

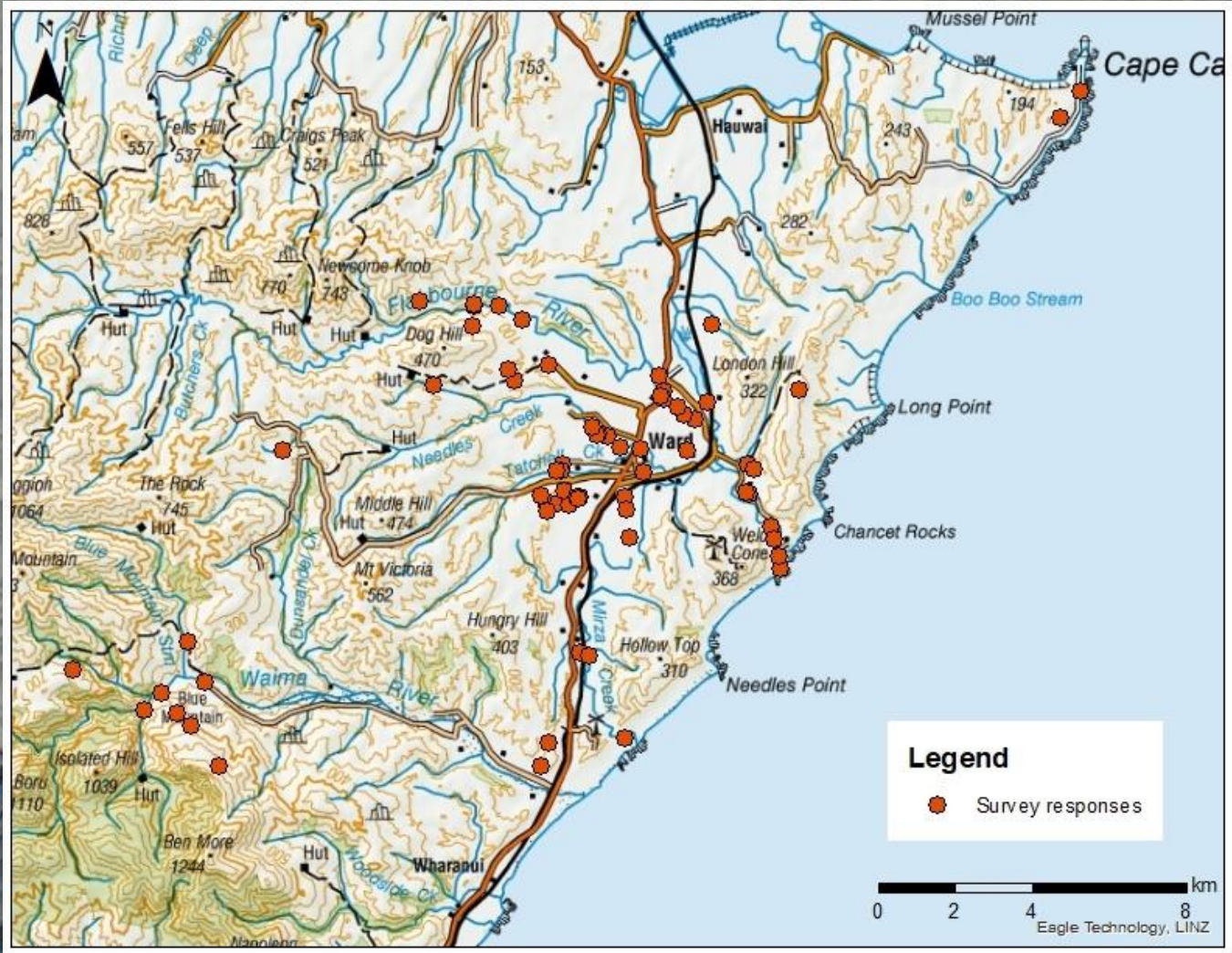
KAIKŌURA EARTHQUAKE WATER RESOURCE IMPACTS



Three distinct zones:

- The 'coastal zone' – uplift at the coast has resulted in significant changes to the channel gradient and processes;
- The '*mid-catchment zone*' – affect surface water-groundwater interactions, and disequilibrium caused by changes in the upper and lower catchments; and
- The '*upper catchment zone*' – where landsliding, and landslide-dammed lakes has affected the timing and volume of runoff.

Consequently, a catchment-based approach to identifying and quantifying changes to the water resources is required.



68 persons accessed the survey
Concentrated near Ward, and along the river valleys
Good coverage throughout the survey area

An aerial photograph of a mountain valley. A river flows through the center of the valley, surrounded by steep, rocky slopes. The terrain is rugged, with patches of green vegetation and large areas of exposed rock. The river appears to be in a deep, narrow channel, and there are some smaller streams or tributaries visible on the slopes.

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, both in specific bores and at a catchment level;**
- **Changes to surface water – groundwater interactions;**
- **Changes to water quality through increased suspended sediment and bedload transport; and**
- **Changes to the flow regimes of rivers because of landslide-dammed lakes etc.**



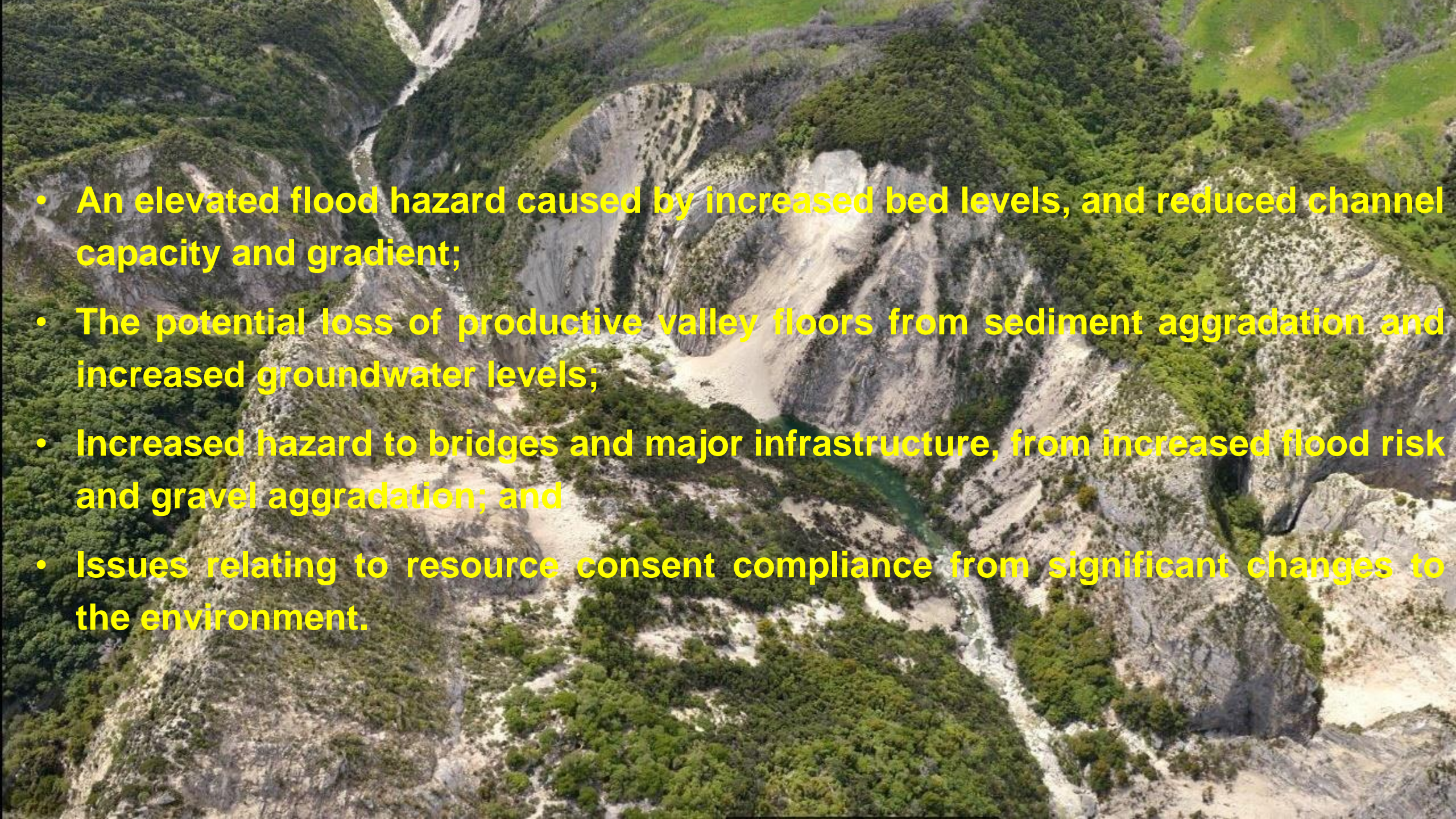
**Marlborough District Council
North Canterbury Transport Infrastructure Recovery (NCTIR)
Victoria University of Wellington
GNS Science**

- **Very little information is available specifically for the Flaxbourne, Mirza or Waima/Ure River catchments.**
- **However, the review and survey has identified several risks to the water resources, and consequently the community.**

An aerial photograph of a mountainous region. A river flows through a valley, surrounded by steep, rocky slopes. The terrain is a mix of dark green forest and light-colored, rocky outcrops. The river is a prominent feature, winding through the center of the valley. The overall scene depicts a rugged, natural landscape.

These risks include:

- **The security of all water supplies; surface and groundwater, domestic and agricultural. Risks to:**
 - **Water quality, from increased suspended sediment;**
 - **Water quantity, caused by changes in the flow regimes, groundwater levels, surface water-groundwater interactions, and topography; and**
 - **The community water supply for Ward;**
- **Changes to the saline interface towards the coast, which could affect water quality;**



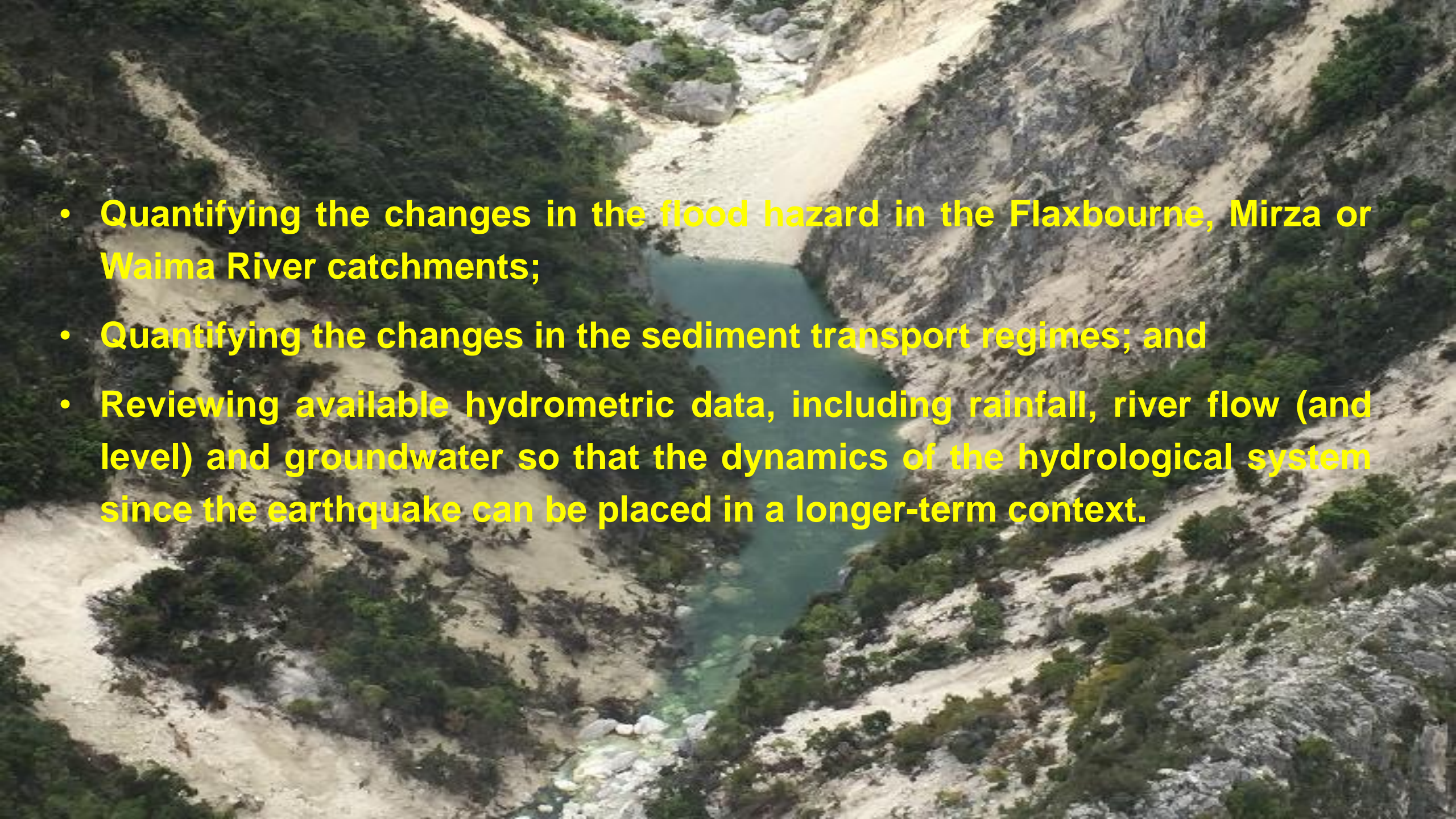
- **An elevated flood hazard caused by increased bed levels, and reduced channel capacity and gradient;**
- **The potential loss of productive valley floors from sediment aggradation and increased groundwater levels;**
- **Increased hazard to bridges and major infrastructure, from increased flood risk and gravel aggradation; and**
- **Issues relating to resource consent compliance from significant changes to the environment.**

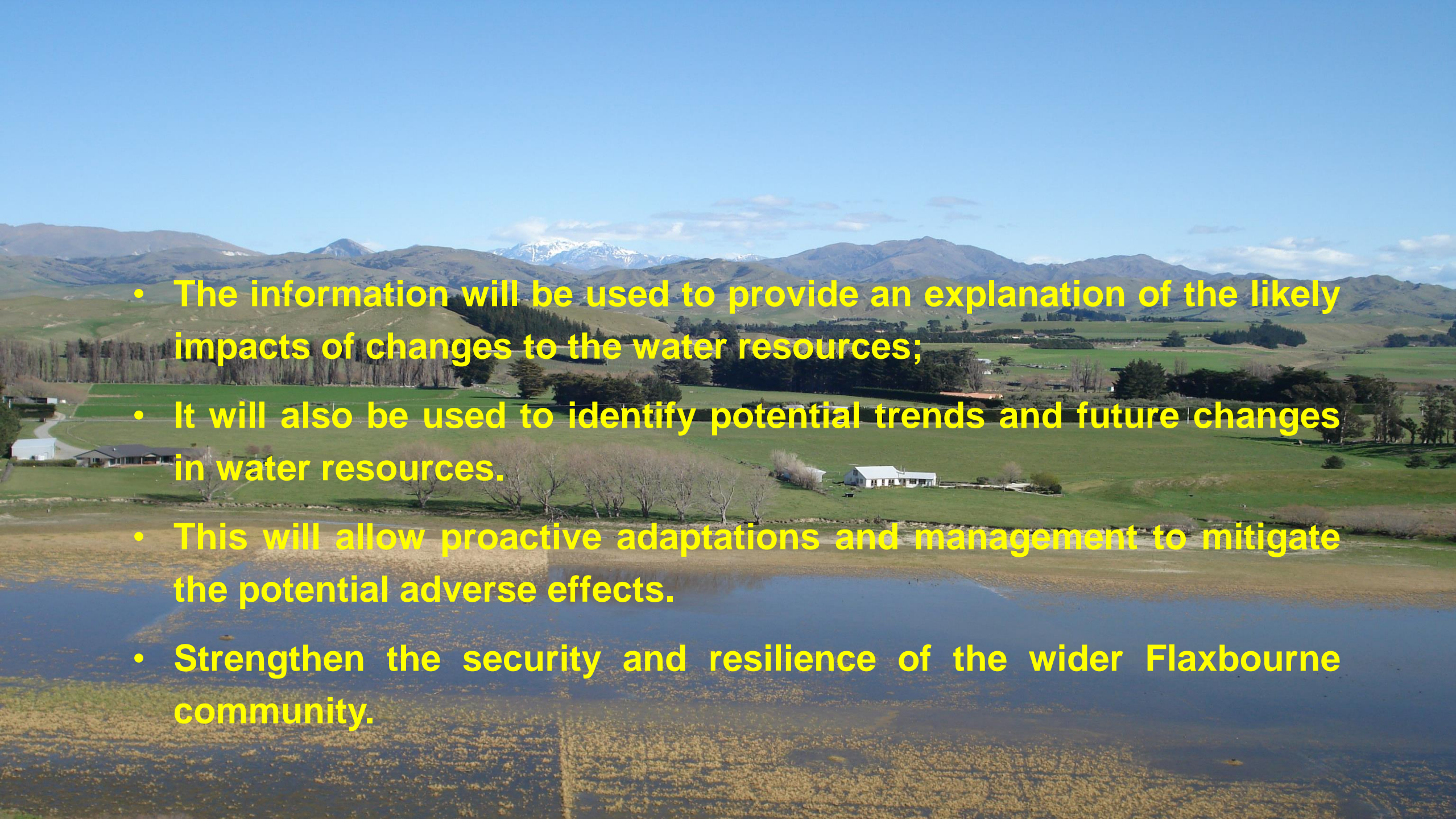
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- An aerial photograph showing a river valley. In the upper left, a river is dammed by a landslide, creating a lake. The surrounding hillsides are covered in dense green vegetation, with some areas showing signs of erosion or landslides. In the lower right, a small village with several buildings and a sports field is visible. The text is overlaid on the left side of the image.
- **Several of these risks will be affected by the landslides, the landslide-dammed lakes, and the large volume of material which has been mobilised in the upper catchment.**
 - **Once these risks and opportunities are understood, then mitigation options and strategies can be developed.**
 - **Without a comprehensive understanding of the principal risks, and their causes, it is not possible to develop cost-effective and efficient mitigation measures.**



To mitigate these risks, and support community resilience, future work should focus on:

- Increasing the coverage of summer low-flow gaugings;
- Monitoring the Ward community bores;
- Re-instatement of the Needles monitoring well;
- Monitoring the suspended sediment concentration;
- Investigate the saline interface at the coast and lower valleys;
- Quantifying the changes in the local topography:
 - Changes in channel form, character and process;
 - Changes to the water resource availability in time and space; and
 - Changes in groundwater conditions.

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- An aerial photograph of a river valley. The river is a dark blue-green color, flowing through a narrow channel. The surrounding slopes are steep and covered with sparse, low-lying vegetation. A large, light-colored, sandy or silty deposit is visible on the left bank, extending into the river channel. The overall scene suggests a post-earthquake environment with significant sediment transport and deposition.
- **Quantifying the changes in the flood hazard in the Flaxbourne, Mirza or Waima River catchments;**
 - **Quantifying the changes in the sediment transport regimes; and**
 - **Reviewing available hydrometric data, including rainfall, river flow (and level) and groundwater so that the dynamics of the hydrological system since the earthquake can be placed in a longer-term context.**

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- The information will be used to provide an explanation of the likely impacts of changes to the water resources;
 - It will also be used to identify potential trends and future changes in water resources.
 - This will allow proactive adaptations and management to mitigate the potential adverse effects.
 - Strengthen the security and resilience of the wider Flaxbourne community.