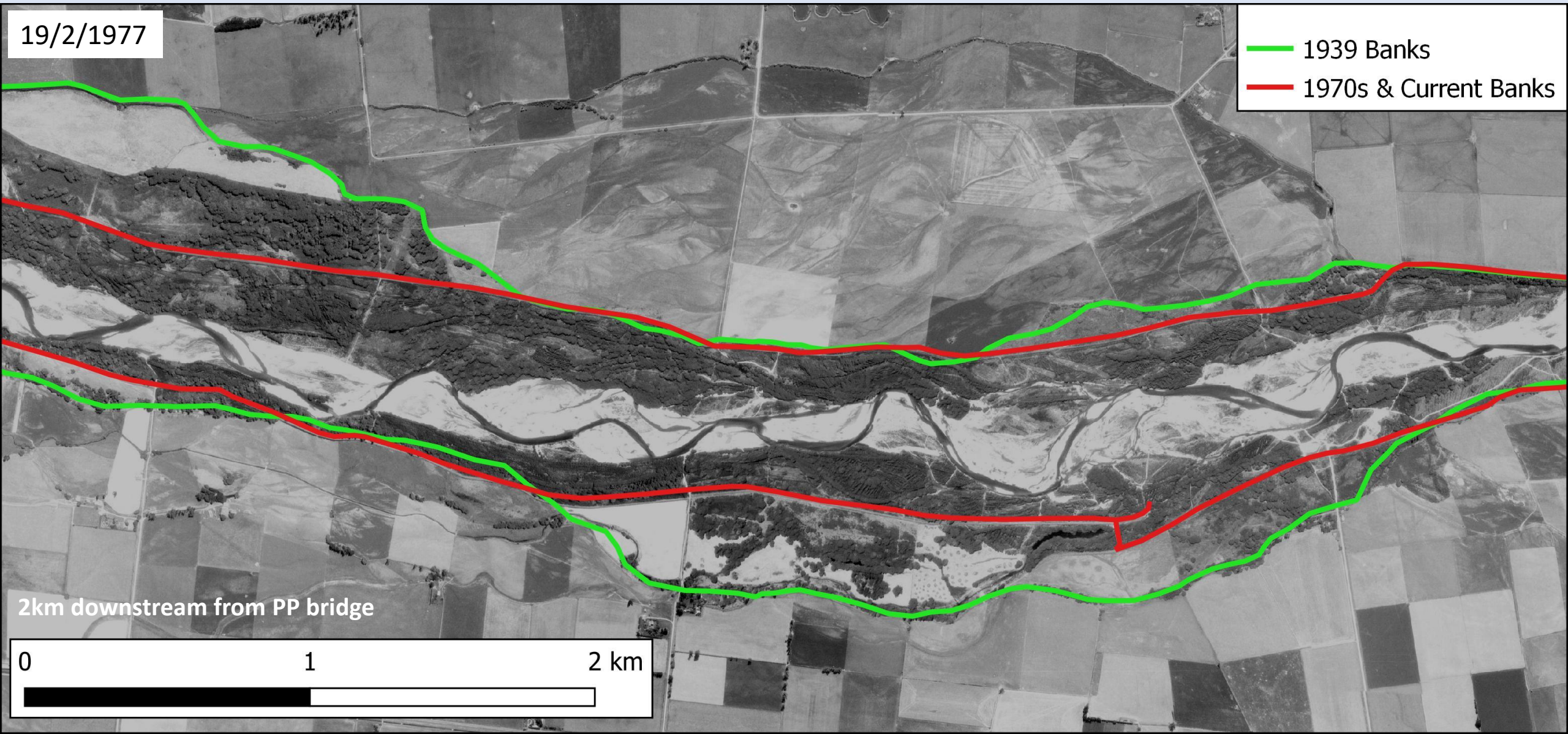
Broad, good braids, islands and bare gravel, but large exotic tree and weed covered islands.



Opihi River

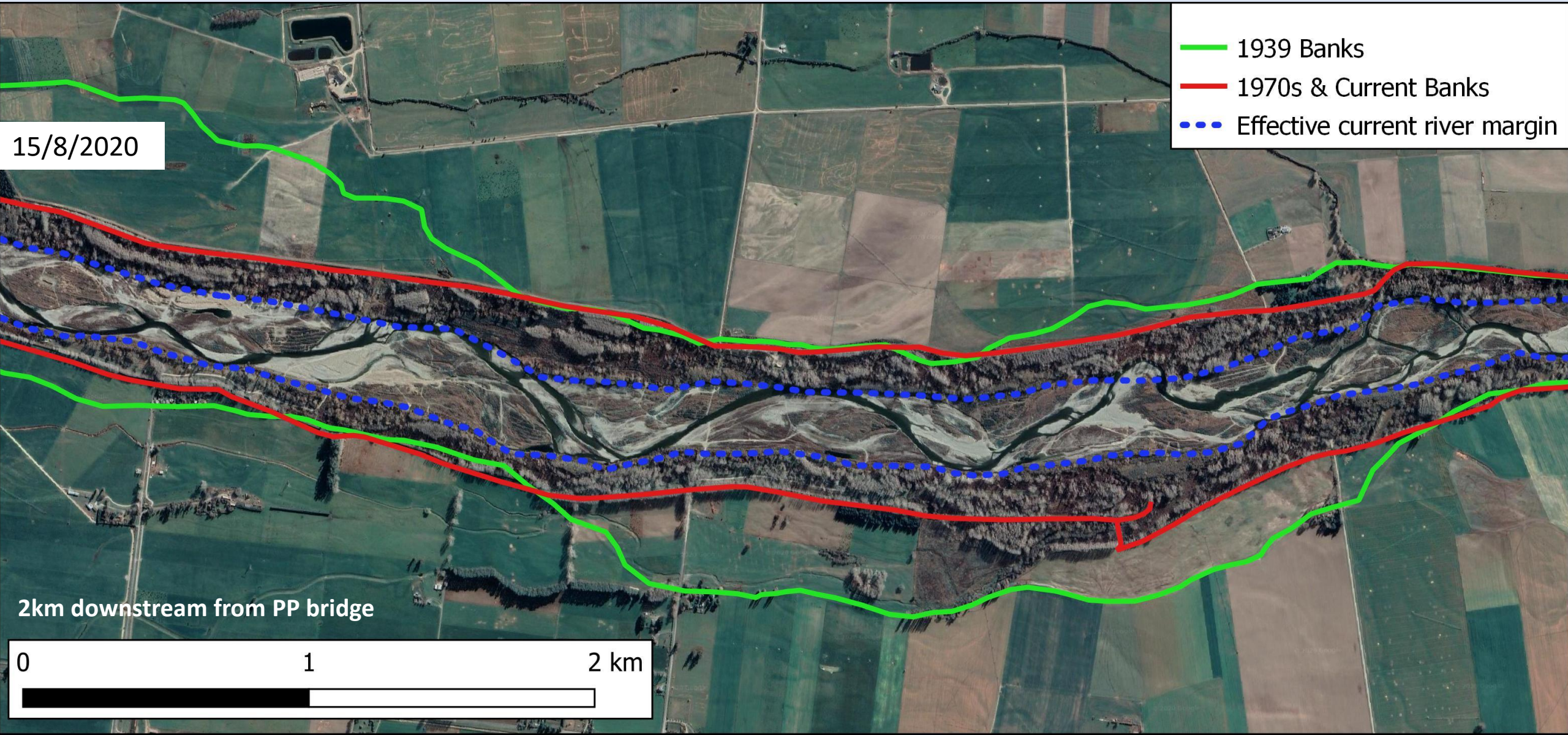
1977

New stopbanks and tree planting in early 1970s. No longer a braided river - an incised single channel. Bird numbers likely plummeted, remaining ones would have been more susceptible to predation



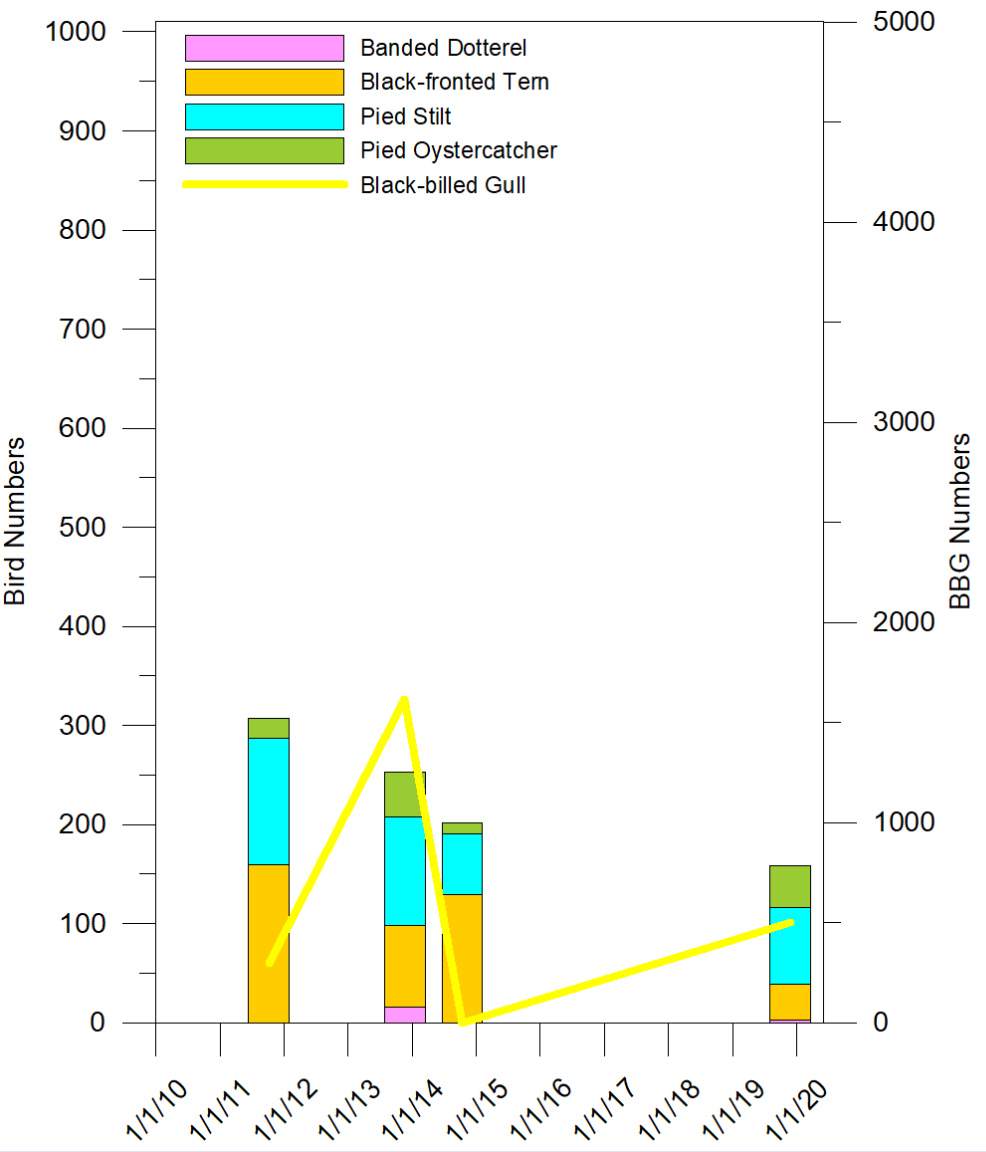
Opihi River 2020

Very little bare gravel – very heavy weed infestation on fairway

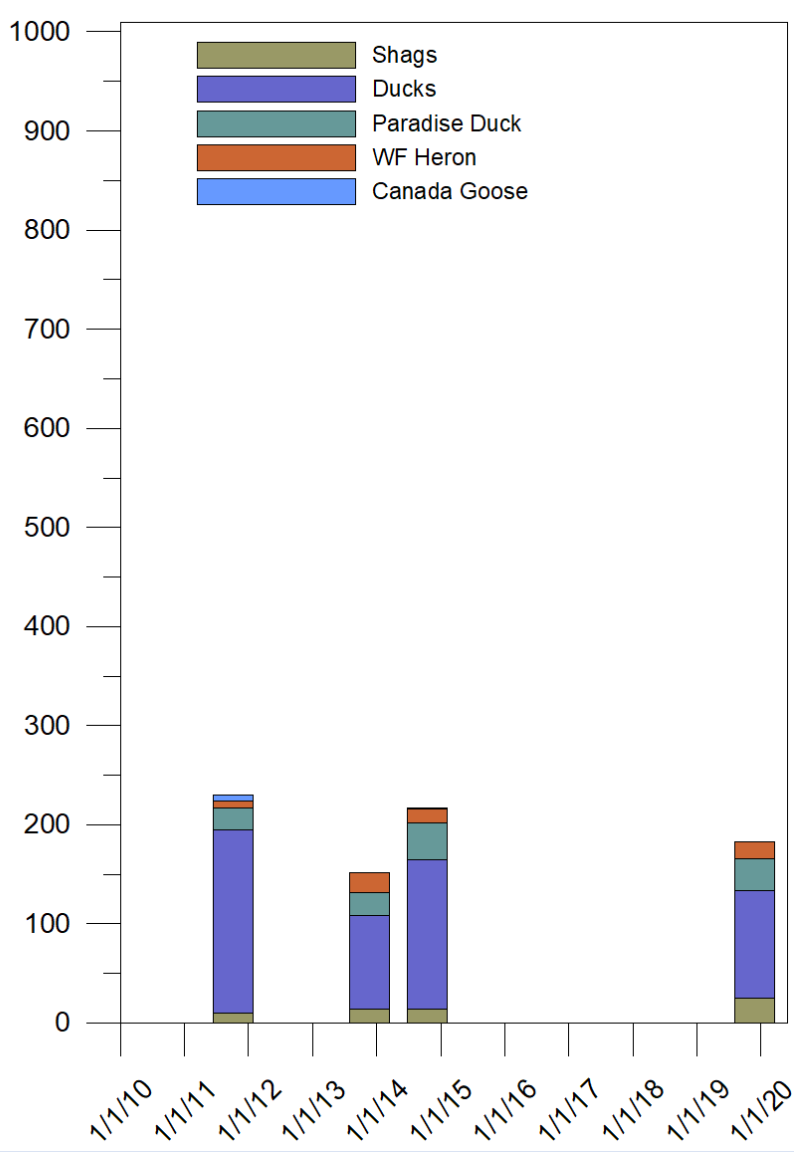


Opihi Annual Bird Counts – Raincliff Bridge to Lagoon – 32 Kilometres

Braided River Birds



River Birds

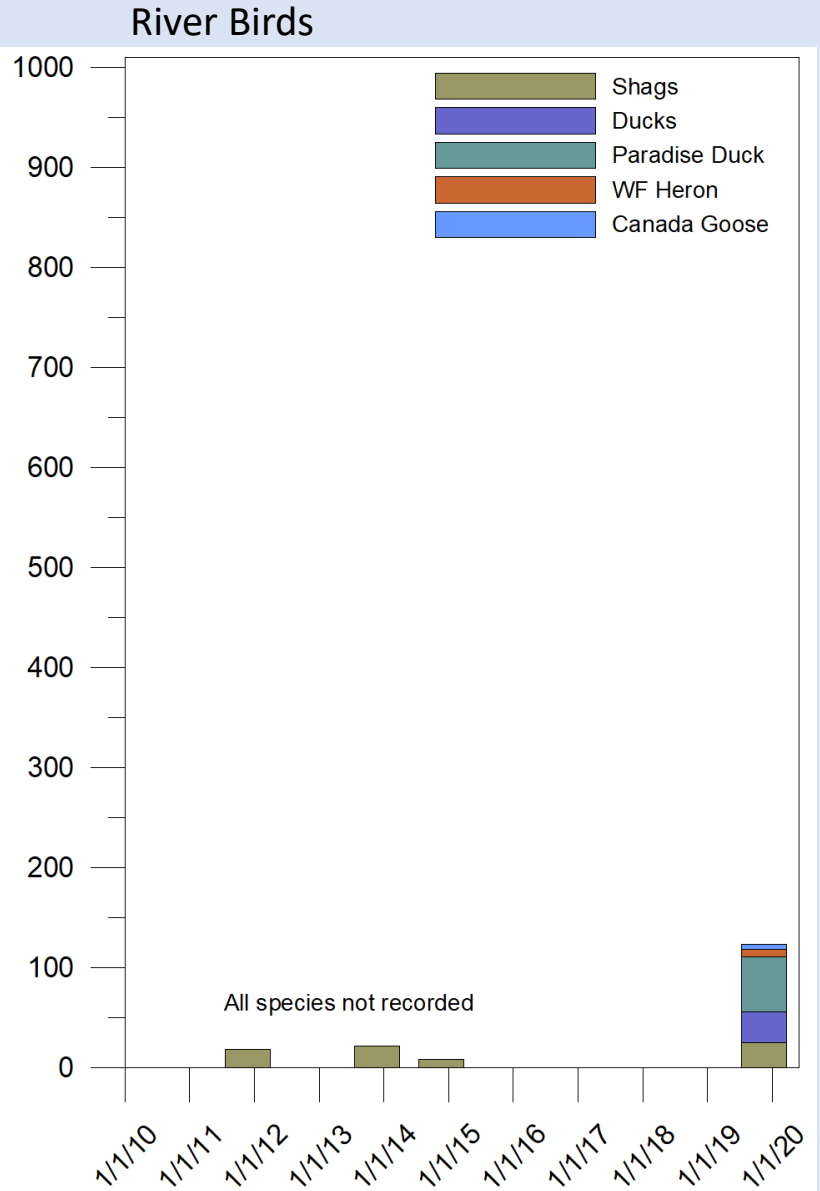
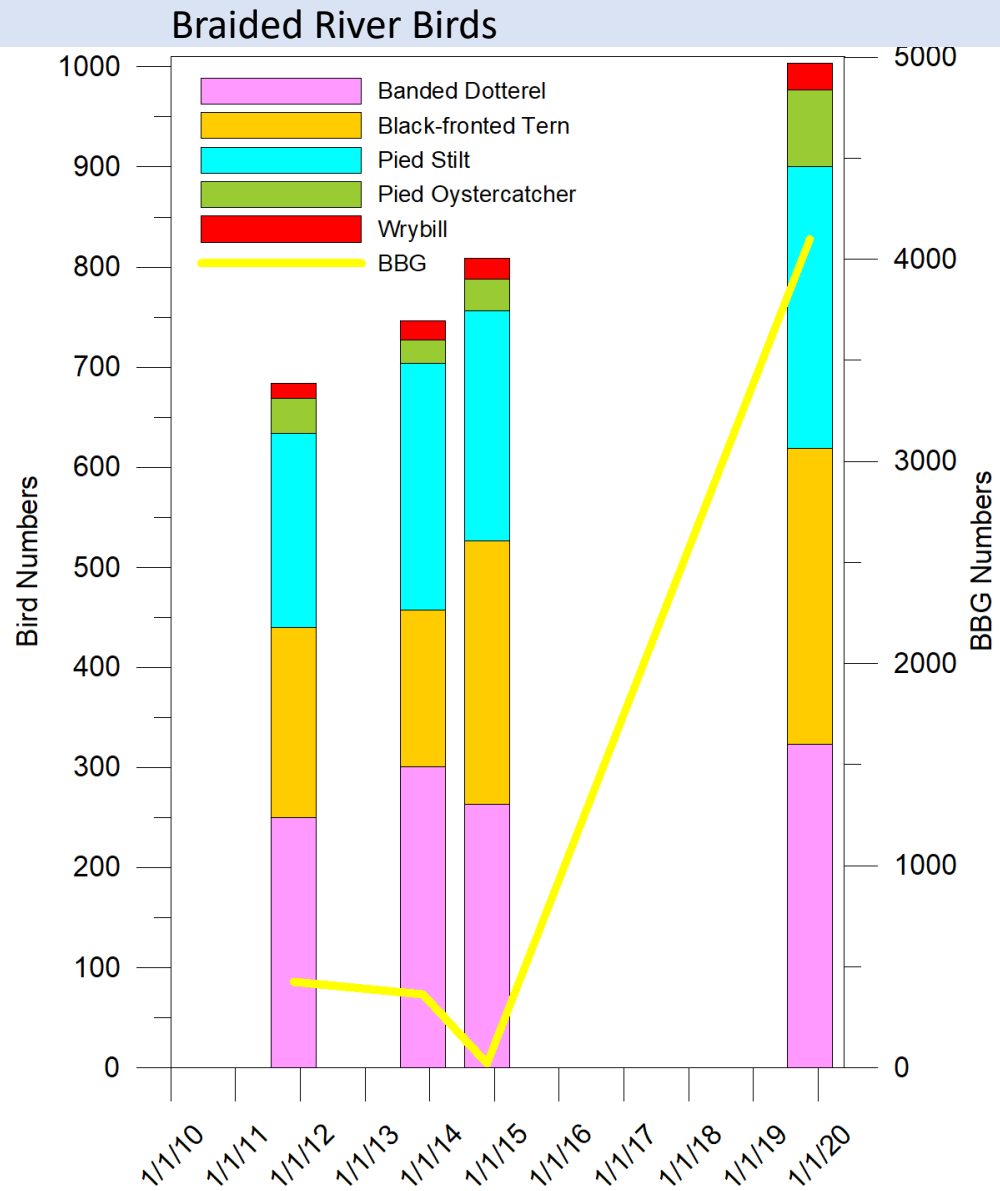


Good BBG numbers, terrible numbers for other braided river birds

“River birds” prefer single channel deep tree-lined rivers. If they nest on the rivers, it is in vegetation as opposed to bare gravel. In a braided river braided river birds should grossly outnumber “river” birds. In 2014 and 2019 river birds outnumber braided river birds.

Average Braided River Birds/River Birds = 1.2

Ashley Annual Bird Counts – Okuku Junction to SH1 – **19 Kilometres**. Same scale



Average Braided River
Birds/River Birds for
2018 - 2020 = 6.3

Opihi – 1.2

Opihi River at SH1 bridge

Zero nesting or
feeding habitat.

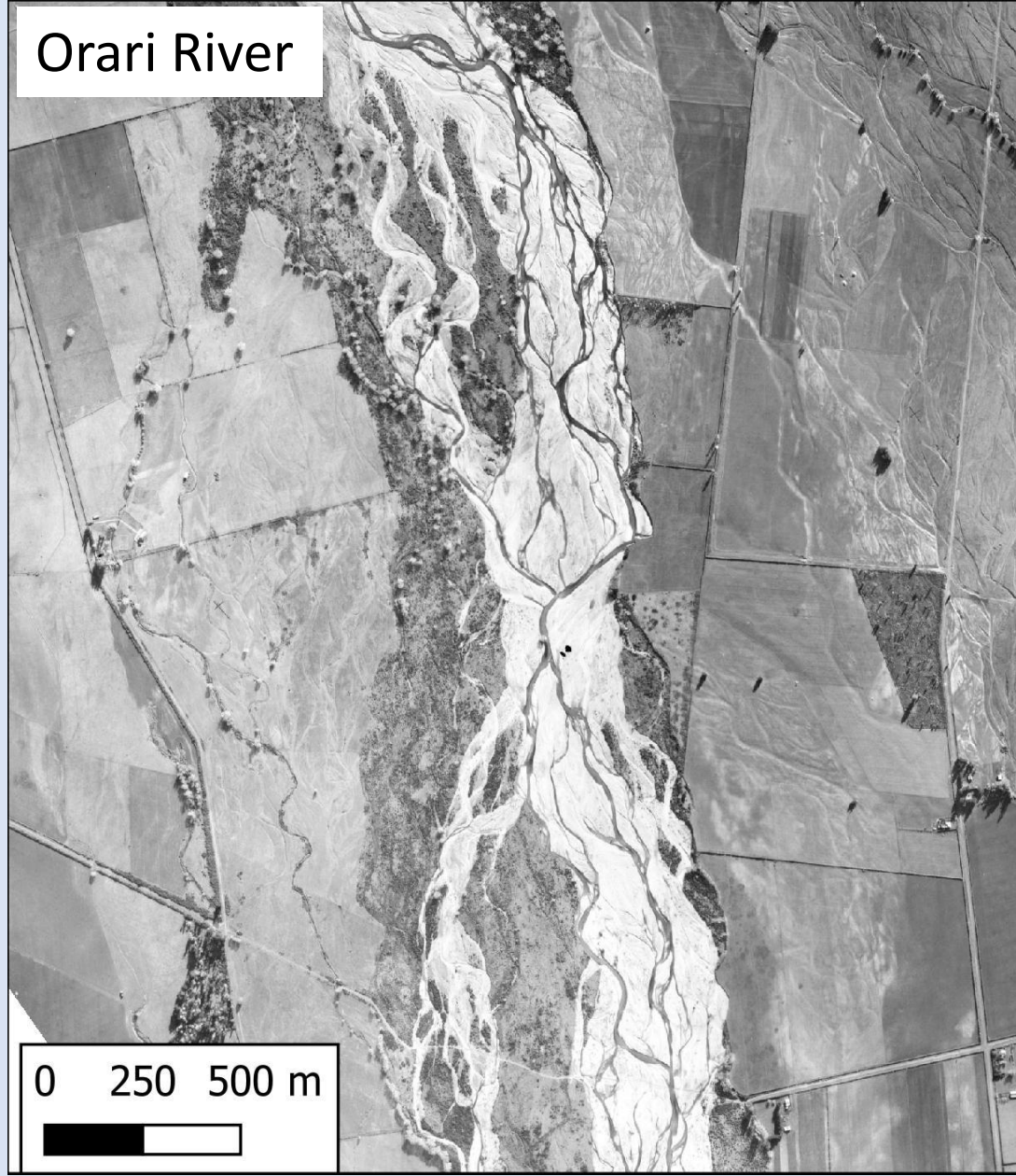
“..a braided river will
evolve into a single-thread
channel when its bed is
invaded by vegetation and
floods are too infrequent to
contain the vegetation
growth.”

Hicks et al., 2007

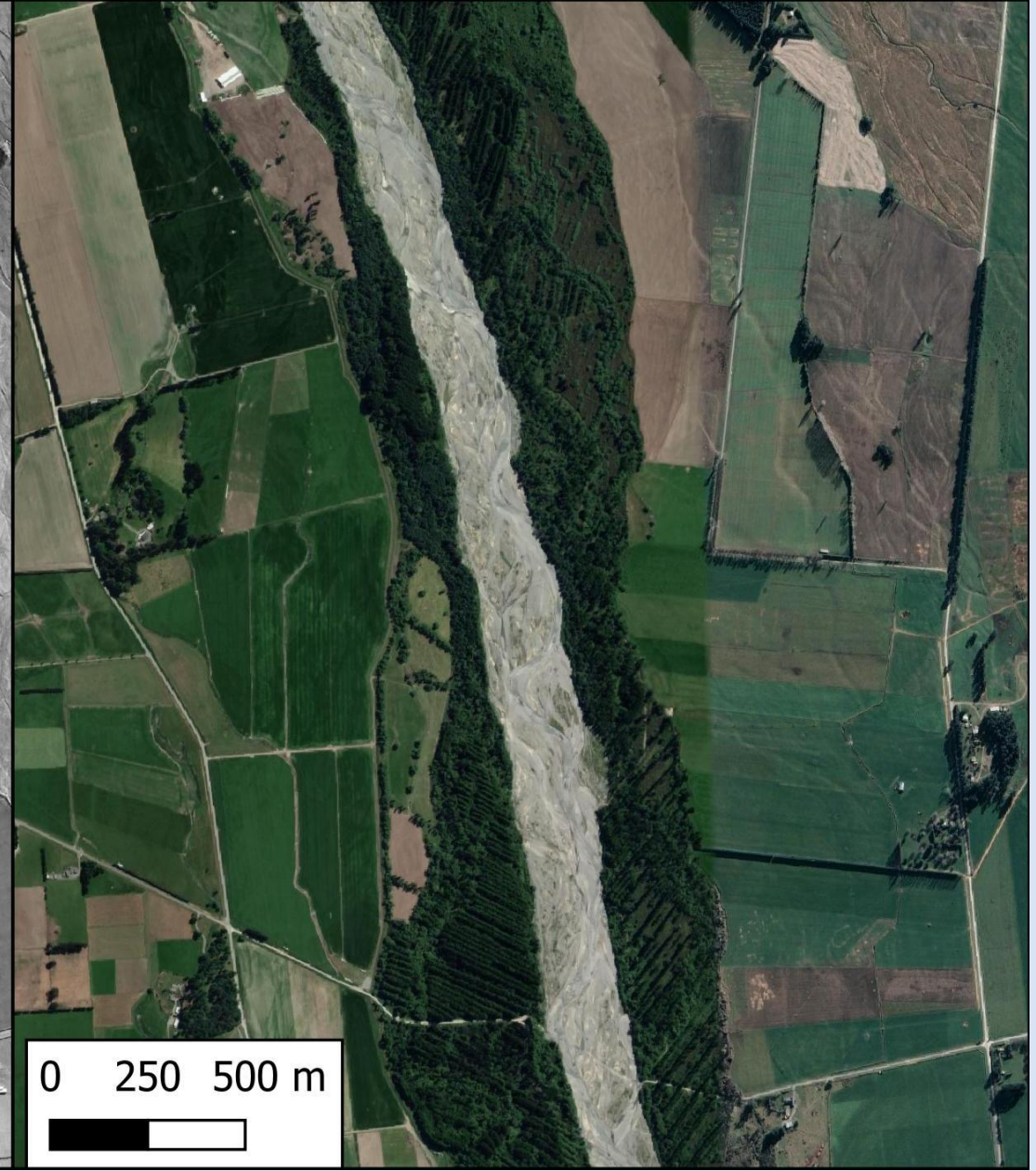
**Are we prepared
to write off the
Opihi as a braided
river bird habitat?**



Orari River



Orari 1942

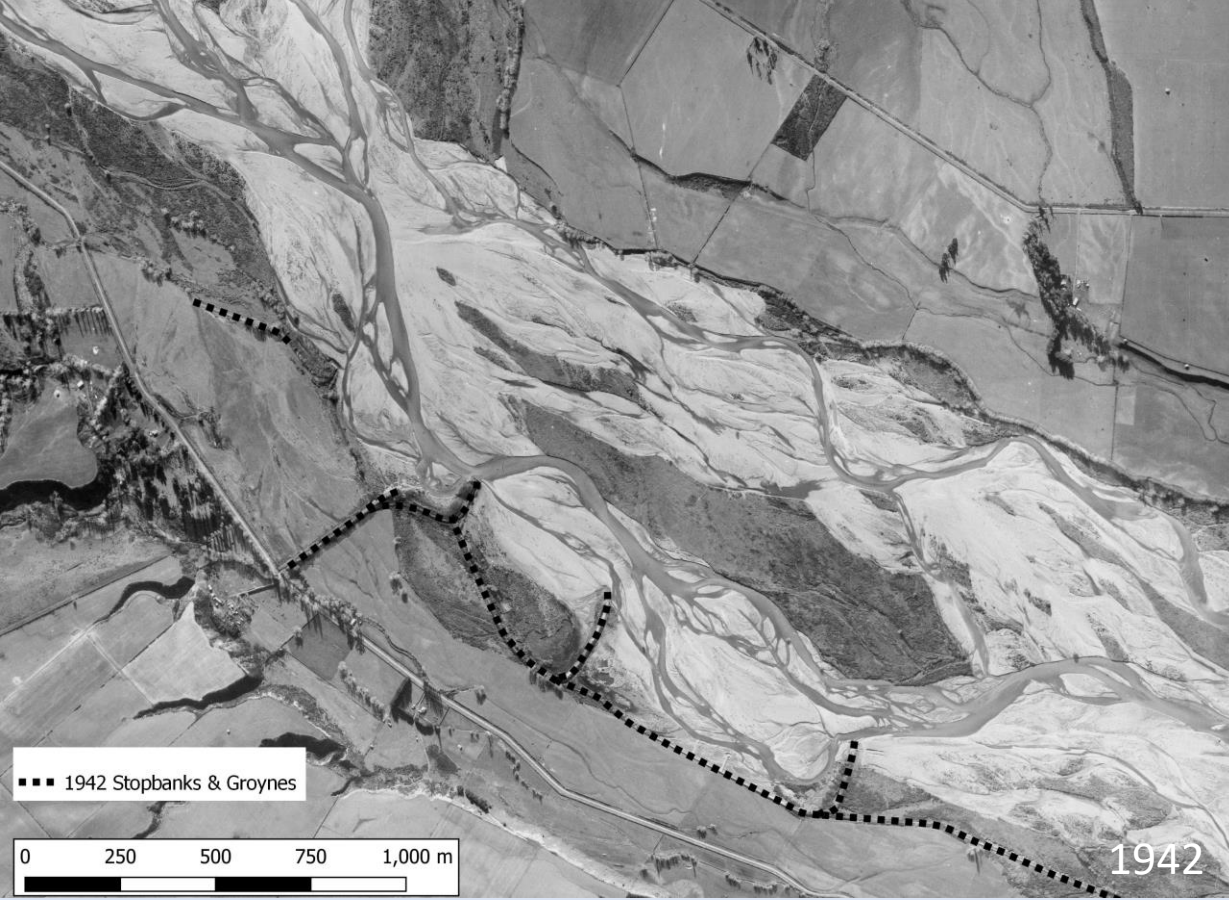


Orari 2020

Encroachment by Flood Protection – same objectives as for Opihi?

Ashley River

not as good as it may seem



During freshes and floods there was a complex interplay between erosion and deposition. In this part of the river erosion rate was slightly greater than deposition. Towards the coast deposition > erosion.



Flow is more confined, deeper and faster and eventually straighter. This will cause greater bed erosion with most deposition being sand deposited on the berm. This leads to greater weed growth, which traps more sand and grows more weed and narrows the river.

What does the deeper faster water do to aquatic insects? Fewer refuges from floods for everything.

Fairway area is now 56% of what it was in 1942, partly due to positive feedback loops?

Mid 2020 replanting of pine trees and flood protection tree planting far from the stopbank.

Reinforcement of berm margins means the river can no longer erode gravel from them.

How much berm is required to protect a stopbank?



14 August 2020

7/5/21



7/7/20



ECan pine forest

Flood protection tree
planting done in mid
2020.

Such work does not
require resource consent

400m to high natural riverbank



160m to edge of berm

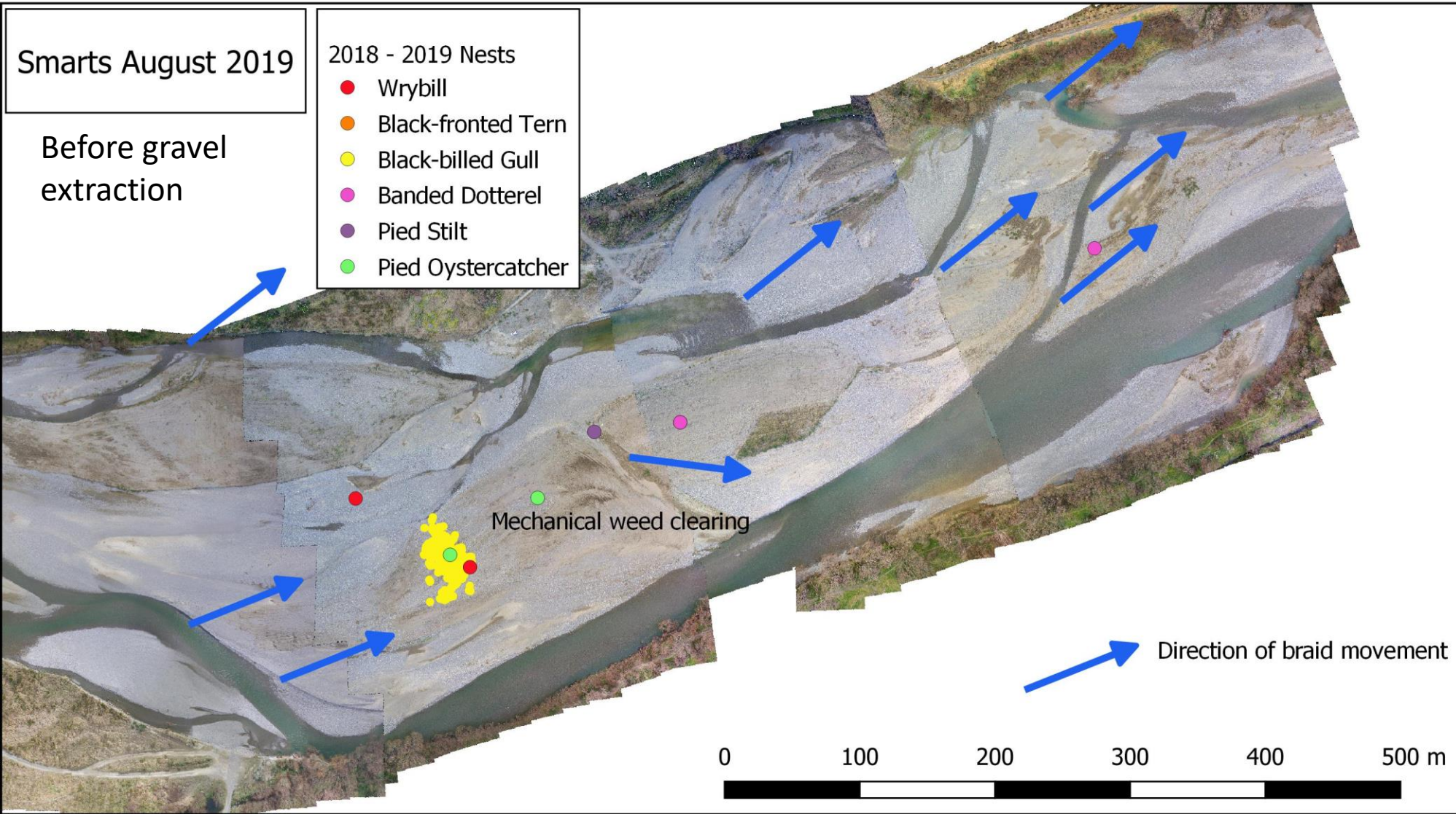


Gravel Extraction

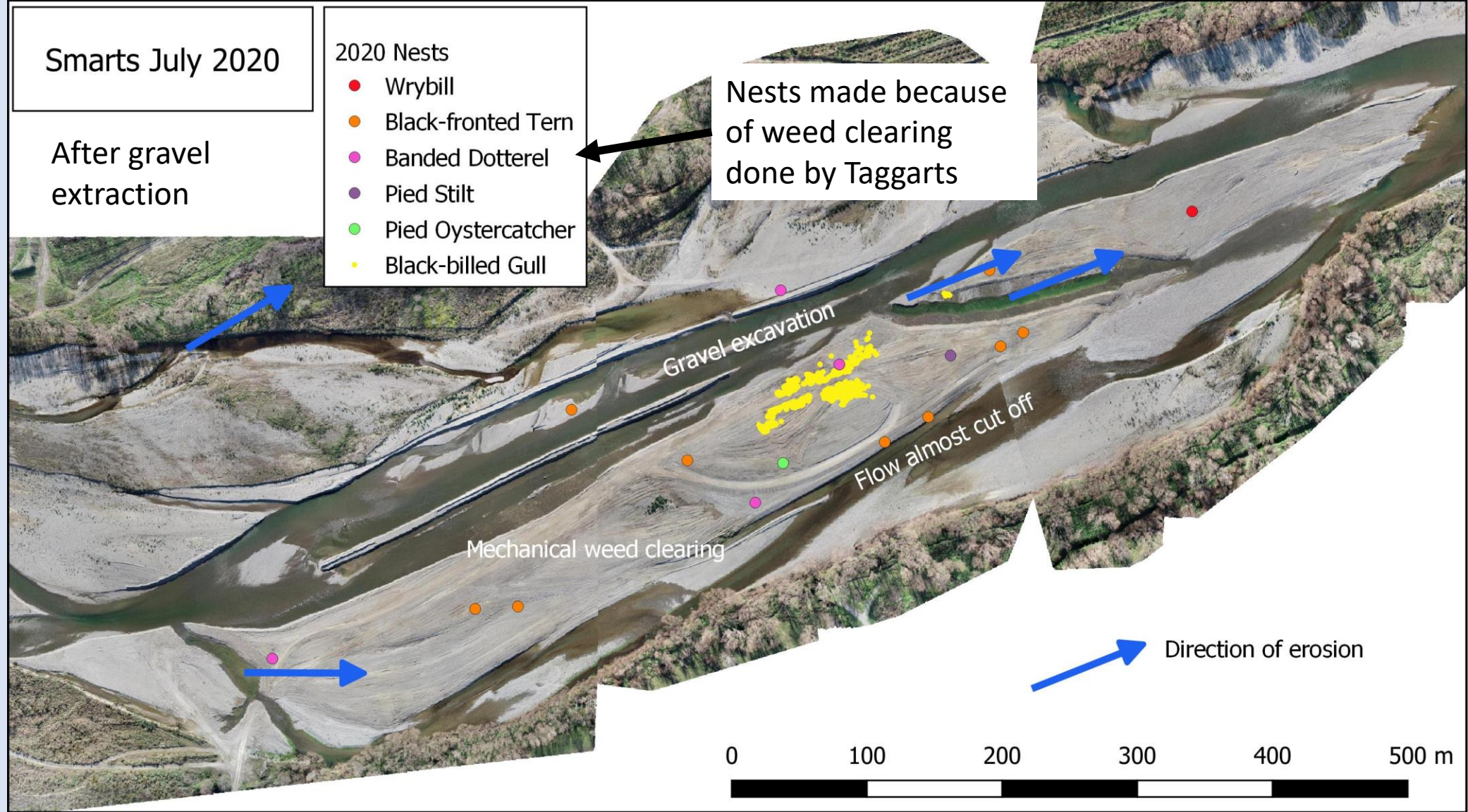
Braided rivers are dependent on abundant sediment (restricted in interglacials) for their existence



Papua – transition between braided and meandering rivers when sediment has been deposited



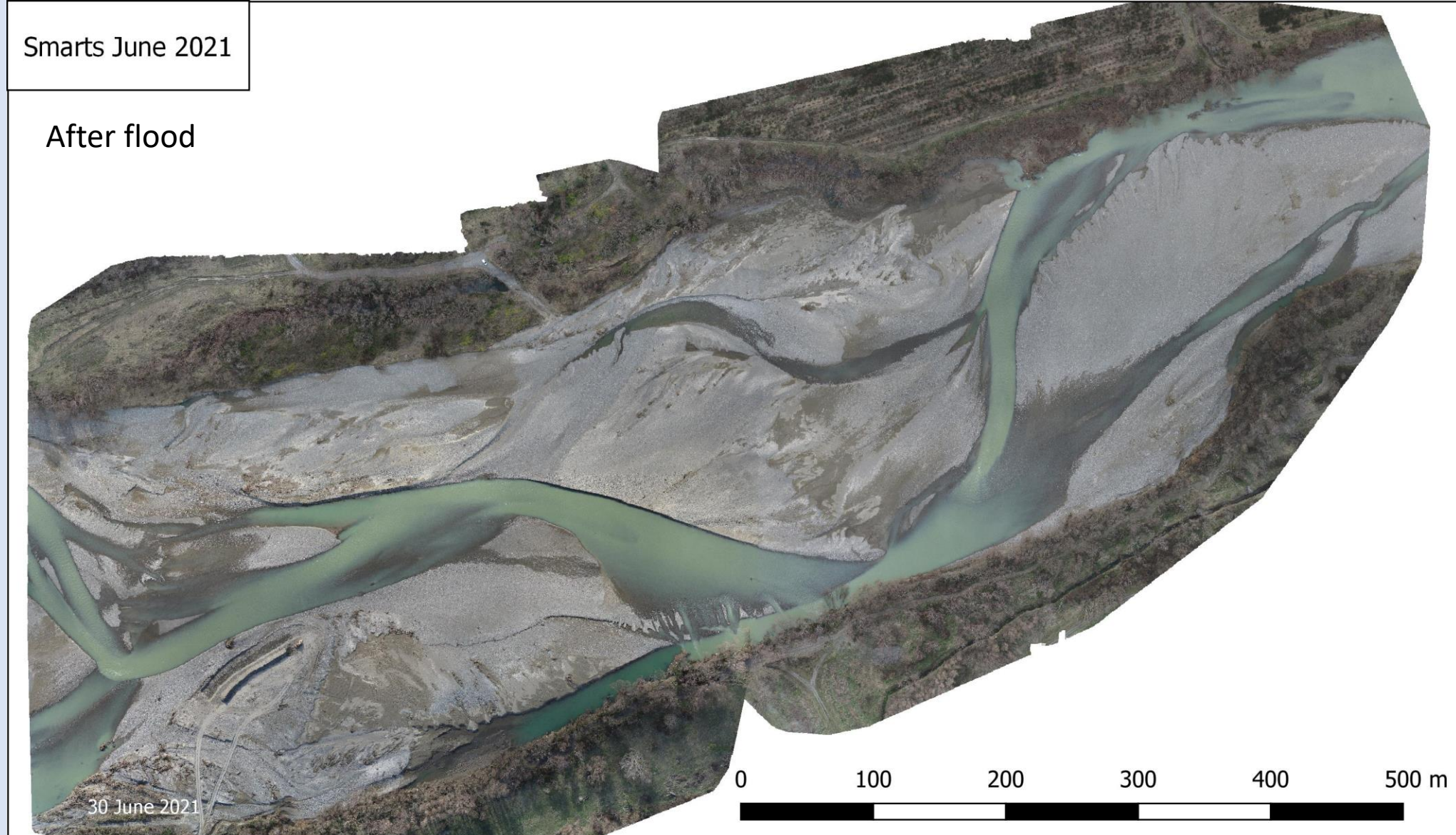
Essential characteristics of braided rivers are that **they consist of sinuous multiple channels which move over time. The current geomorphology of the Ashley river is a result of a 1 in 10 year flood in 2017.** This created new channels and islands, removed sand and weeds and made new nesting habitat



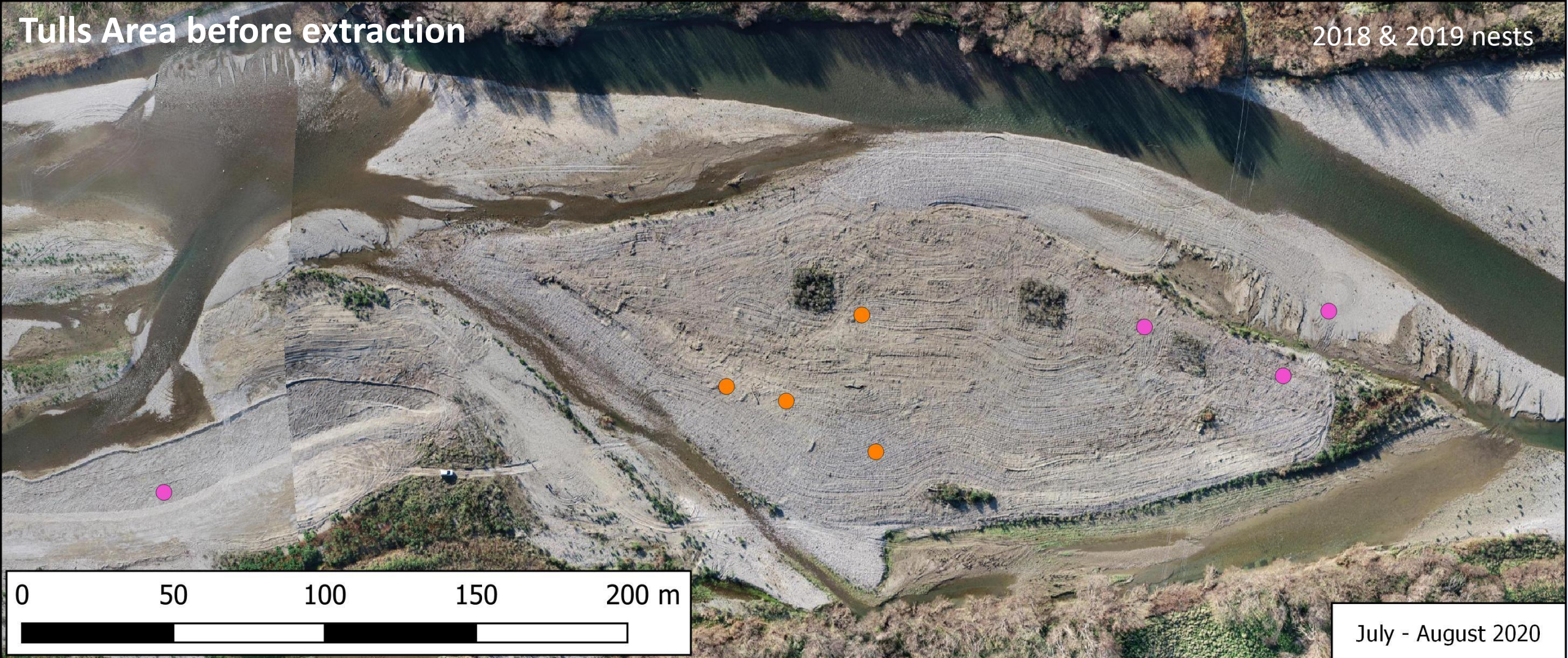
The artificially straightened and deepened river could have remained so for years – this morphology had been in place for 4 years.

Smarts June 2021

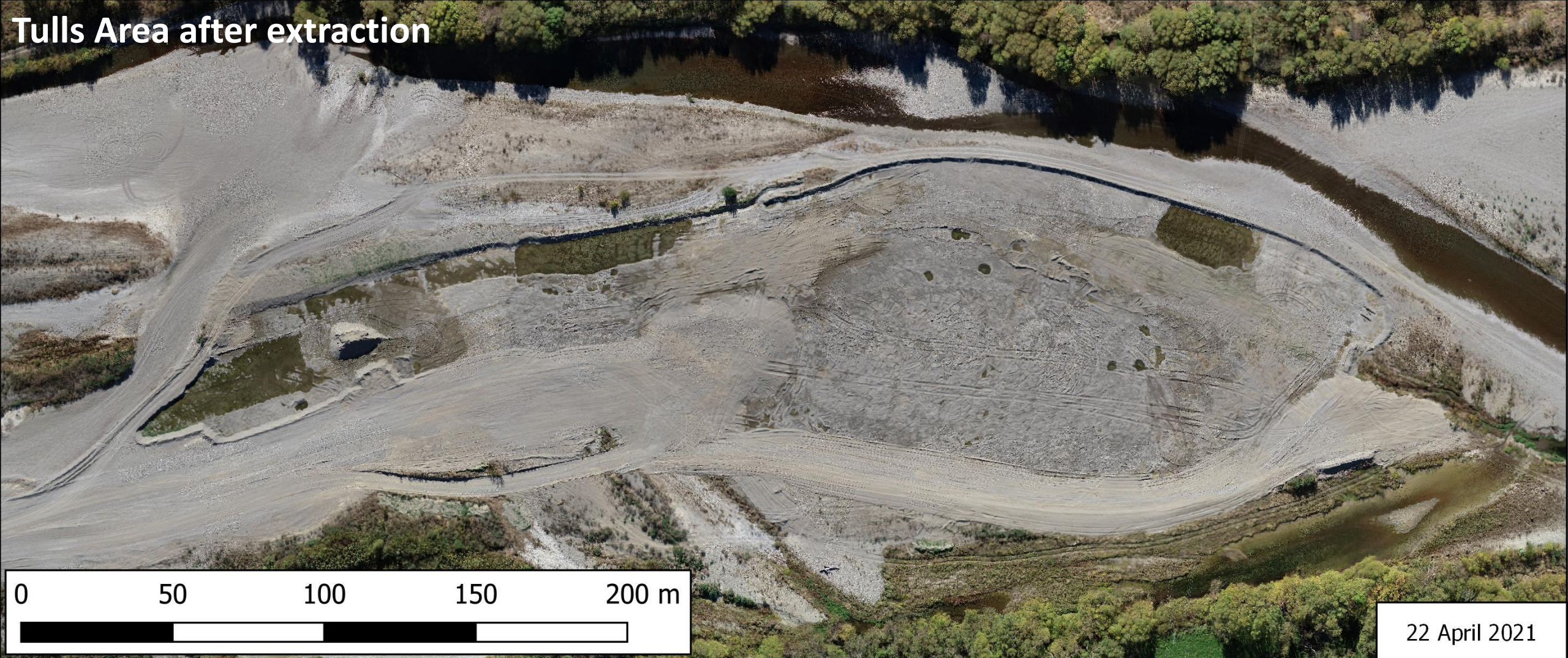
After flood



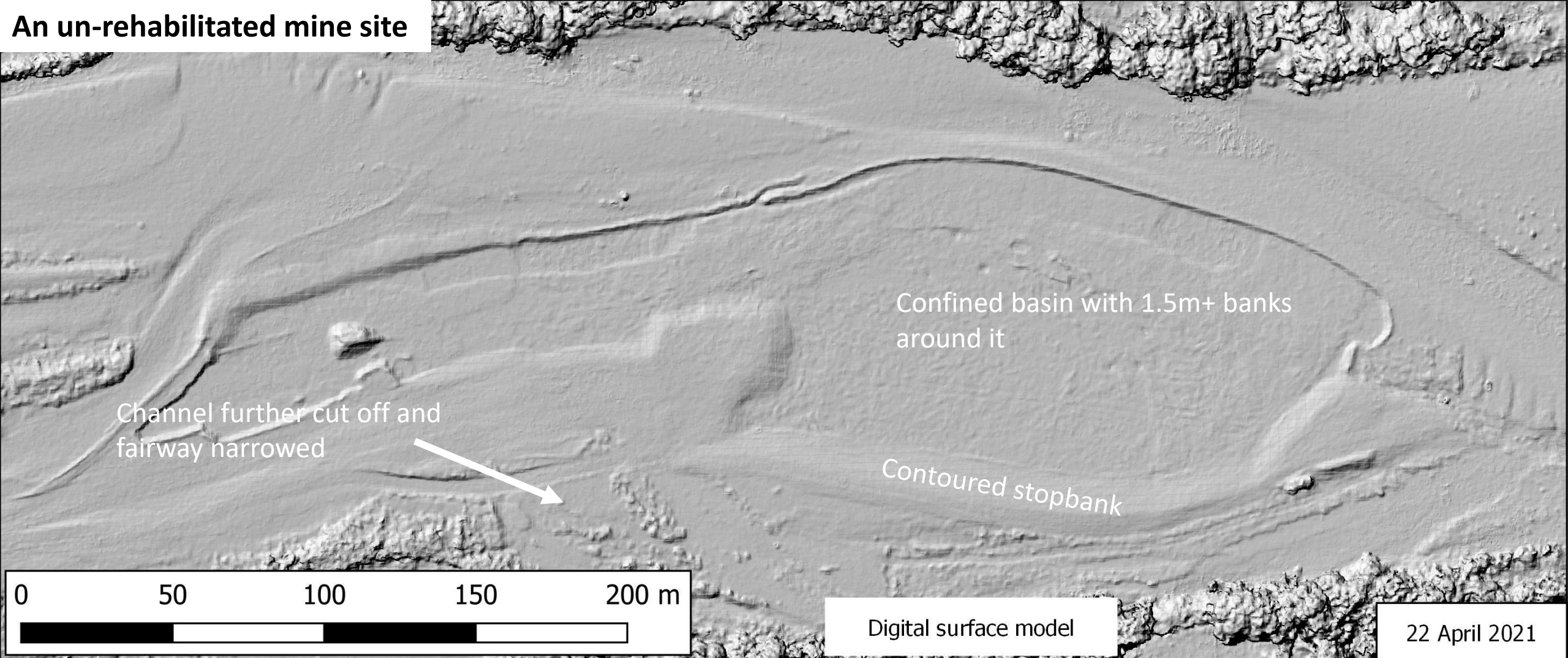
But – the major flood this year completely remade the geomorphology of the river, removed weed and left most surfaces sand-free. Smaller floods do not remove weeds and they drop sand on the islands.



- Superficially excellent bird nesting island – initially good flow around it but substrate too sandy and upstream gravel extraction cut off southern flow
- Cleared of weeds three years running by ARRG (ECan funding)
- Subject of a PhD study (Sanaz Safavian) on weed regeneration, DOC insect study and ARRG monitoring
- The above not notified of consent application, not consulted in consent process, not notified that consent was given



Started January 2021, completed March 2021, 35,000 m³ consented

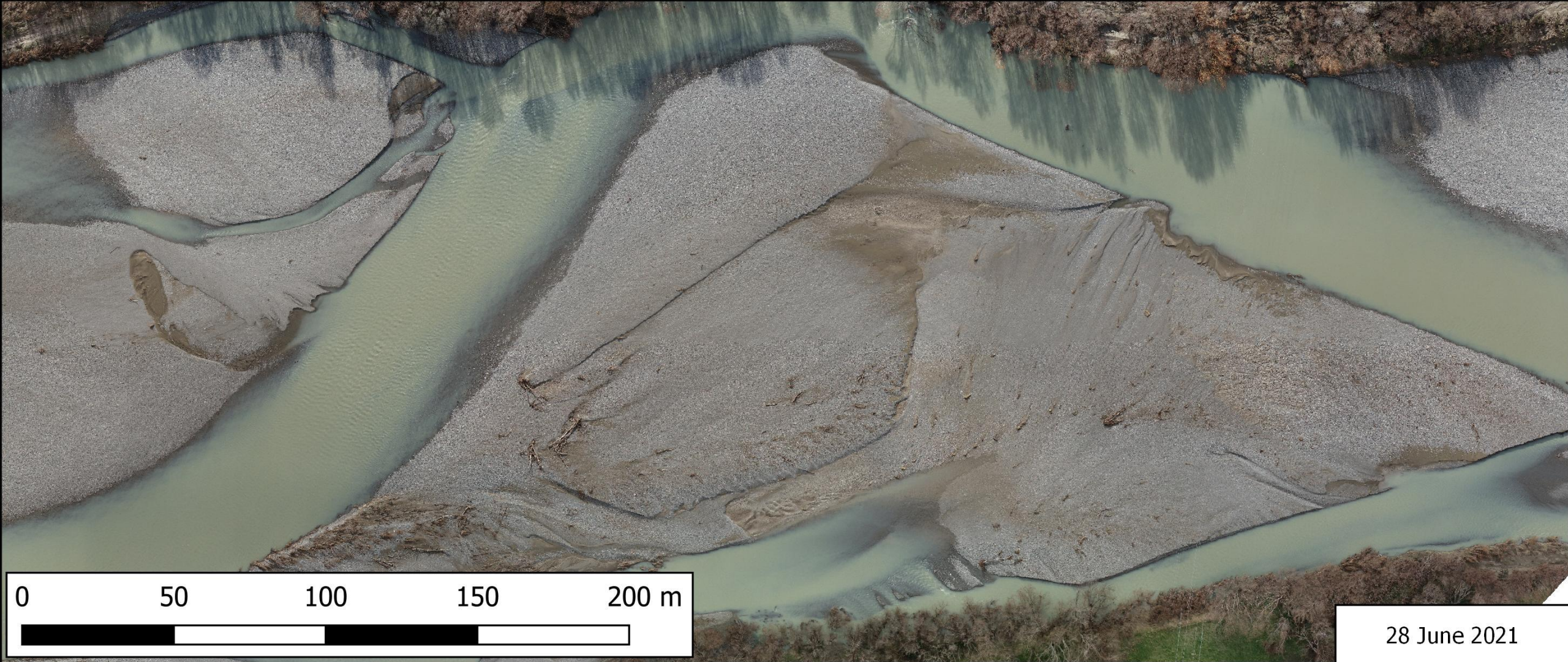


ECan says Canterbury braided rivers are iconic landscapes

Gravel extraction code of practice:

Site rehabilitation

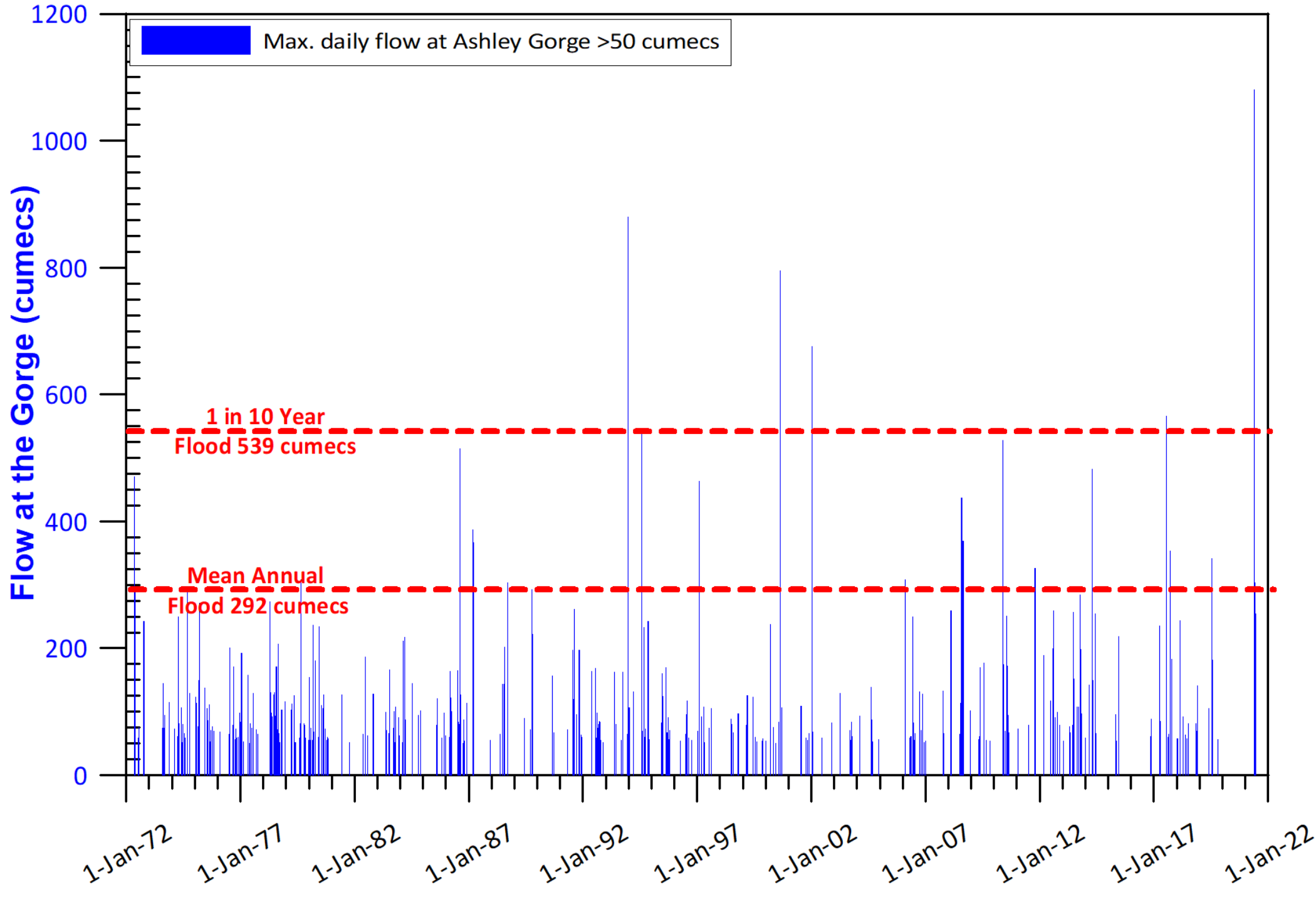
The area shall be restored to a state consistent with the **natural character of the riverbed** before any works occurred, unless the authorisation permits or requires environmental enhancement works to be carried out



But – the major flood this year completely remodeled the area and reinstated the island – 3m of gravel deposited in excavation

Ashley Flow at Gorge

A flood of approximately 1 in 10-year recurrence interval is needed to remodel the river and create new nesting habitat



Assessment of Environmental Effects for Gravel Extraction Consent Renewal – Ashley/Rakahuri River

✦ Prepared for

Taggart Earthmoving Ltd

✦ May 2020

In most parts of the world, this activity is known as instream mining

Presumably accepted by ECan as consent was given

Considered or done

- Bird disturbance
- Effects on fish
- Entry to water
- Stockpiling
- Sediment and dust discharge
- Bridge integrity

Not considered or done:

- Site descriptions
- Site visits??
- **Assessment of cumulative effects** – no knowledge shown of fragility of braided river environment and international scale endangerment of this. Gravel mining seems to be everywhere implicated
- **No detailed mining plan.** Method specified was different to that used in one site.
- **No rehabilitation detail**
- No knowledge shown of habitat requirements of birds
- No reference to ARRG reports

Reasons to consider cumulative impacts of gravel extraction

ECan reports say that:

- The Ashley has a relatively **low estimated annual supply of gravel** making its way down from the foothills. Volumes extracted are not replenished at the same rate.
- 2009 - A trend of degradation of the fairway which has accelerated markedly since the 1997 survey is evident from the survey record. In the period since 1997 degradation far exceeds the reported gravel extraction
- 2020 - The Ashley river has experienced a noticeable increase in gravel extraction since 2010 as a result of the Christchurch earthquakes, large scale subdivision development north of Christchurch and increased demand for roading and farming activities.
- 2020 - The trend taken from the survey data is that the mean bed level has continued to lower (as it has done at every survey since the 1960's). Real effort to remove the stored gravel (the volume sitting above the design/minimum bed level) has resulted in the **bed now sitting at the minimum bed level or below at most sections of the river.**
- 2020 - There are records of approximately **2 million m³** taken in total since 1993.

Extraction is halting due to flood requirements being met, but will it start again due to reshuffle downstream of gravel in the flood?

Where the river is too narrow a braided habit is impossible.

The major flood increased the width of the fairway, but did not increase the amount of braiding.

Is this partly a result of constriction and perhaps gravel extraction which change the nature of the river??



June 2021

Looking toward SH1 and the Ashley estuary

Recommendations for smaller rivers

The environment must be given much higher importance in river management.

- Trees should not be planted without careful environmental consideration
- Gravel extraction should go through a proper resource consent process considering site characteristics and cumulative impacts
- Much more emphasis must be placed on weed control
- In some places engineering work needs to be done to create braiding where it has previously been destroyed
- It should be recognized that these rivers are more fragile than the major ones, they are reworked much less often by floods and have less sediment supply
- Work of volunteer groups should be taken into account
- Work by the river engineers and foresters in the riverbeds should be subject to proper environmental oversight by river geomorphologists and ecologists.

Environment Canterbury have previously been presented with this material and their response has been very encouraging