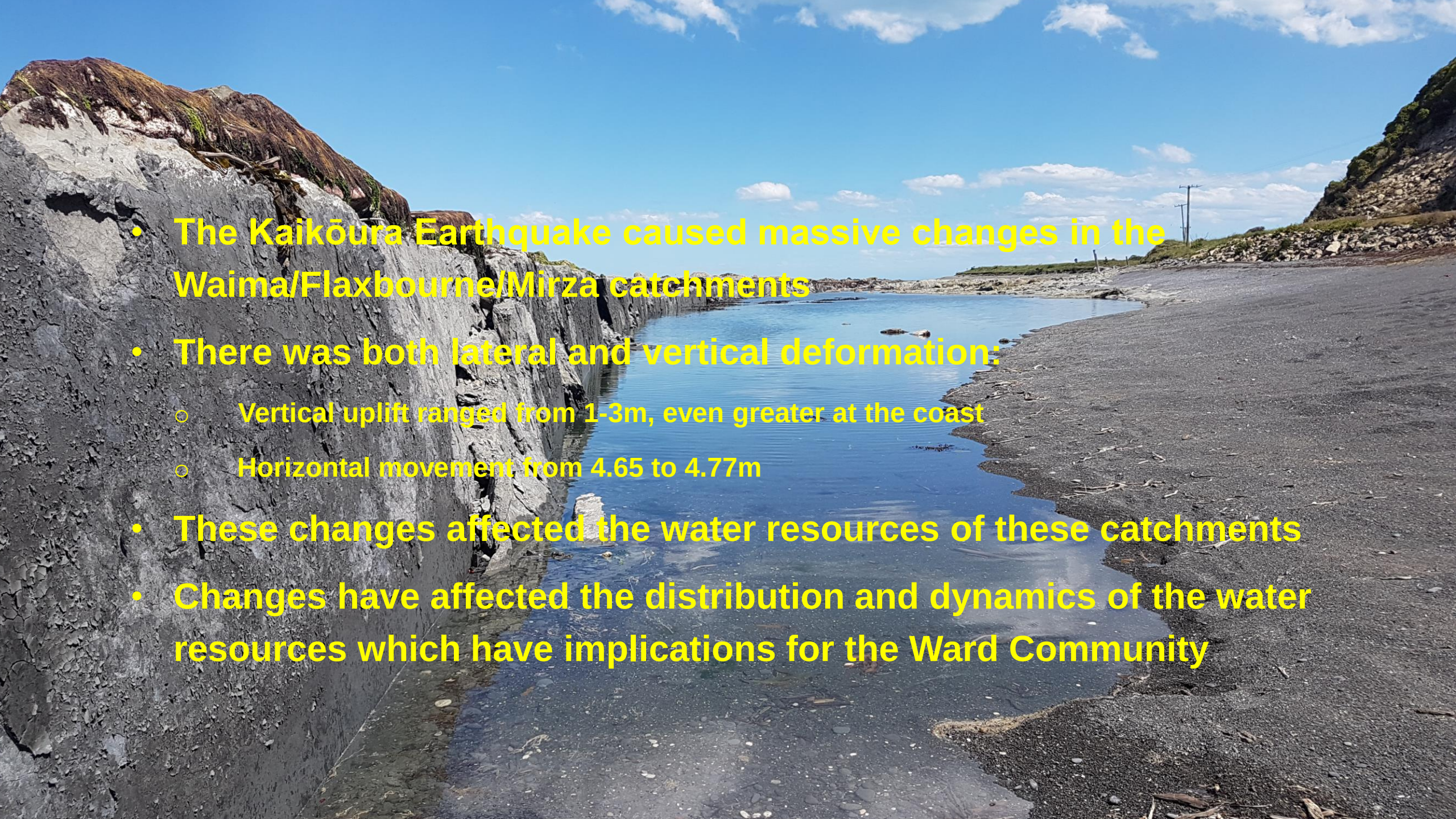
KAIKŌURA EARTHQUAKE
WATER RESOURCE IMPACTS
PROJECT SUMMARY

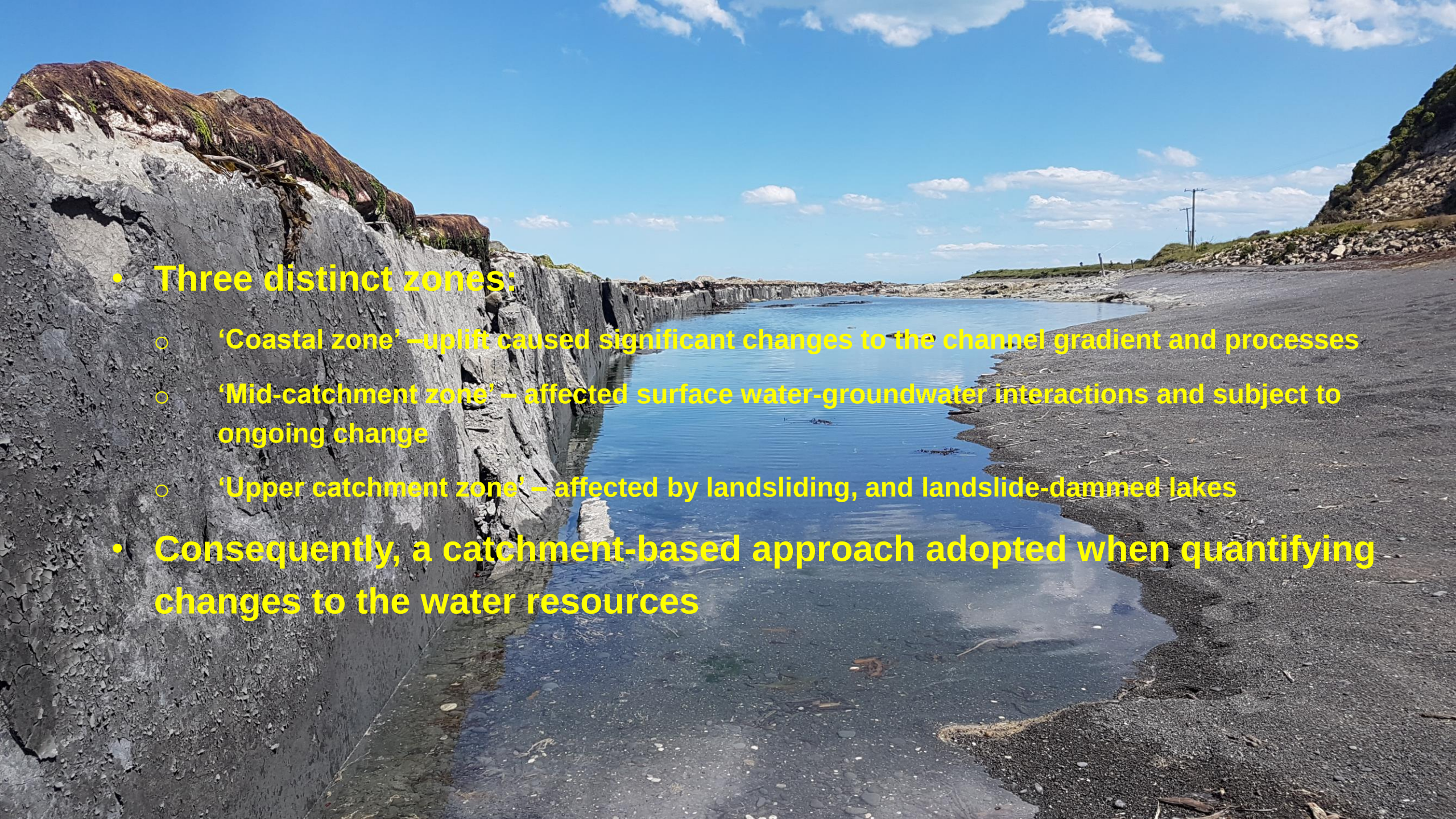
Ministry for Primary Industries
Manatū Ahu Matua

MARLBOROUGH RESEARCH CENTRE
Te Rito Hiranga o Wairau

wsp

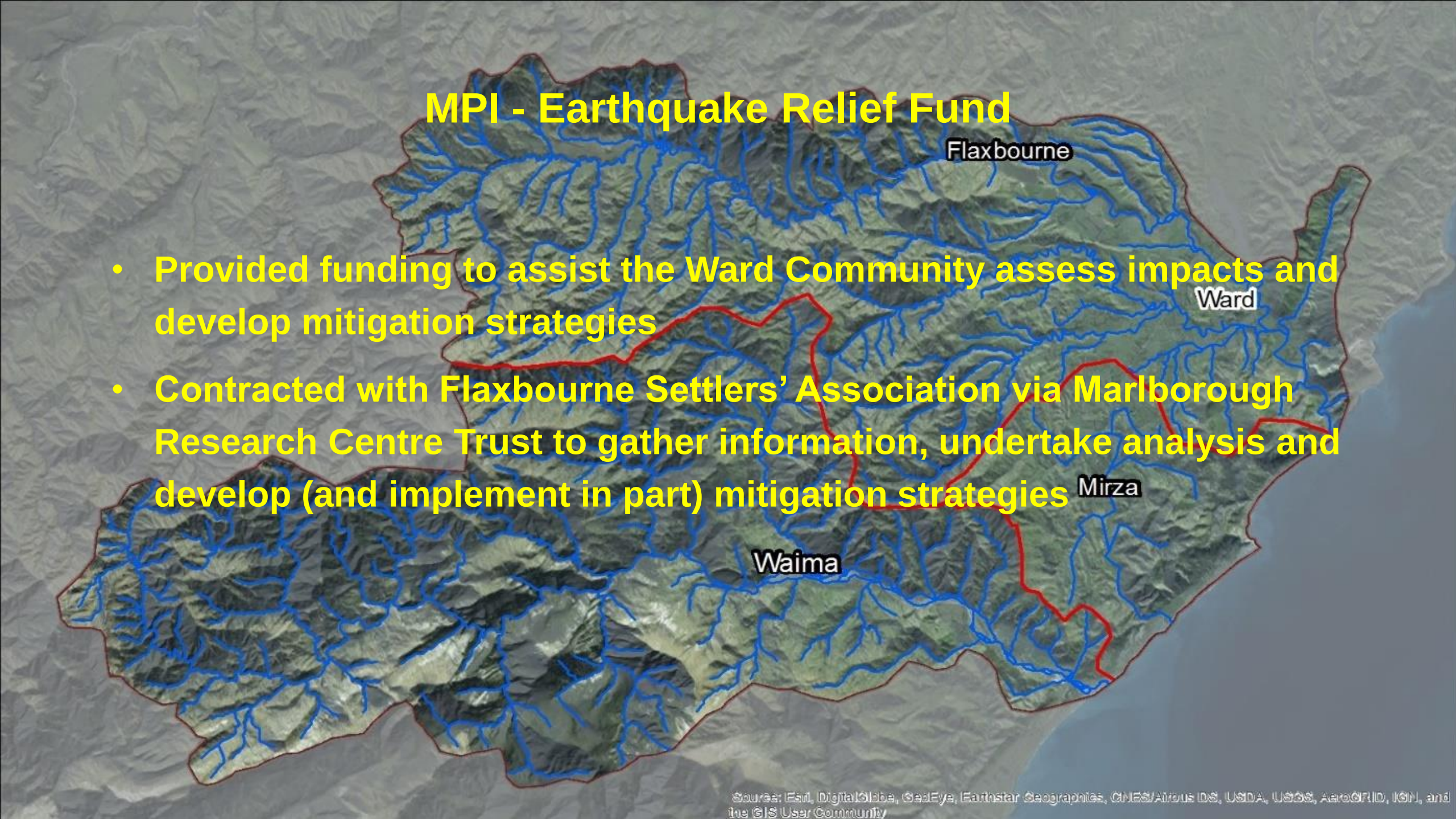


- The Kaikōura Earthquake caused massive changes in the Waima/Flaxbourne/Mirza catchments
- There was both lateral and vertical deformation:
  - Vertical uplift ranged from 1-3m, even greater at the coast
  - Horizontal movement from 4.65 to 4.77m
- These changes affected the water resources of these catchments
- Changes have affected the distribution and dynamics of the water resources which have implications for the Ward Community

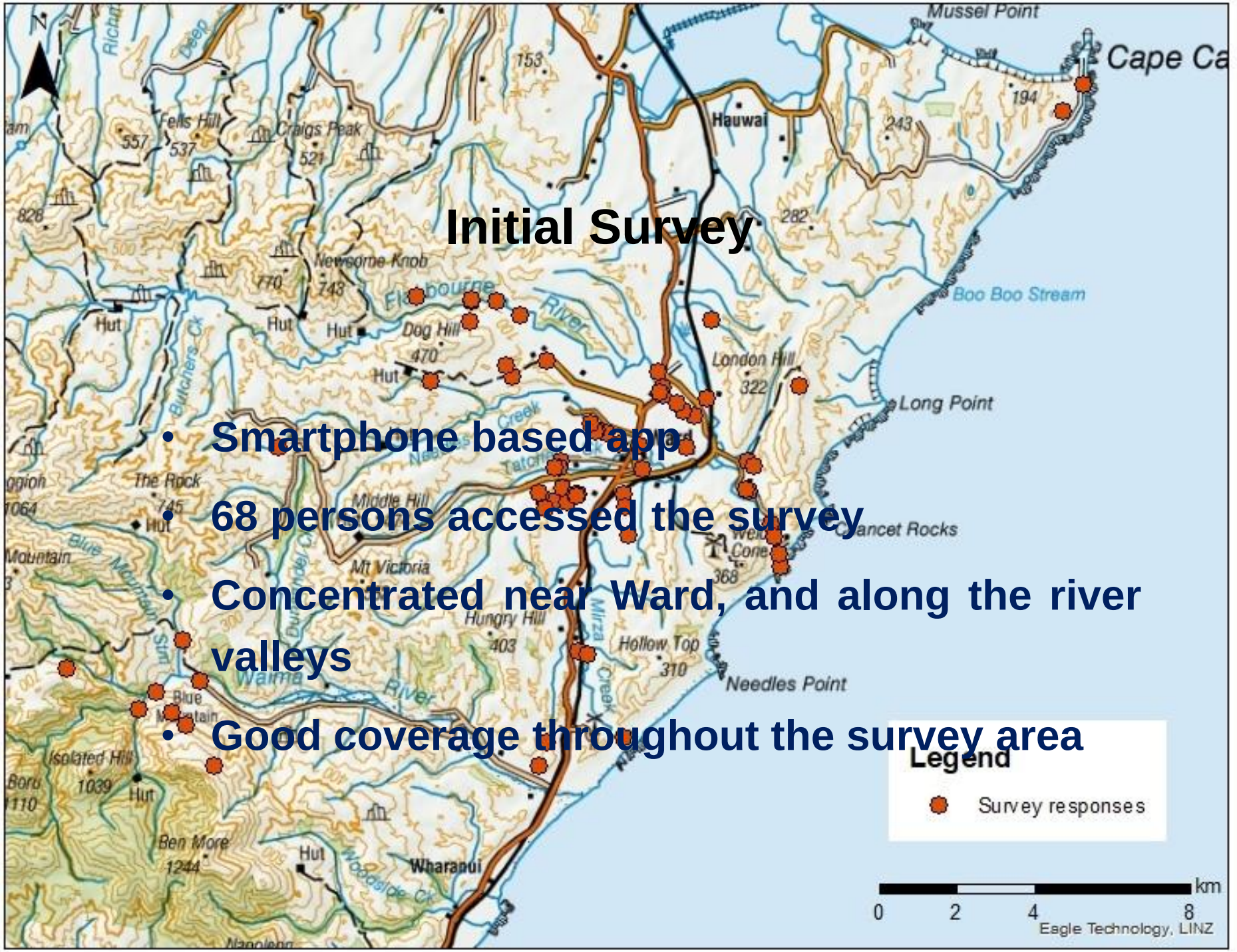


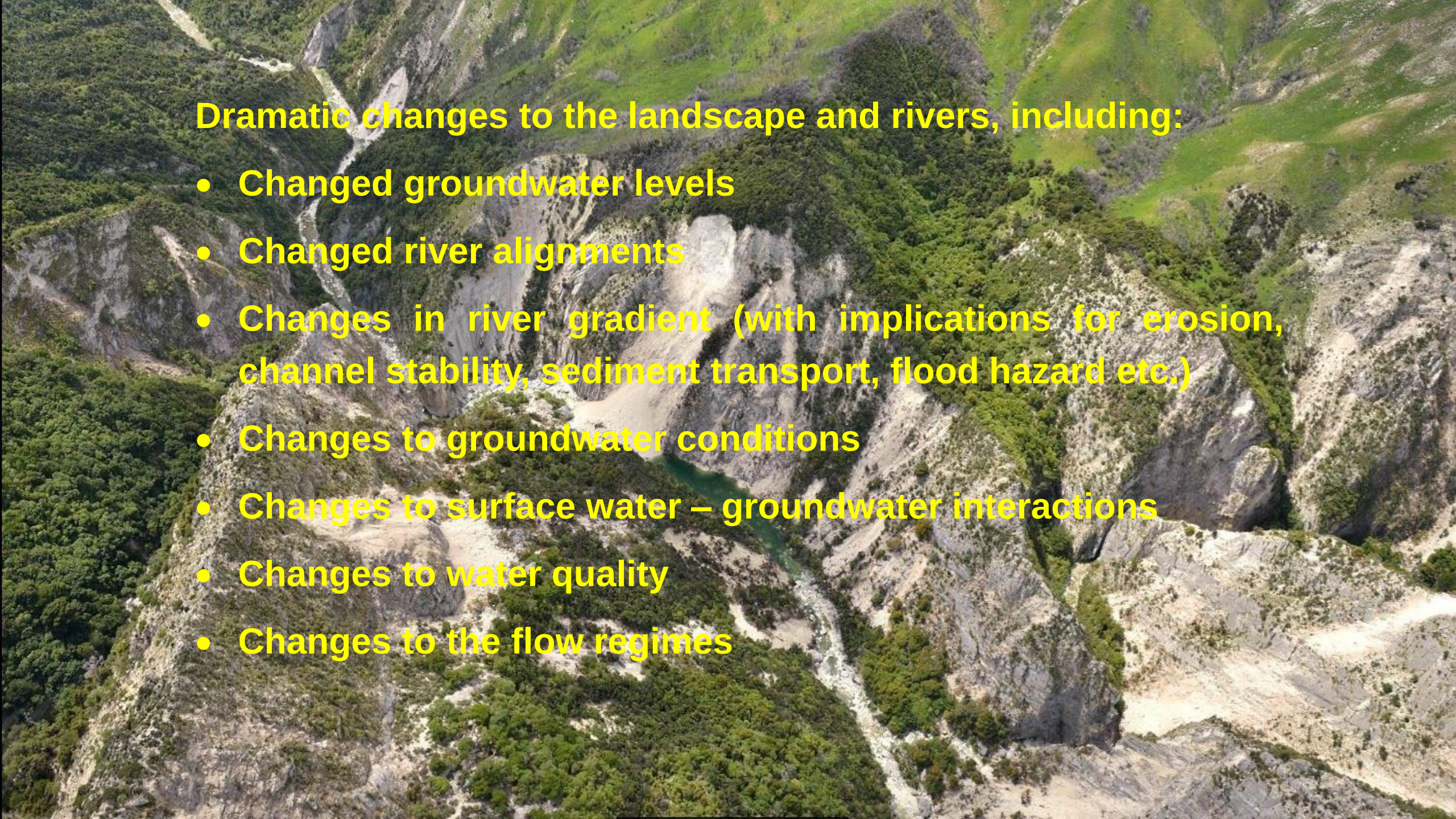
- Three distinct zones:
  - ‘Coastal zone’ –uplift caused significant changes to the channel gradient and processes
  - ‘Mid-catchment zone’ – affected surface water-groundwater interactions and subject to ongoing change
  - ‘Upper catchment zone’ – affected by landsliding, and landslide-dammed lakes
- Consequently, a catchment-based approach adopted when quantifying changes to the water resources

MPI - Earthquake Relief Fund



- Provided funding to assist the Ward Community assess impacts and develop mitigation strategies
- Contracted with Flaxbourne Settlers' Association via Marlborough Research Centre Trust to gather information, undertake analysis and develop (and implement in part) mitigation strategies


Initial Survey
• Smartphone based app
• 68 persons accessed the survey
• Concentrated near Ward, and along the river valleys
• Good coverage throughout the survey area
Legend
Survey responses
km
0
2
4
8
Eagle Technology, LINZ
Mussel Point
Cape Ca
Hauwai
Fells Hill
Craigs Peak
Newsome Knob
Dog Hill
Hut
Boo Boo Stream
London Hill
Long Point
The Rock
Middle Hill
Mt Victoria
Blue Mountain
Hungry Hill
Hollow Top
Needles Point
Isolated Hill
Ben More
Wharanui
Flaxbourne River
Waima River



Dramatic changes to the landscape and rivers, including:

- Changed groundwater levels
- Changed river alignments
- Changes in river gradient (with implications for erosion, channel stability, sediment transport, flood hazard etc.)
- Changes to groundwater conditions
- Changes to surface water – groundwater interactions
- Changes to water quality
- Changes to the flow regimes

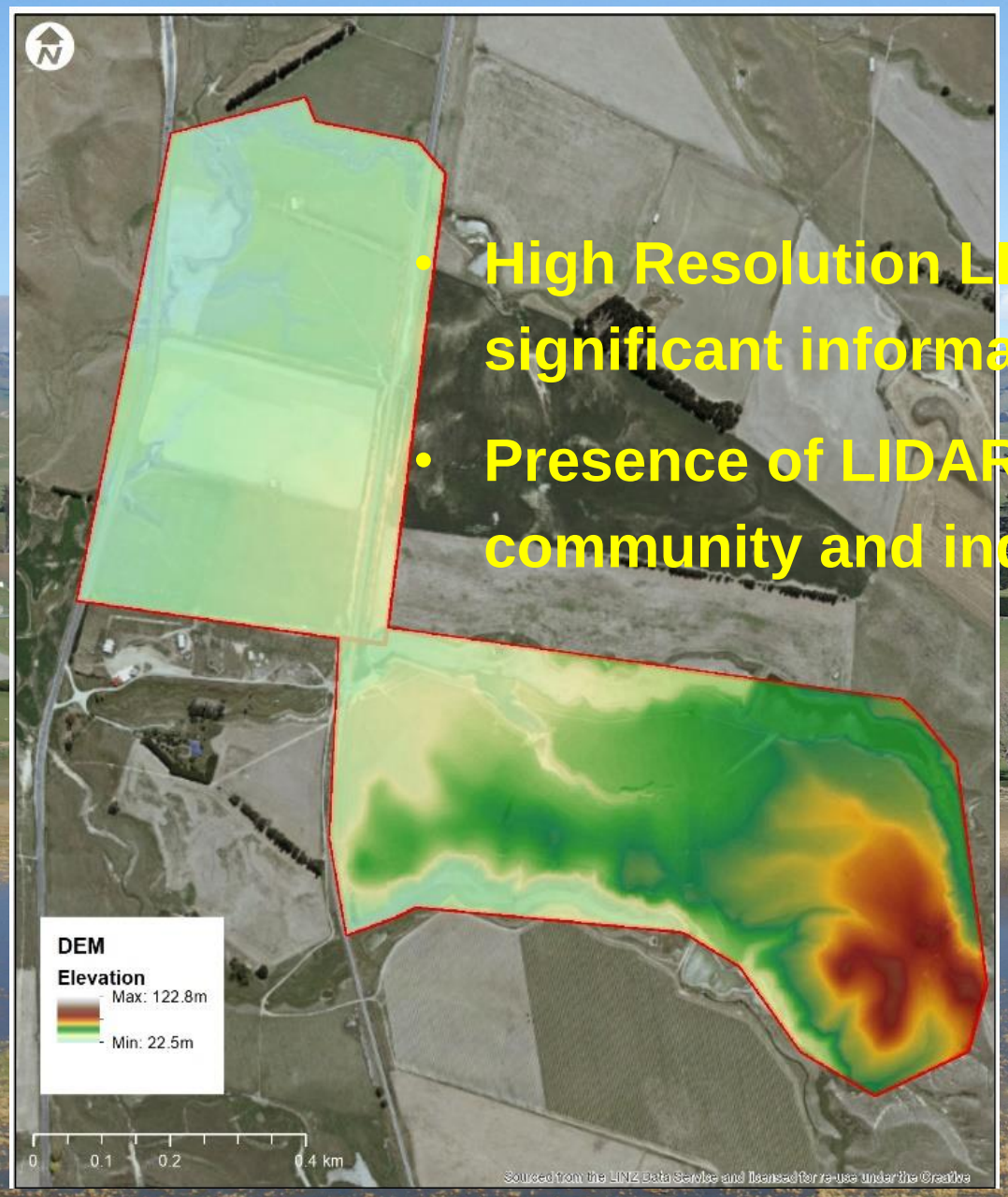
Reports & Analyses

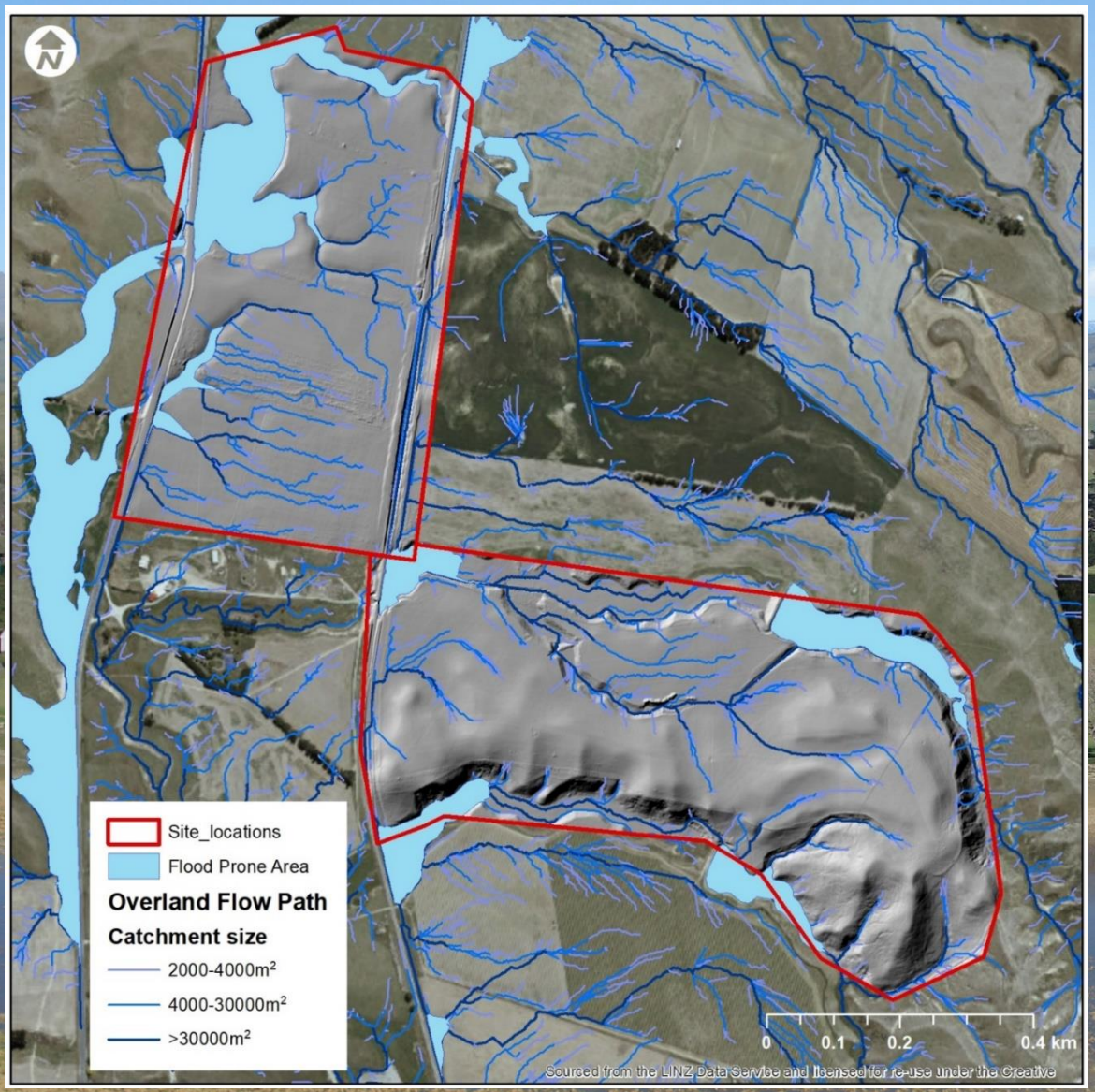
The following reports produced and available on the MRC website www.mrc.org.nz

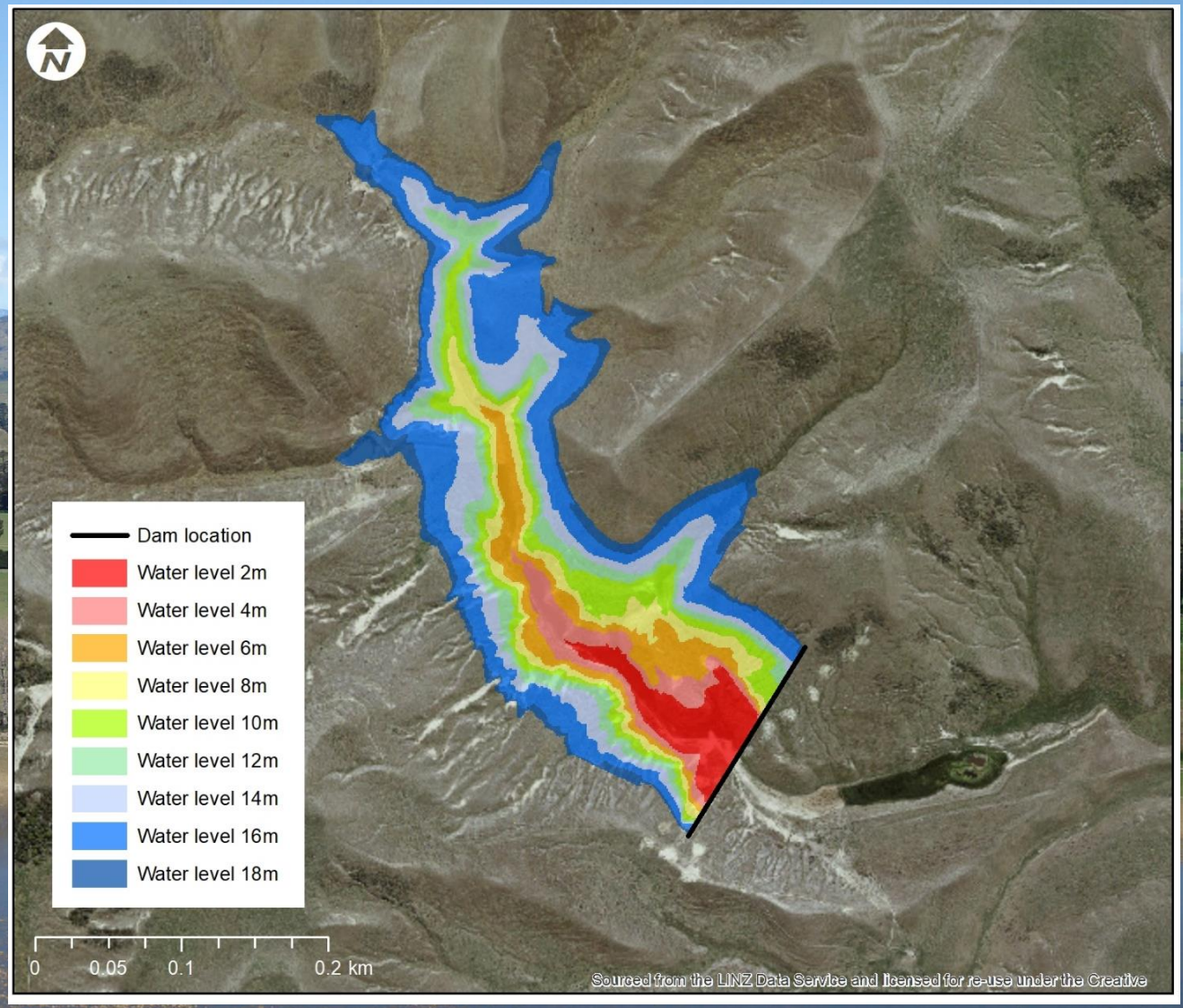
- Post-Earthquake Information Assessment
- LIDAR – Practical Uses (LIDAR data held by MDC and can be viewed through MDC's Smart maps application)
- Terrain Analysis
- Community Water Supplies and Geophysical Attributes of the Aquifer
- Needles Creek Monitoring Well
- Flaxbourne Turbidity Monitoring
- Flood Hazard Modelling
- Lake Elterwater Water Balance
- Low Flow Gauging and Water Resource Implications
- Regulatory Response

Project Outcomes

- High Resolution LIDAR post earthquake provided significant information to assist analyses
- Presence of LIDAR is an ongoing asset for the community and individual landowners



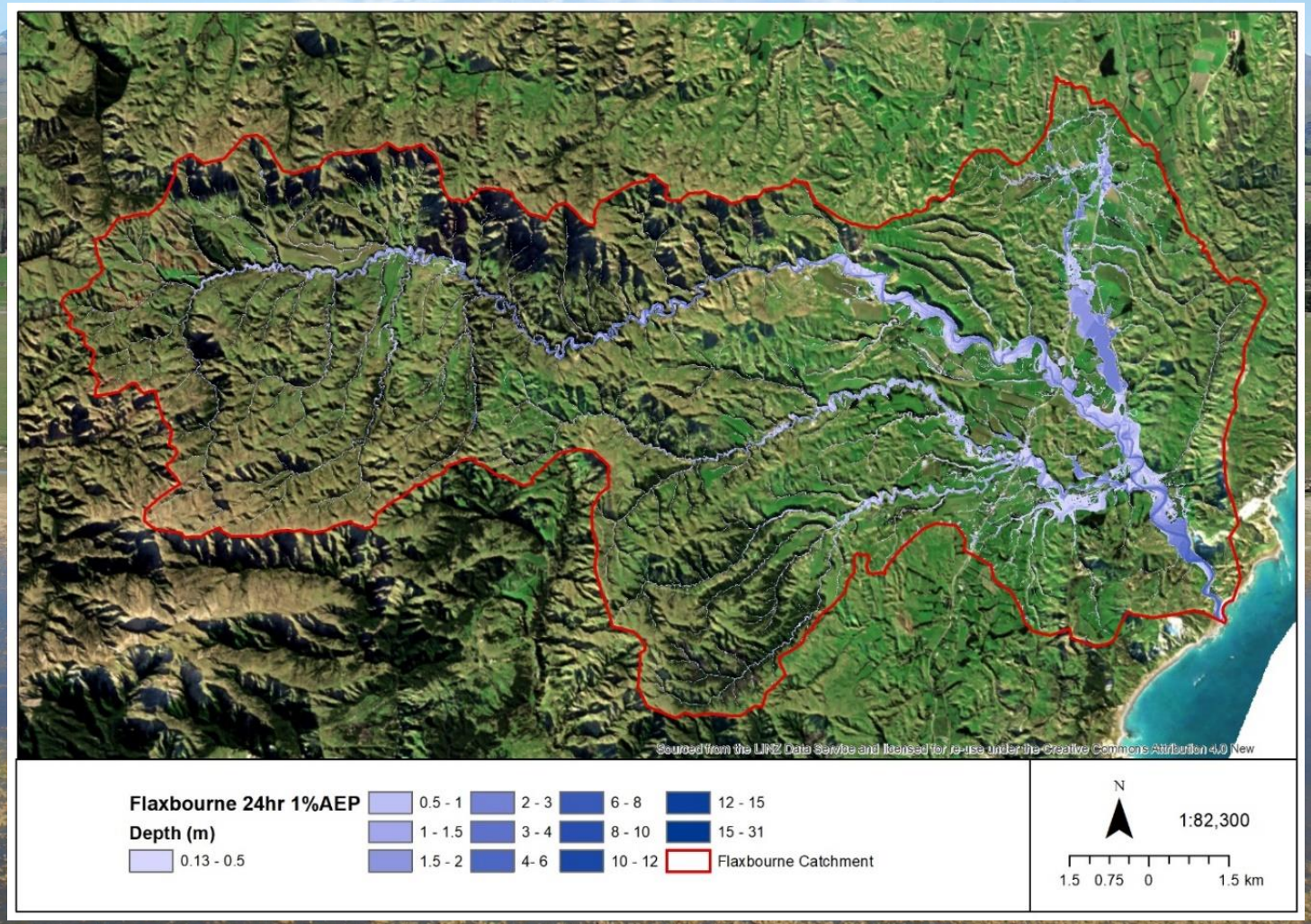


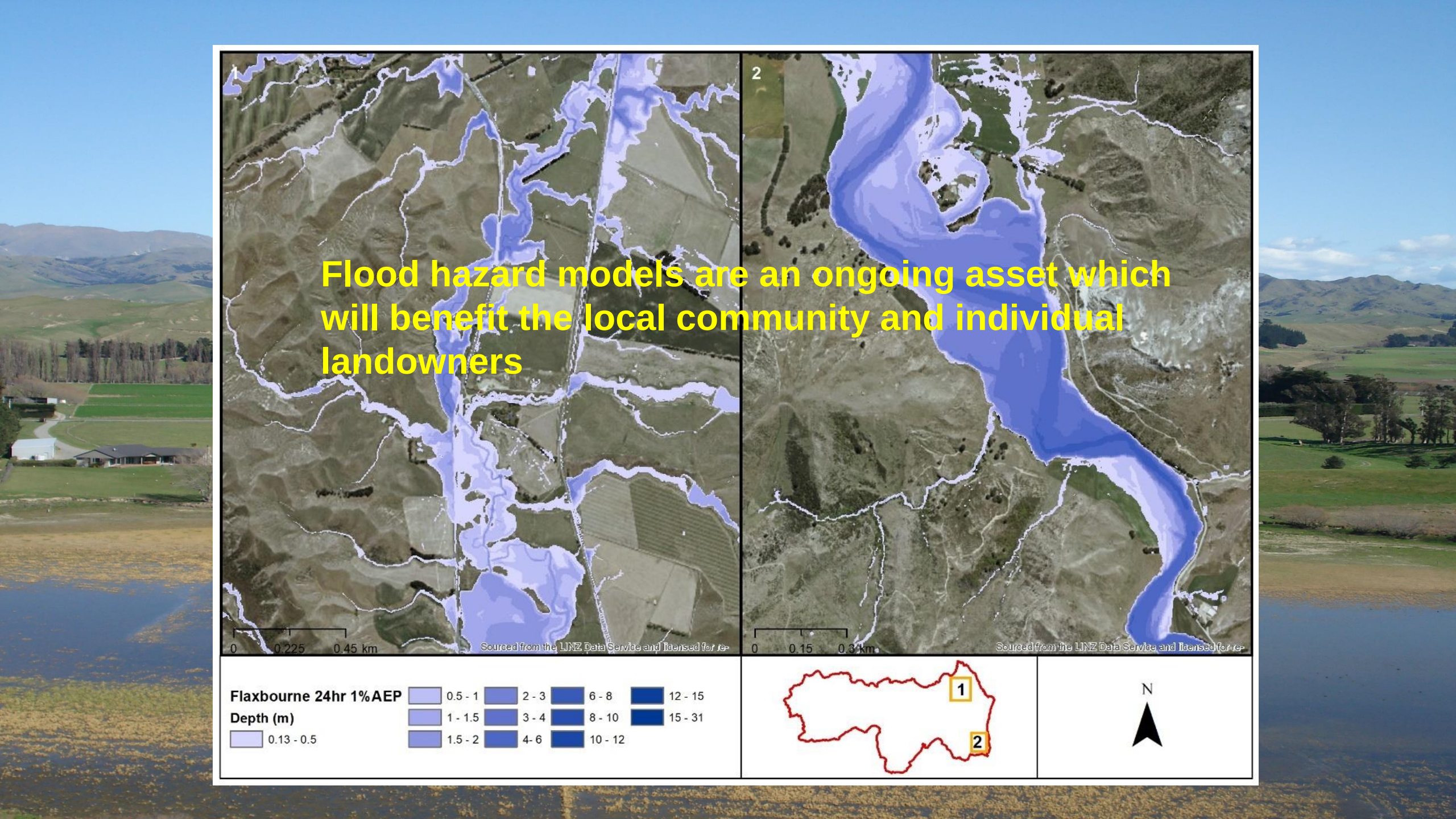


Water level (m)	2m	4m	6m	8m	10m	12m	14m	16m	18m
Volume (m^3)	4329	15261	34857	64328	103916	156062	222551	356905	417136

Flood Modelling

The flood hazard within the Flaxbourne, Waima/Ure and Mirza catchments was investigated using a 2-D rain-on-grid model

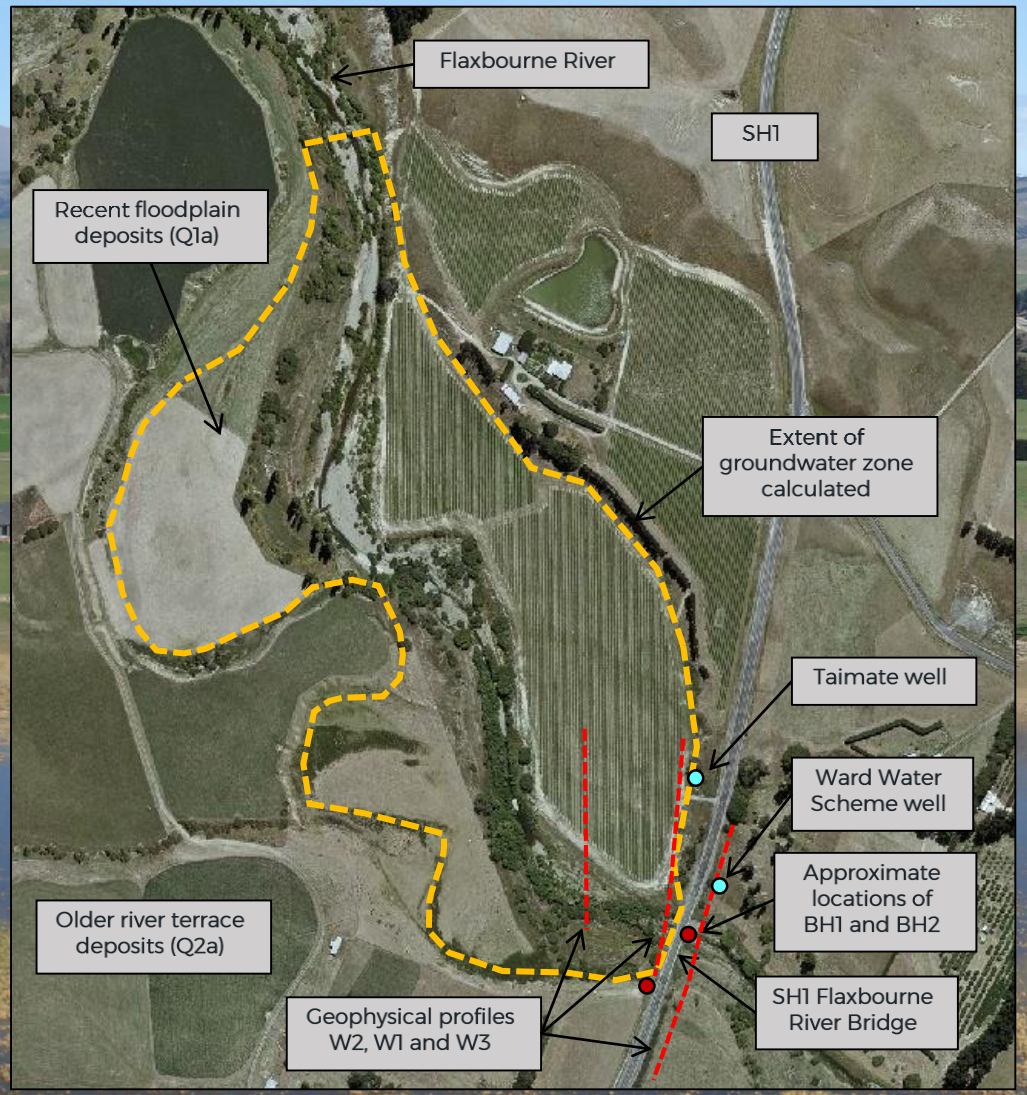


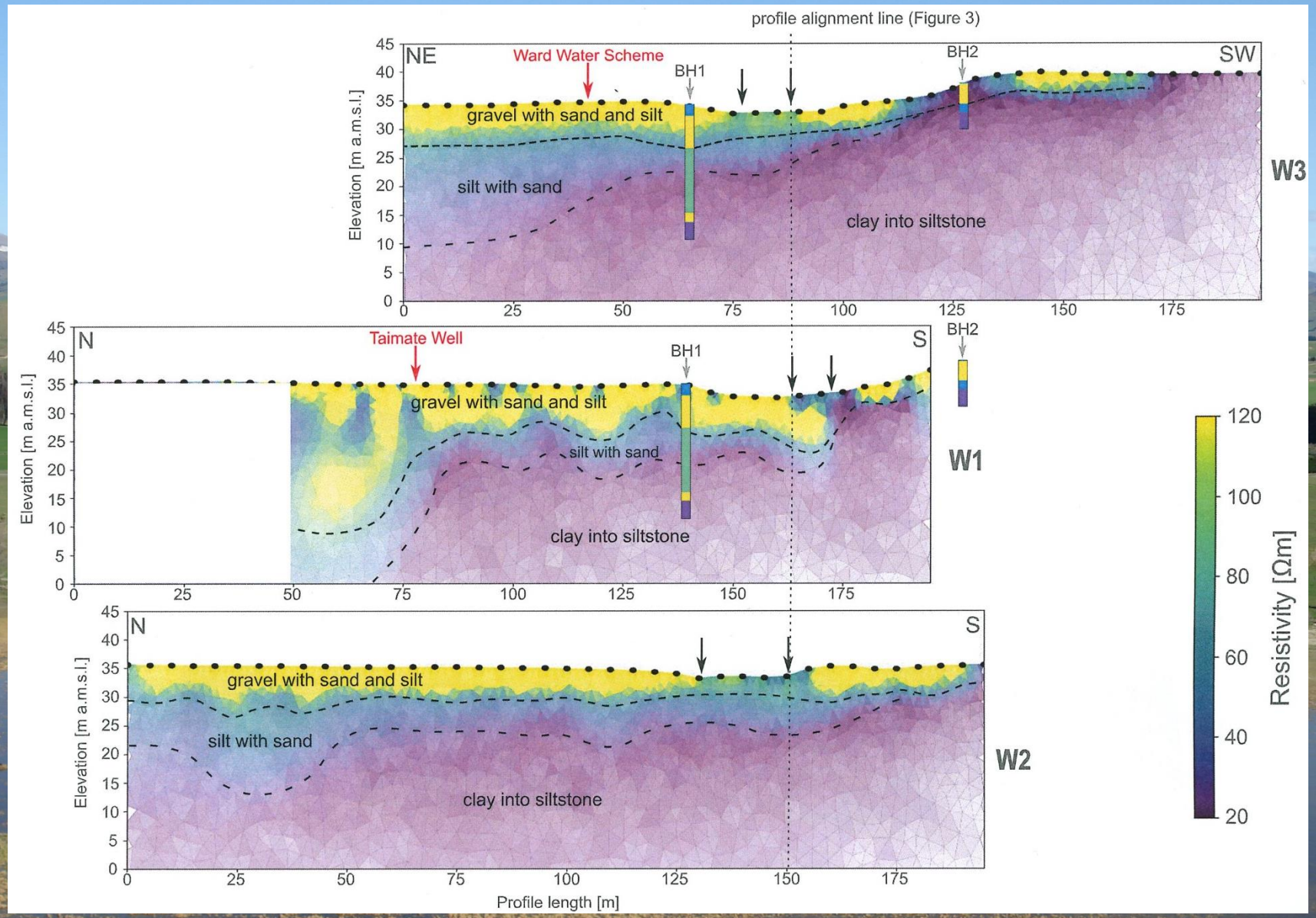

Flood hazard models are an ongoing asset which will benefit the local community and individual landowners
1
2
0 0.225 0.45 km
0 0.15 0.3 km
Sourced from the LINZ Data Service and licensed for re-
Sourced from the LINZ Data Service and licensed for re-
Flaxbourne 24hr 1%AEP
Depth (m)
0.13 - 0.5
0.5 - 1
1 - 1.5
1.5 - 2
2 - 3
3 - 4
4- 6
6 - 8
8 - 10
10 - 12
12 - 15
15 - 31
1
2
N

Low Flow Gaugings

- No relationship between flows in the Waima/Ure and the Flaxbourne, therefore a need for a flow recorder, most likely at Blue Mountain
- Significantly less surface flow at SH1 relative to Blue Mountain since the earthquake. This has implications for:
  - The management and maintenance of surface flows
  - The connectivity between surface water and groundwater
  - Nature of the groundwater resource
  - Further changes over the coming years

Community Water Supplies




profile alignment line (Figure 3)
NE
SW
Ward Water Scheme
BH1
BH2
gravel with sand and silt
silt with sand
clay into siltstone
W3
N
S
Taimate Well
W1
W2
Elevation [m a.m.s.l.]
Profile length [m]
Resistivity [Ωm]
120
100
80
60
40
20

Findings

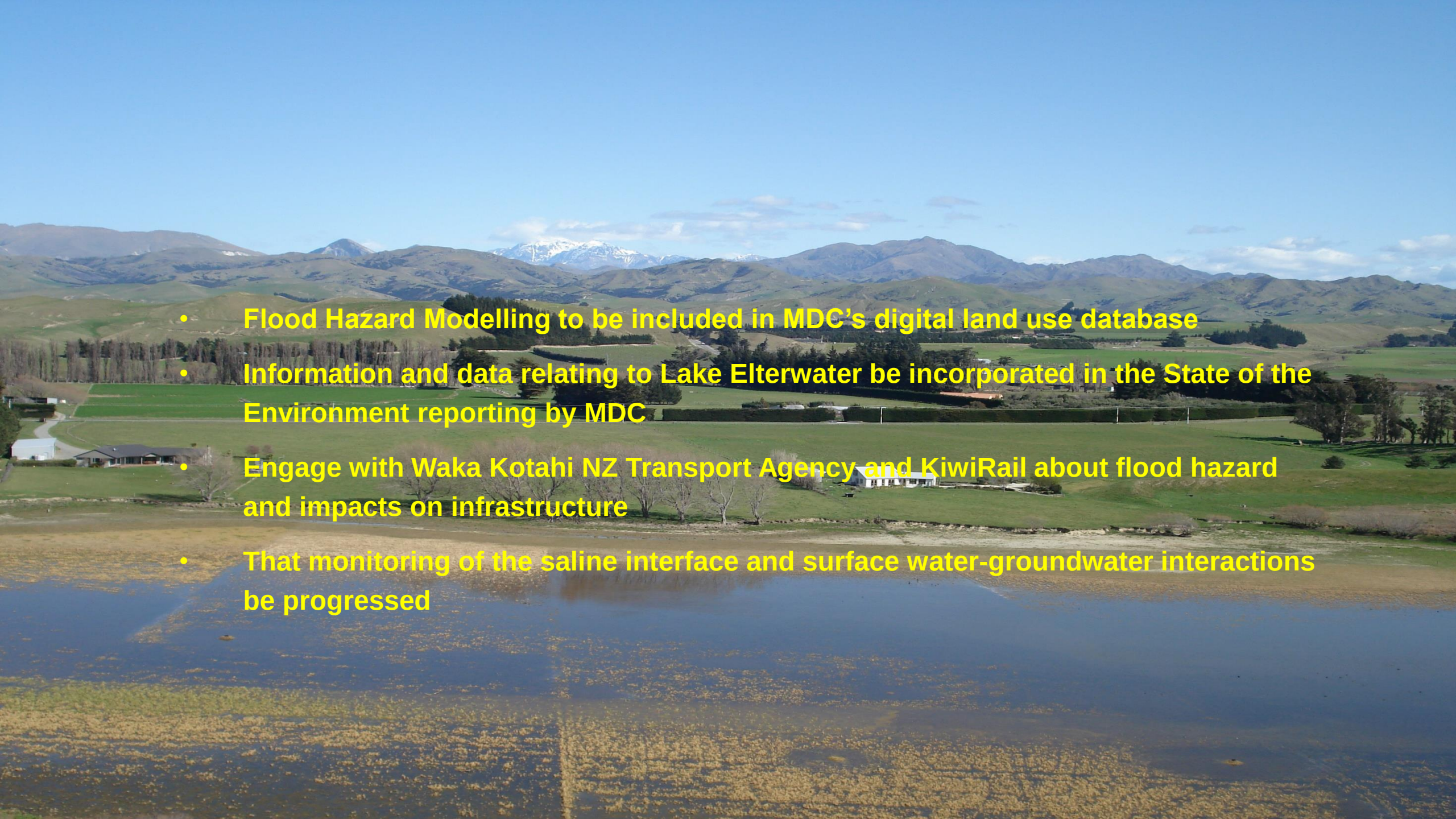
- **Gravel deposits are 5m to 8m thick**
- **Implications for water resource management include:**
  - **A direct hydraulic connection between the Flaxbourne River and the groundwater resource**
  - **Limited availability of groundwater**
  - **Rapid recharge during periods of higher flow in the Flaxbourne River**
  - **Limited storage potential to buffer periods of sustained low flow in the Flaxbourne River**
  - **No buffer to prevent contamination of the groundwater from the ground surface**
- **Improved resilience by upgrading monitoring systems to assist supply management**

Ongoing Monitoring

- **Reinstatement or implementation of monitoring regimes:**
  - **Needles Creek Monitoring Well**
  - **Low flow river monitoring (over last three summers)**
  - **Turbidity monitoring in Flaxbourne River**
  - **Lake Elterwater monitoring**
  - **Community water supply monitoring**
- **Monitoring regimes to be maintained by MDC**

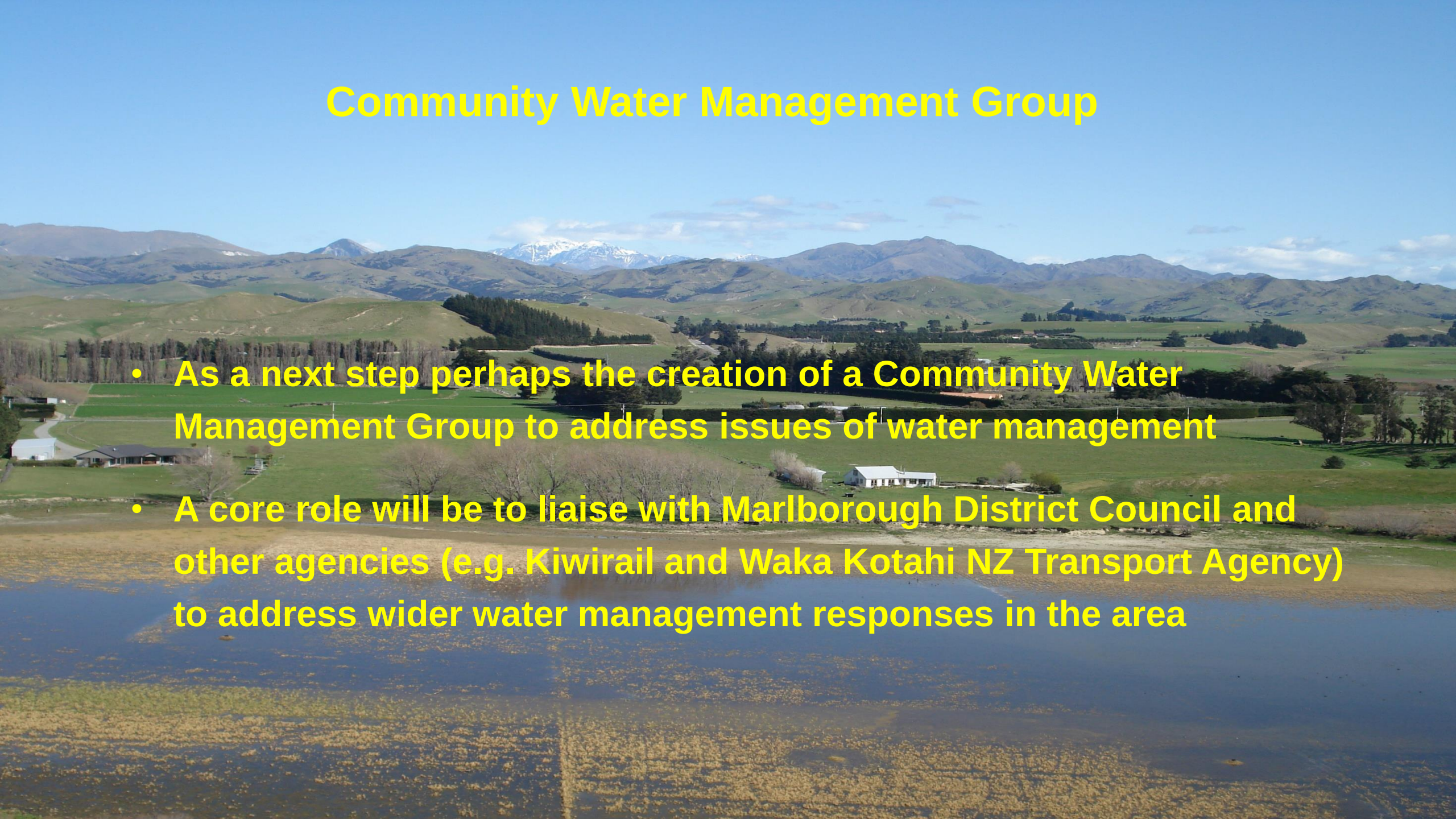
Regulatory responses

- Identified mitigation strategies to meet future challenges posed by the ongoing impacts of the earthquake
- Key recommendations are:
  - Low flow and water quality monitoring continue to be carried out by MDC
  - Regular topographic surveys of the channels of at least the Waima/Ure and Flaxbourne Rivers
  - Riparian management, and particularly planting, should be encouraged
  - Removal of willows and other invasive species should be encouraged
  - In reaches of aggradation, the extraction of gravel should become a ‘permitted activity’



- Flood Hazard Modelling to be included in MDC's digital land use database
- Information and data relating to Lake Elterwater be incorporated in the State of the Environment reporting by MDC
- Engage with Waka Kotahi NZ Transport Agency and KiwiRail about flood hazard and impacts on infrastructure
- That monitoring of the saline interface and surface water-groundwater interactions be progressed

Community Water Management Group



- As a next step perhaps the creation of a Community Water Management Group to address issues of water management
- A core role will be to liaise with Marlborough District Council and other agencies (e.g. Kiwirail and Waka Kotahi NZ Transport Agency) to address wider water management responses in the area