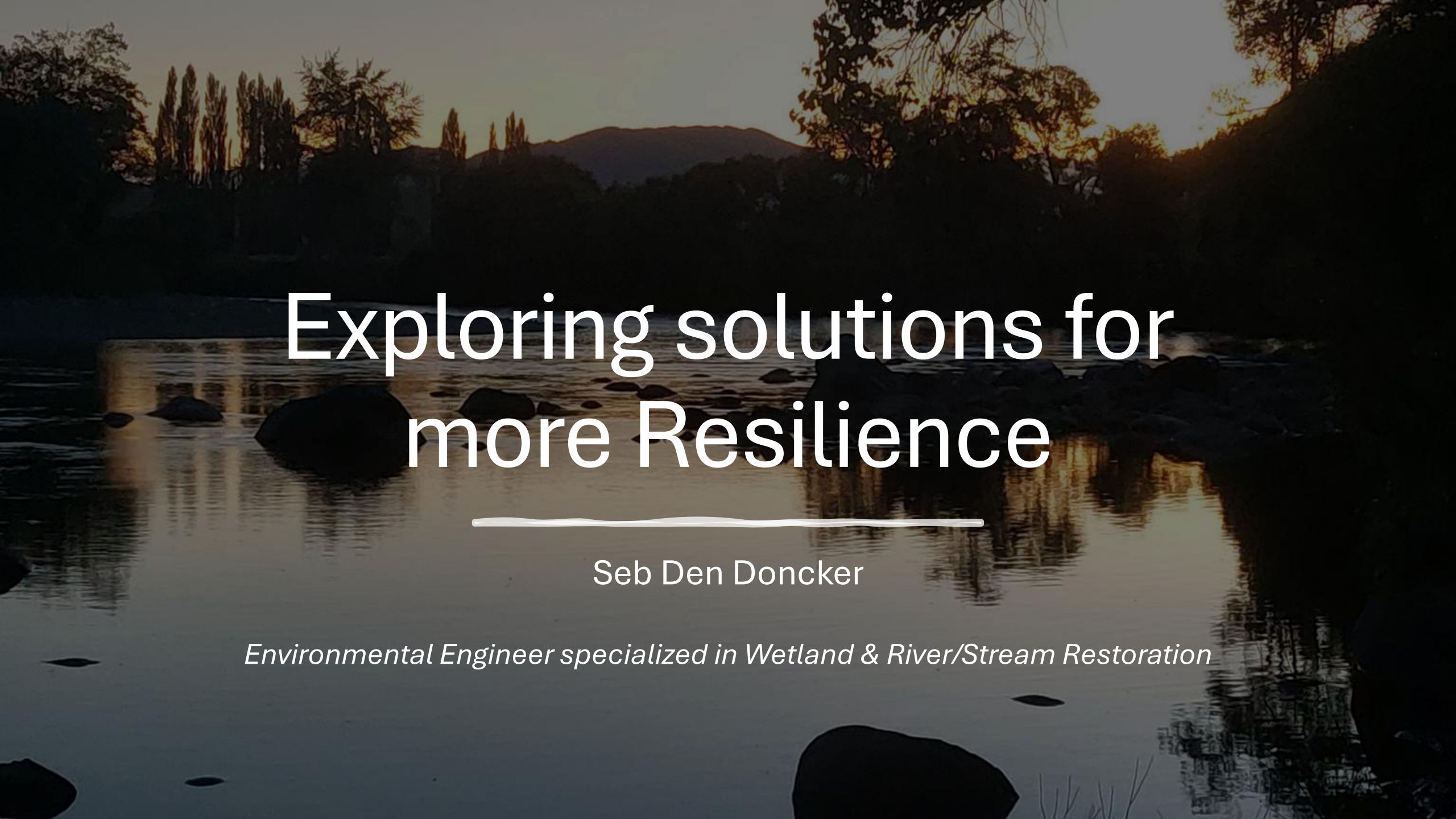


Exploring solutions for more Resilience

Seb Den Doncker

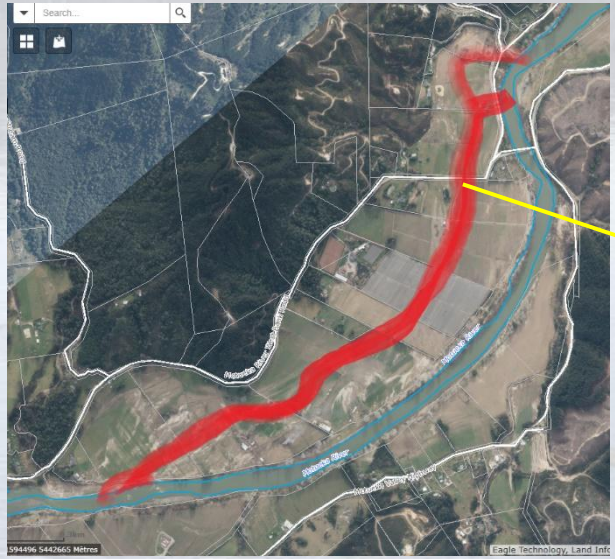
Environmental Engineer specialized in Wetland & River/Stream Restoration

1. Infrastructures in the flood plain – The Motueka downstream : A River who is naturally flooding his flood plain each 5 years!

   => how can we manage this ?

1. The Motueka : A River who is naturally flooding his flood plain each 5 years!
   => how can we manage this ?

   1.1 One solutions could be more room for the river and f.i. create *secondary channels*



TULL, N. et PASSALACQUA, P. Flood wave attenuation as a function of floodplain storage, secondary channel conveyance, and discharge. Water Resources Research, 2025, vol. 61, no 5, p. e2024WR038582.

WANG, Lihong, CUI, Shenghui, LI, Yuanzheng, et al. A review of the flood management: from flood control to flood resilience. Heliyon, 2022, vol. 8, no 11.

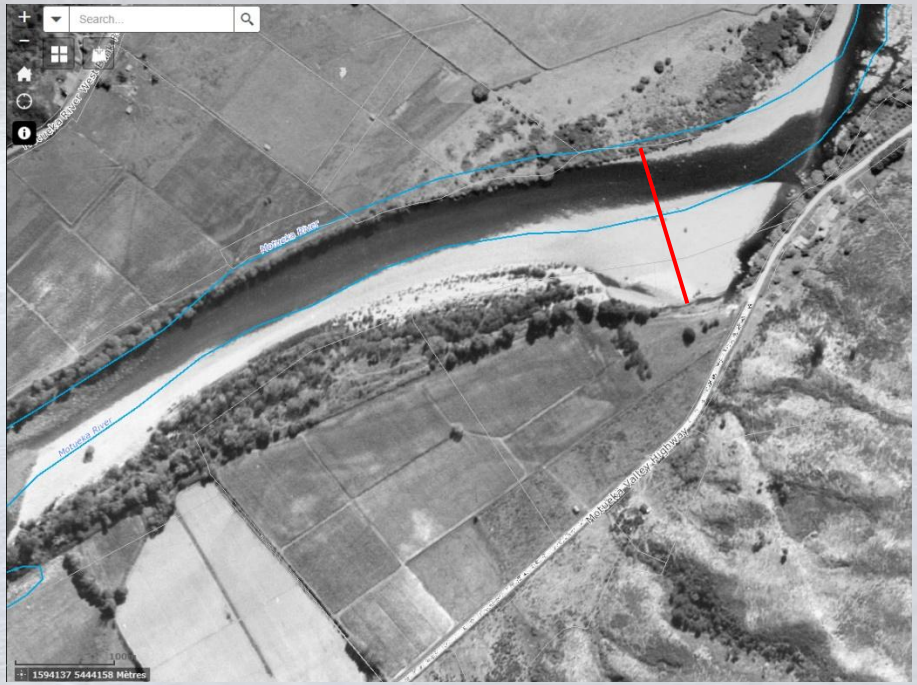
QUINN, Paul Francis, HEWETT, Caspar JM, WILKINSON, Mark E., et al. The role of runoff attenuation features (RAFs) in natural flood management. Water, 2022, vol. 14, no 23, p. 3807.

Exploring solutions for more Resilience
Seb Den Doncker

1. Infrastructures in the flood plain – The Motueka downstream : A River who is naturally flooding his flood plain each 5 years!

   => how can we manage this ?

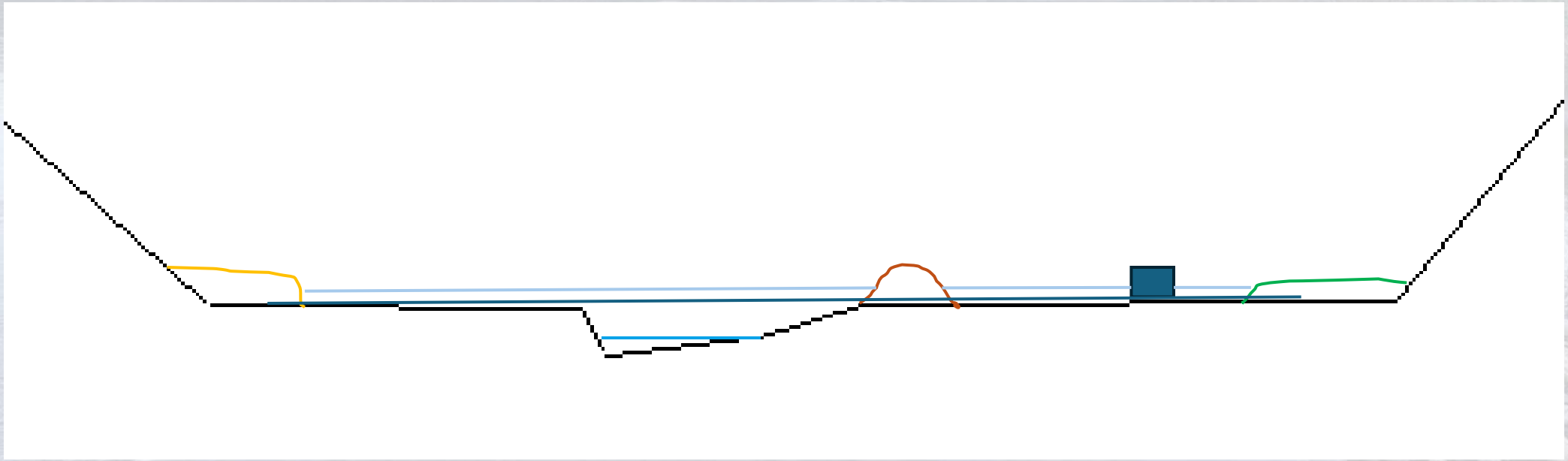
   1.2 One solutions could be more room for the river and f.i. ***stop*** narrowing the river bed



1. Infrastructures in the flood plain – The Motueka downstream : A River who is naturally flooding his flood plain each 5 years!

   => how can we manage this ?

   1.3 One solutions could be more room for the river and f.i. – stop building /backfilling in the flood plain



1. Infrastructures in the flood plain – The Motueka downstream : A River who is naturally flooding his flood plain each 5 years!

   => how can we manage this ? stop building /backfilling in the flood plain

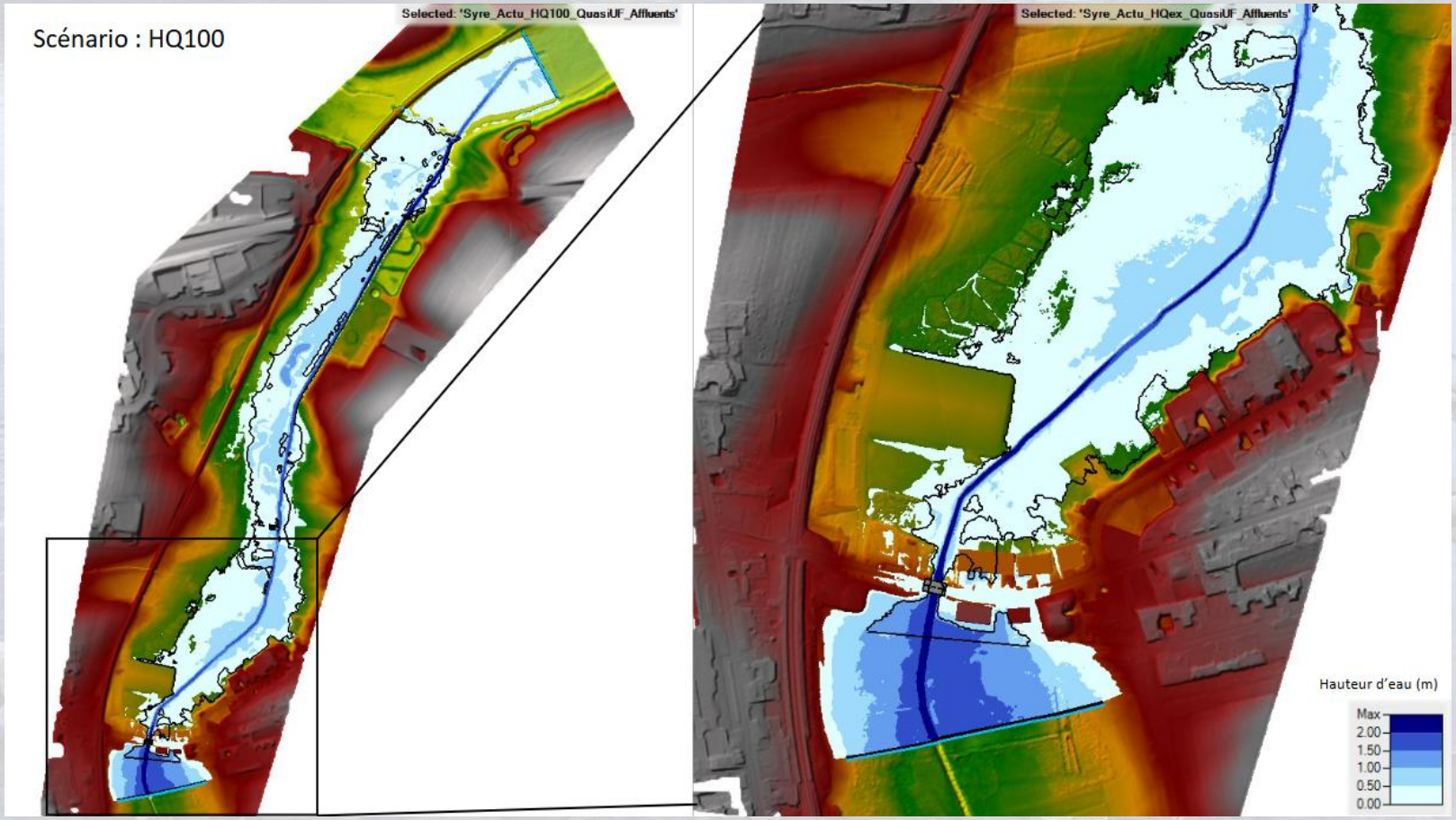
   1.4 Financial incentive : pay less tax or less rates when farmland is regularly flooded ?

Exploring solutions for more Resilience
Seb Den Doncker

1. Infrastructures in the flood plain – The Motueka downstream : A River who is naturally flooding his flood plain each 5 years!

   => how can we manage this ? stop building /backfilling in the flood plain

   1.5 stock water temporarily in specific areas : *temporary immersion areas*



2. But could we reduce peak flows working upstream ?

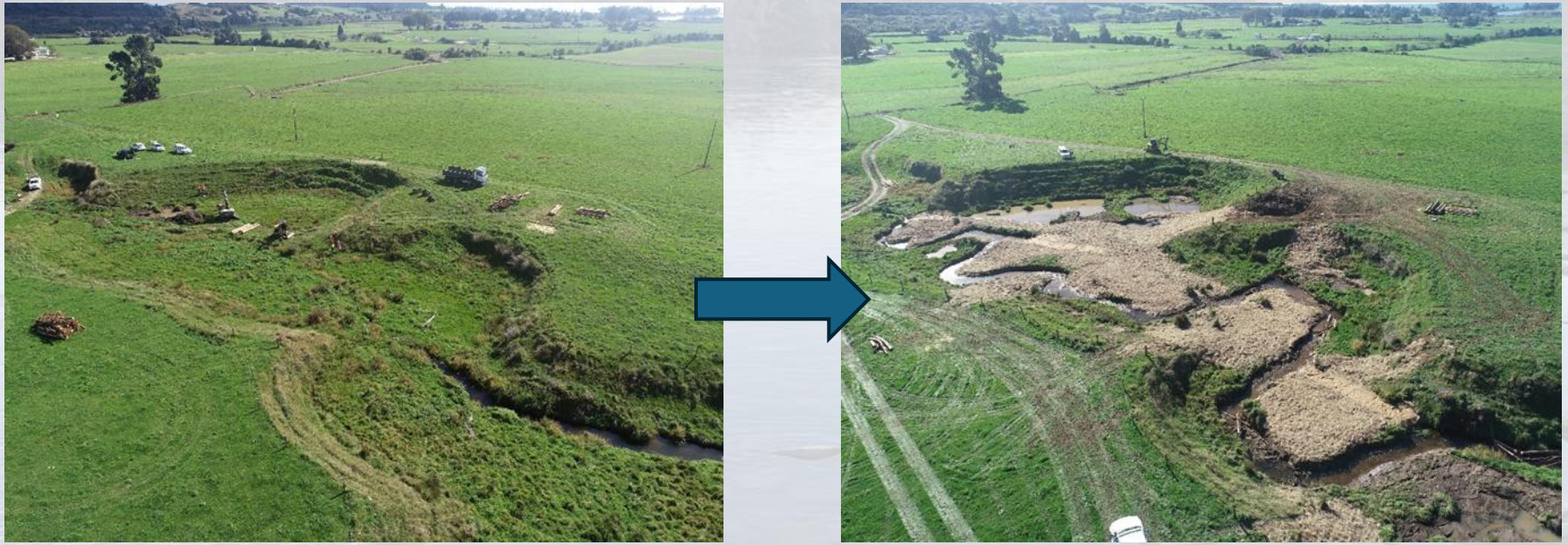
2.1 to decrease the peak flow, we can try to keep the water upstream as much as we can: restore the sponge effect, the soil structure & wetlands …

2. But could we reduce peak flows working upstream ?

2.1 to decrease the peak flow, we can try to keep the water upstream as much as we can: restore the sponge effect, the soil structure & wetlands …

2. But could we reduce peak flows working upstream ?

2.1 to decrease the peak flow, we can try to keep the water upstream as much as we can: restore the sponge effect, the soil structure & wetlands …



ROBERTS, Martyn T., GERIS, Josie, HALLETT, Paul D., et al. Mitigating floods and attenuating surface runoff with temporary storage areas in headwaters. Wiley Interdisciplinary Reviews: Water, 2023, vol. 10, no 3, p. e1634.

WU, Yanfeng, SUN, Jingxuan, HU, Boting, et al. Wetland-based solutions against extreme flood and severe drought: Efficiency evaluation of risk mitigation. Climate risk management, 2023, vol. 40, p. 100505.

2. But could we reduce peak flows working upstream ?

2.1 to decrease the peak flow, we can try to keep the water upstream as much as we can: restore the sponge effect, the soil structure & wetlands …

=> SHADE !

=> Wetland is not a “carp pond”

2. But could we reduce peak flows working upstream ?

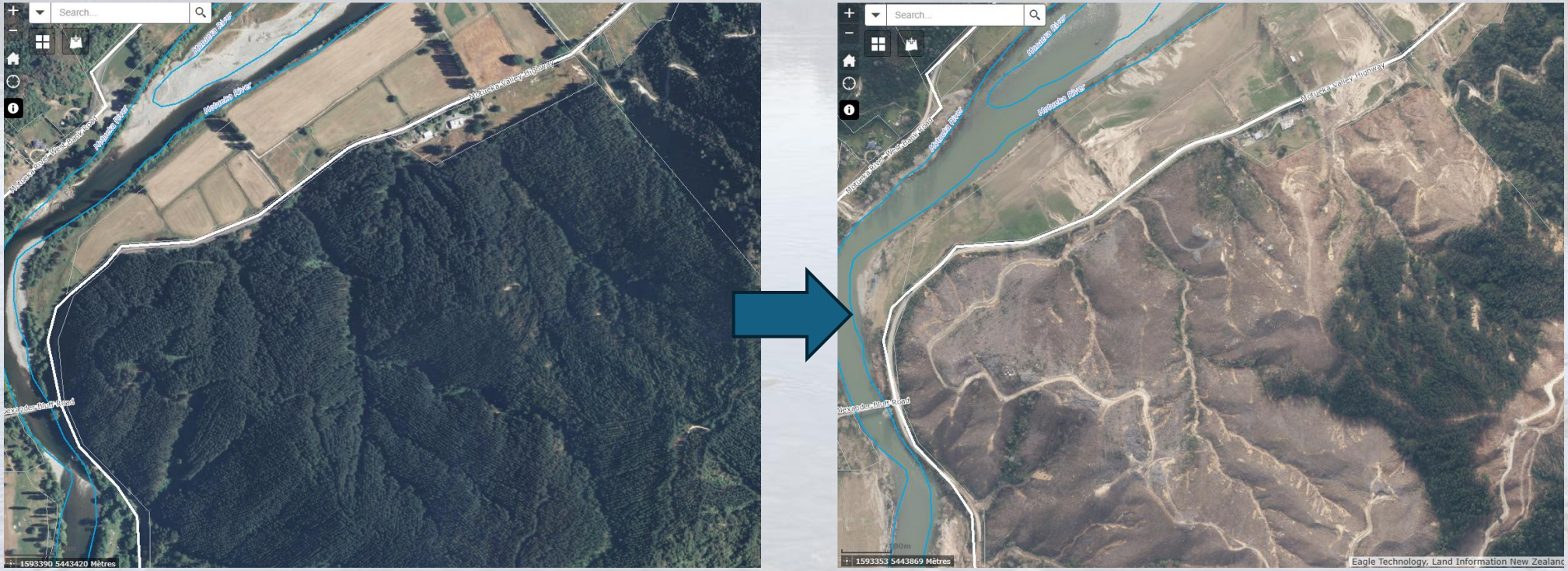
2.2 to decrease the peak flow, we can try to keep the water upstream as much as we can: restore the sponge effect, the upper catchments soil structure & wetlands …

2. But could we reduce peak flows working upstream ?

2.2 to decrease the peak flow, we can try to keep the water upstream as much as we can: restore the sponge effect, the upper catchments soil structure & wetlands …

2. But could we reduce peak flows working upstream ?

2.2 to decrease the peak flow, we can try to keep the water upstream as much as we can: restore the sponge effect, the upper catchments soil structure & wetlands …



2. But could we reduce peak flows working upstream ?

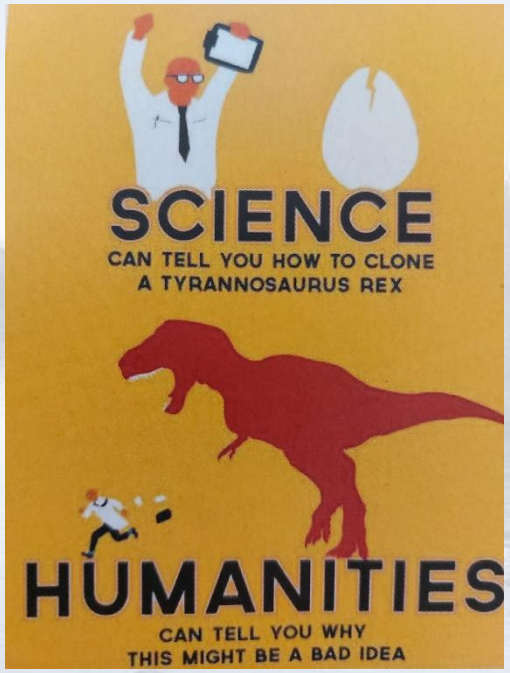
2.2 to decrease the peak flow, we can try to keep the water upstream as much as we can:
restore the sponge effect, the upper catchments soil structure & wetlands …

Create bigger Buffer zones, avoid to plant on sensitive land,…
&
Restore the water cycle : keep the moisture in the soil – increase infiltration, decrease runoff -…

Exploring solutions for more Resilience
Seb Den Doncker

2. But could we reduce peak flows working upstream ?

2.3 more references



OYARZUN, C. E. et PEÑA, L. Soil erosion and overland flow in forested areas with pine plantations at coastal mountain range, central Chile. *Hydrological Processes*, 1995, vol. 9, no 1, p. 111-118.

MARDEN, Michael, ROWAN, Donna, WATSON, Alex, et al. Effect of changes in forest water balance and inferred root reinforcement on landslide occurrence and sediment generation following Pinus radiata harvest on Tertiary terrain, eastern North Island, New Zealand. New Zealand Journal of Forestry Science, 2023, vol. 53.

BELLINGHAM, P. J., ARNST, E. A., CLARKSON, B. D., et al. The right tree in the right place? A major economic tree species poses major ecological threats. Biological Invasions, 2023, vol. 25, no 1, p. 39-60.

WATT, Michael S., HOLDAWAY, Andrew, CAMARRETTA, Nicolò, et al. Mapping Windthrow Risk in Pinus radiata Plantations Using Multi-Temporal LiDAR and Machine Learning: A Case Study of Cyclone Gabrielle, New Zealand. Remote Sensing, 2025, vol. 17, no 10, p. 1777.

...

3. The issues with a constrained channel

=> more riverbank protection, less room for the river…the river will start to dig the summer channel

INCISION => more riverbank unsalability , more maintenance, more cost, less biodiversity & less resilience

3. The issues with a constrained channel

=> more riverbank protection, less room for the river…not always easy and usually expensive

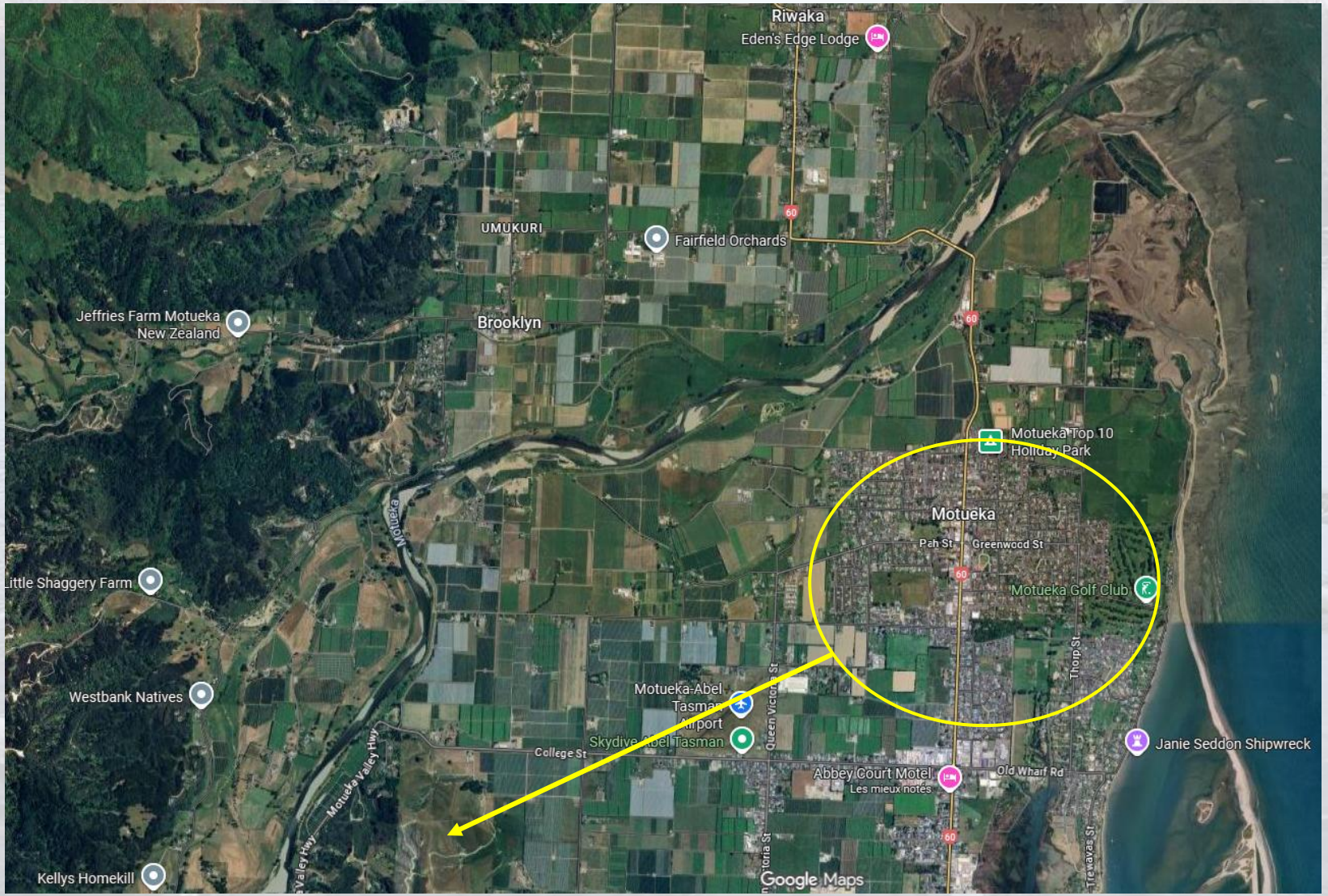
3. The issues with a constrained channel

=> more riverbank protection, less room for the river…

3.1 Move the road and not the river ?

4. The issues with assets in a flood plain

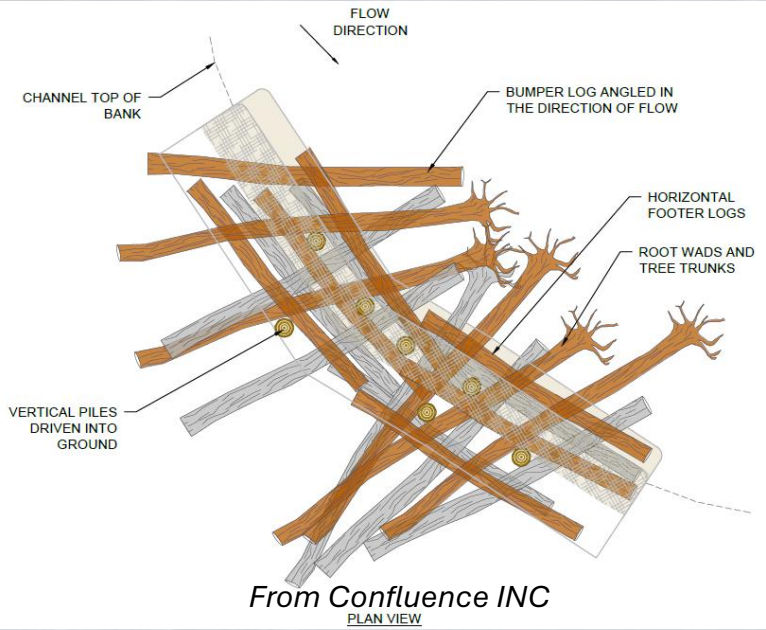
4.1 maybe need a plan to some other assets out of a flooding area (+sea level rise risk)



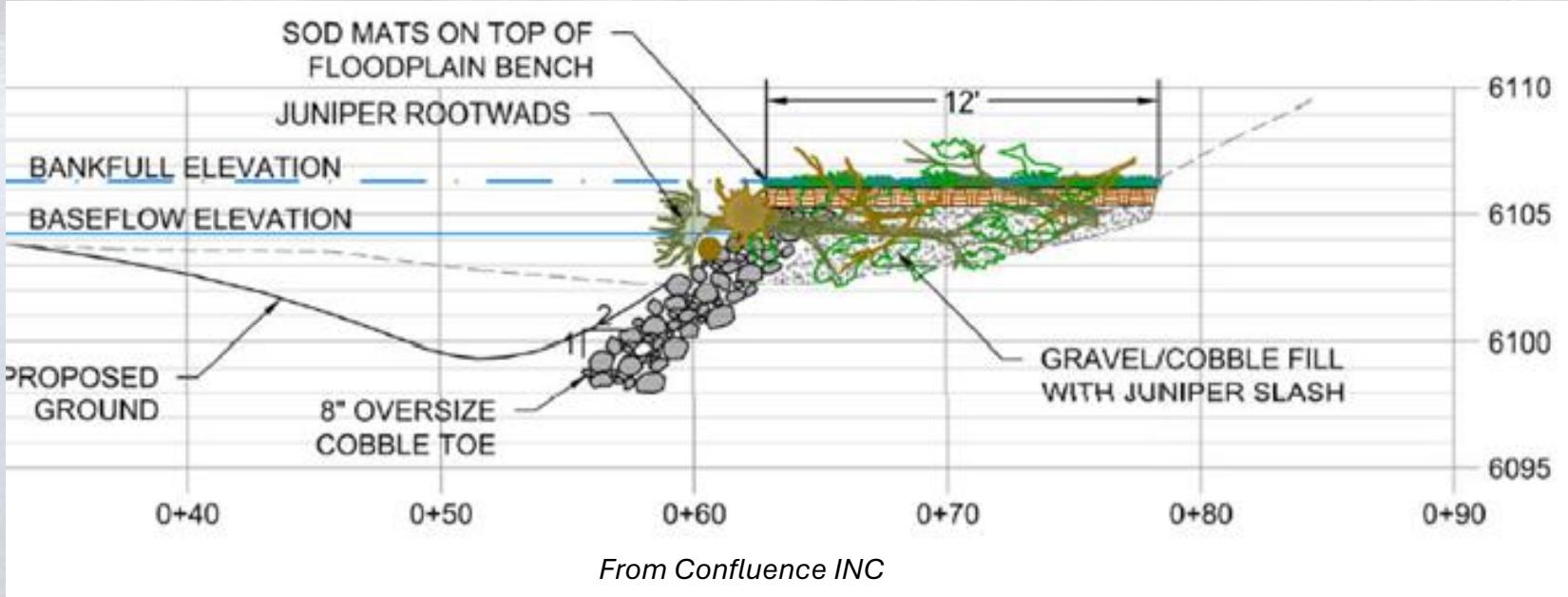
5. The issues with a constrained channel

5.1 some alternatives to rockwalls

Mitigation process : Nature Based Solutions (NBS) for riverbank protection



From Confluence INC



From Confluence INC

5. The issues with a constrained channel

5.1 Mitigation process : Nature Based Solutions (NBS) for riverbank protection

5. The issues with a constrained channel

5.1 some alternatives to rockwalls

Is it a drain or a river ?

The WCO, art 9 said:

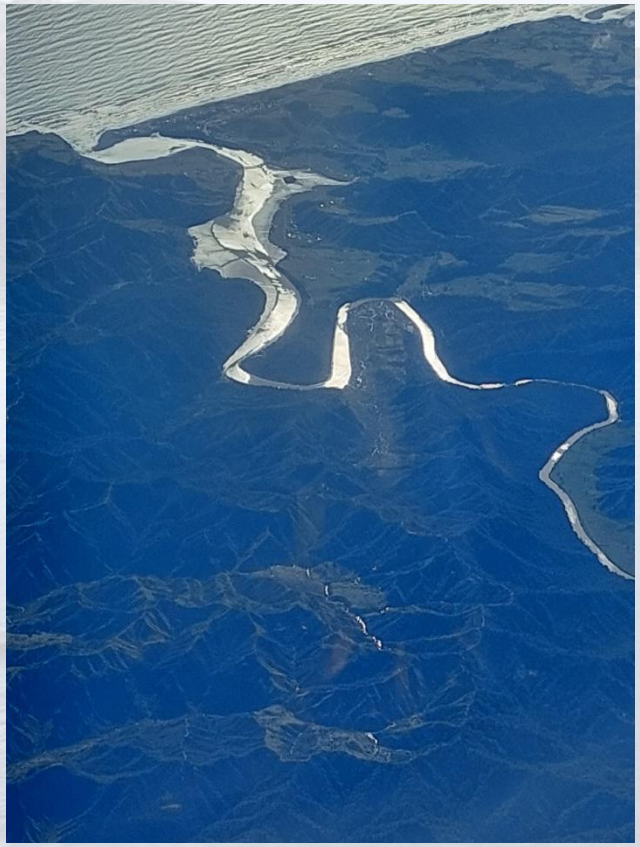
Restrictions on alterations of river flows and form
No resource consent may be granted or rule included in a regional plan that—

(a)**will cause the material alteration of the channel cross-section, meandering pattern, and braided river channel characteristics of the form of any river specified in Schedule 2**; or

(b)…

6. Global understanding – acting locally

6.1 gravel mining & impact on the estuary



GAILLOT, S. et PIEGAY, H. Impact of gravel-mining on stream channel and coastal sediment supply: example of the Calvi Bay in Corsica (France). *Journal of Coastal Research*, 1999, p. 774-788.

6. Global understanding – acting locally

6.2 gravel mining & issues related

Should we extract (more) gravel out to manage flooding ?

On a 270 meters flood plain, a flood 2700m3/s (1%AEP flood Motueka River downstream) increase in theory the level of the water vertically of 10 meters at 1m/s (water velocity)

If you dug 8m3 for each linear meter of river (800 m3/100m linear of River – 2000 tons!),

you decrease the water level of about 3 cm maximum in 1% AEP flood

Exploring solutions for more Resilience
Seb Den Doncker

6. Global understanding – acting locally

6.2 gravel mining & issues related

Should we extract (more) gravel out to manage flooding ?

=> Usually no as the river/estuary needs the gravel and extracting/mining the gravel is:

- ❑ Most of the time ineffective (especially for big floods)
- ❑ Create other issues like incision, erosion & bank instability => costly for the community!
- ❑ Destroy the ecosystem

FULLER, Ian C., BASHER, Les R., et HICKS, D. Murray. Towards understanding river sediment dynamics as a basis for improved catchment, channel, and coastal management: the case of the Motueka catchment, Nelson, New Zealand. *International journal of river basin management*, 2014, vol. 12, no 3, p. 175-192.

KONDOLF, G. Mathias. Geomorphic and environmental effects of instream gravel mining. *Landscape and Urban planning*, 1994, vol. 28, no 2-3, p. 225-243

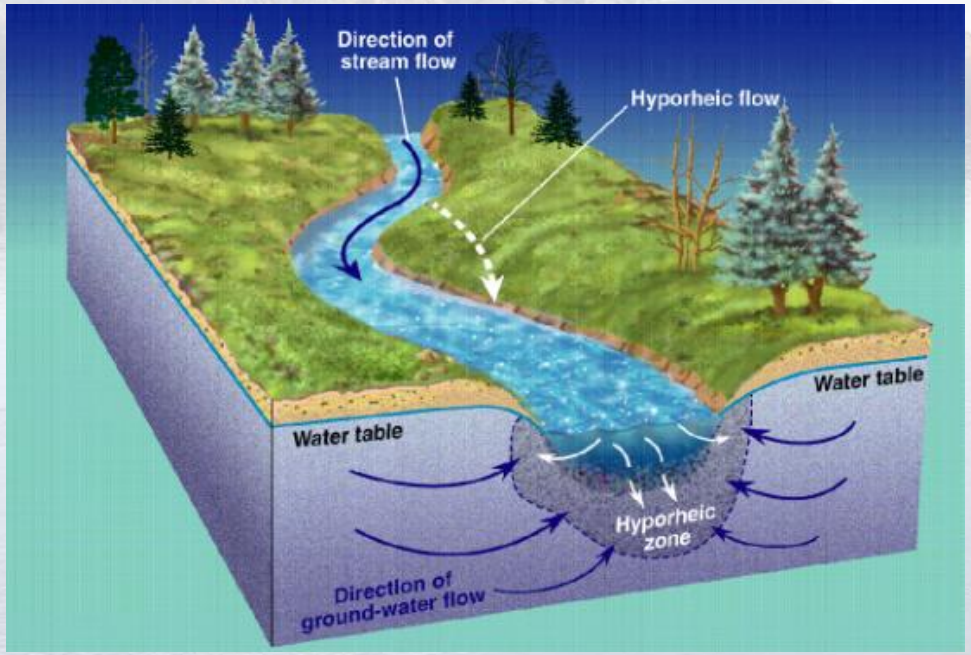
SURIAN, Nicola et RINALDI, Massimo. Morphological response to river engineering and management in alluvial channels in Italy. *Geomorphology*, 2003, vol. 50, no 4, p. 307-326.

7. Why keep a meandering river or stream ?

Extreme event : not only floods…but also droughts

7. Why keep a meandering river or stream ?

7.1 Extreme event : not only floods…but also droughts : keep the natural river shape for a cool river



Bakke, P. D., Hrachovec, M., & Lynch, K. D. (2020). Hyporheic Process Restoration : Design and Performance of an Engineered Streambed. Water, 12(2), Article 2. https://doi.org/10.3390/w12020425

Boulton, A. J. (2000). The functional role of the hyporheos. Internationale Vereinigung Für Theoretische Und Angewandte Limnologie: Verhandlungen. https://www.tandfonline.com/doi/abs/10.1080/03680770.1998.11901203

8. Why keep a meandering river or stream ?

8.1 Extreme event : not only floods…but also droughts : keep a cool river

Dramatic example from France (Loue river) : temperature increase, algae and cyanob. developed, less oxygen, More pollutants concentration, more disease, fish mortality…

source photo : Bastien Fournier (Bastoc)

8. Why keep a meandering river or stream ?

8.1 Extreme event : not only floods…but also droughts : keep a cool river

9. Knowledge is key – avoid more degradations when repairing Rivers & Streams

9.1 Organize workshops, conferences and specific training for contractors

10. More understanding, more respect …Our rivers need some TLC…