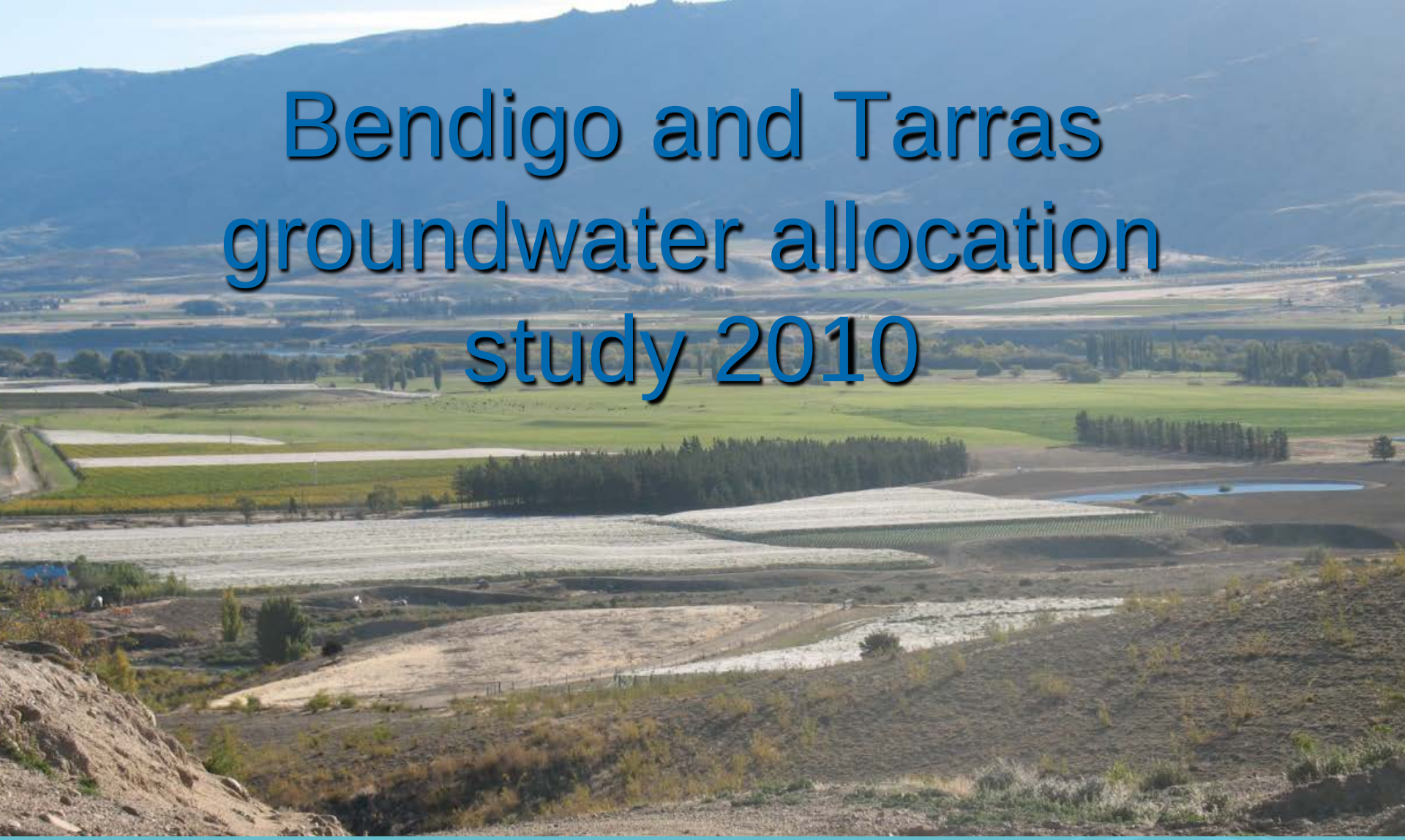


Bendigo and Tarras groundwater allocation study 2010

Purpose:

To propose groundwater allocation limits based on technical findings.

Computer Groundwater Model

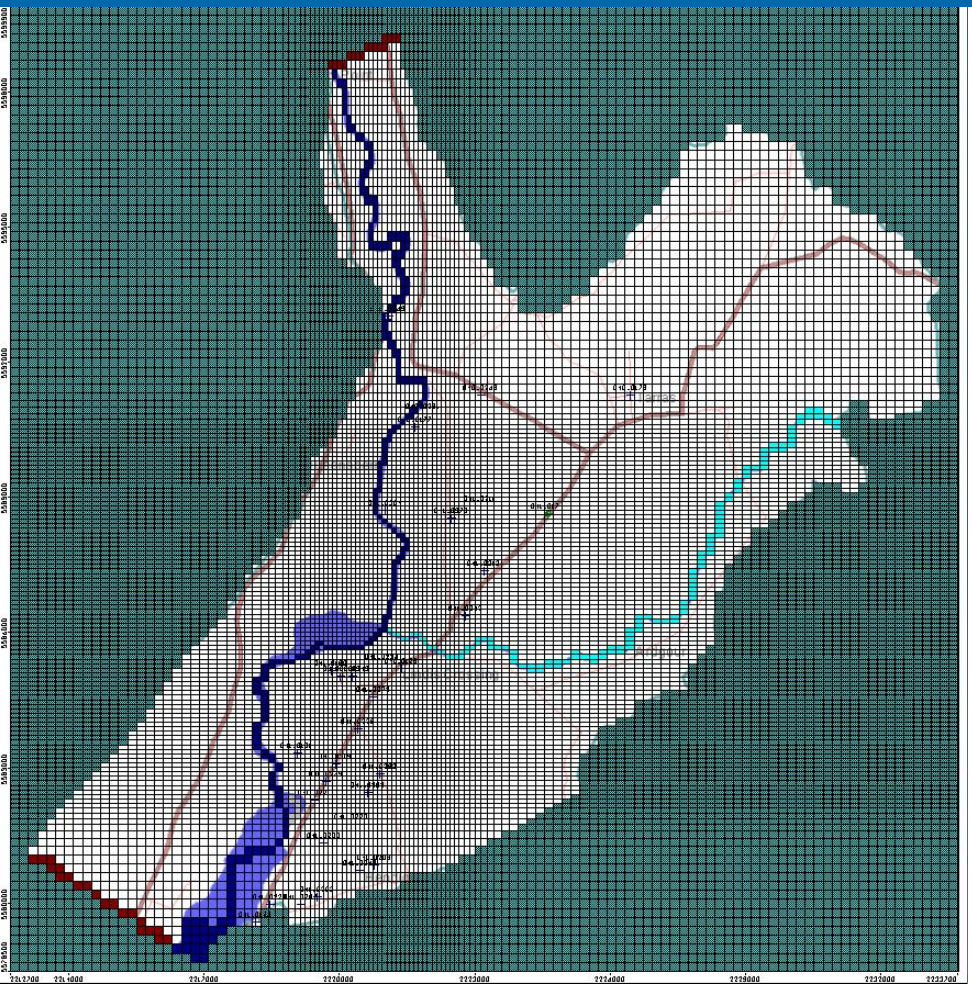
3D set of flow equations

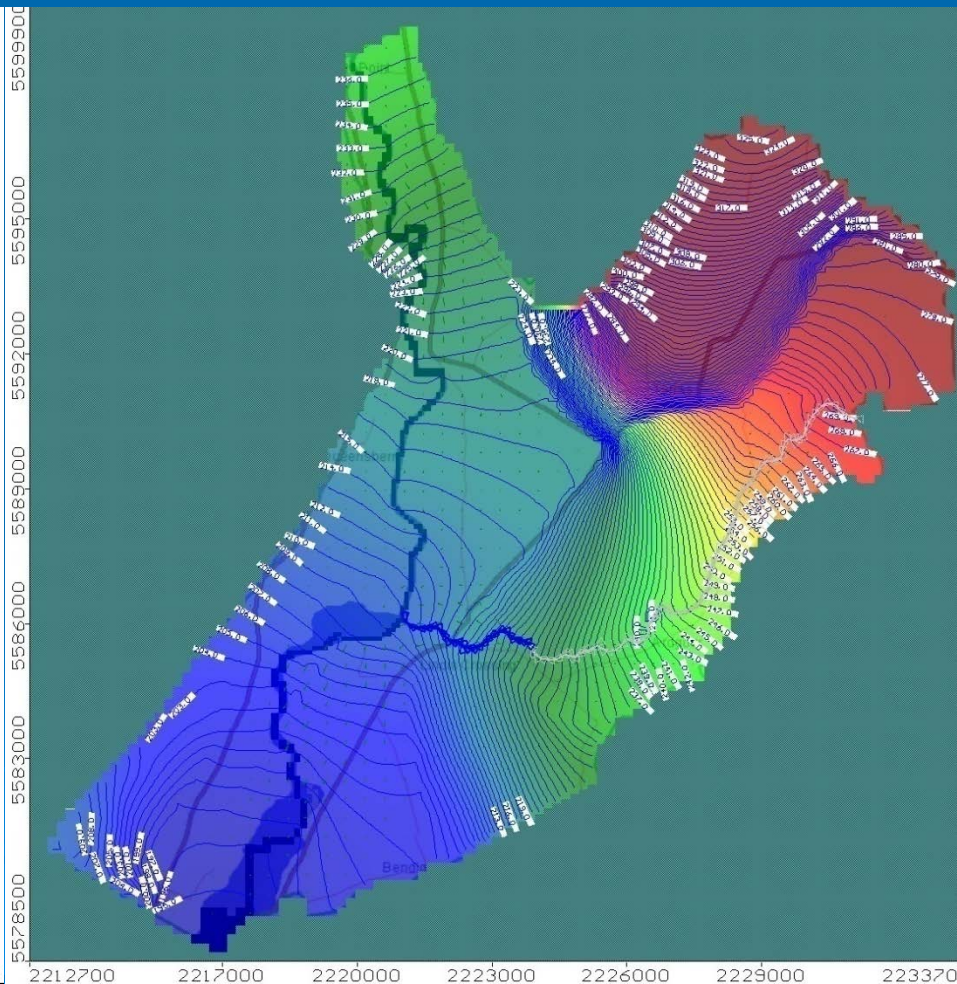
We use all available knowledge to build it:

- Geology (bore logs & maps)
- Geophysics (Glass Earth ER)
- Topography
- Soils, rainfall & evapotranspiration
- Groundwater levels
- River levels & flows
- Consented water takes (water meters)

Computer Groundwater Model

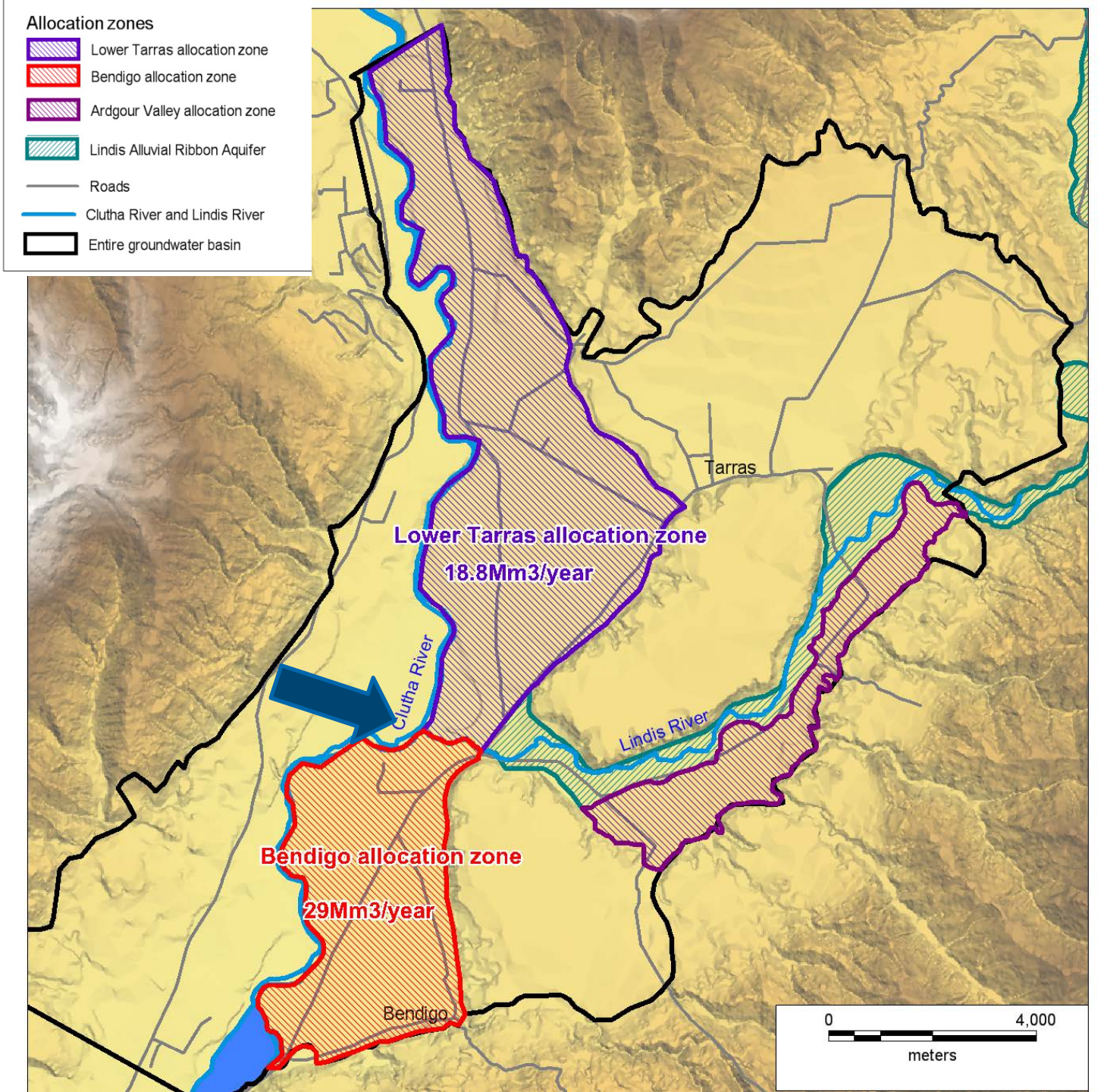
Build –> Calibrate –> Simulate

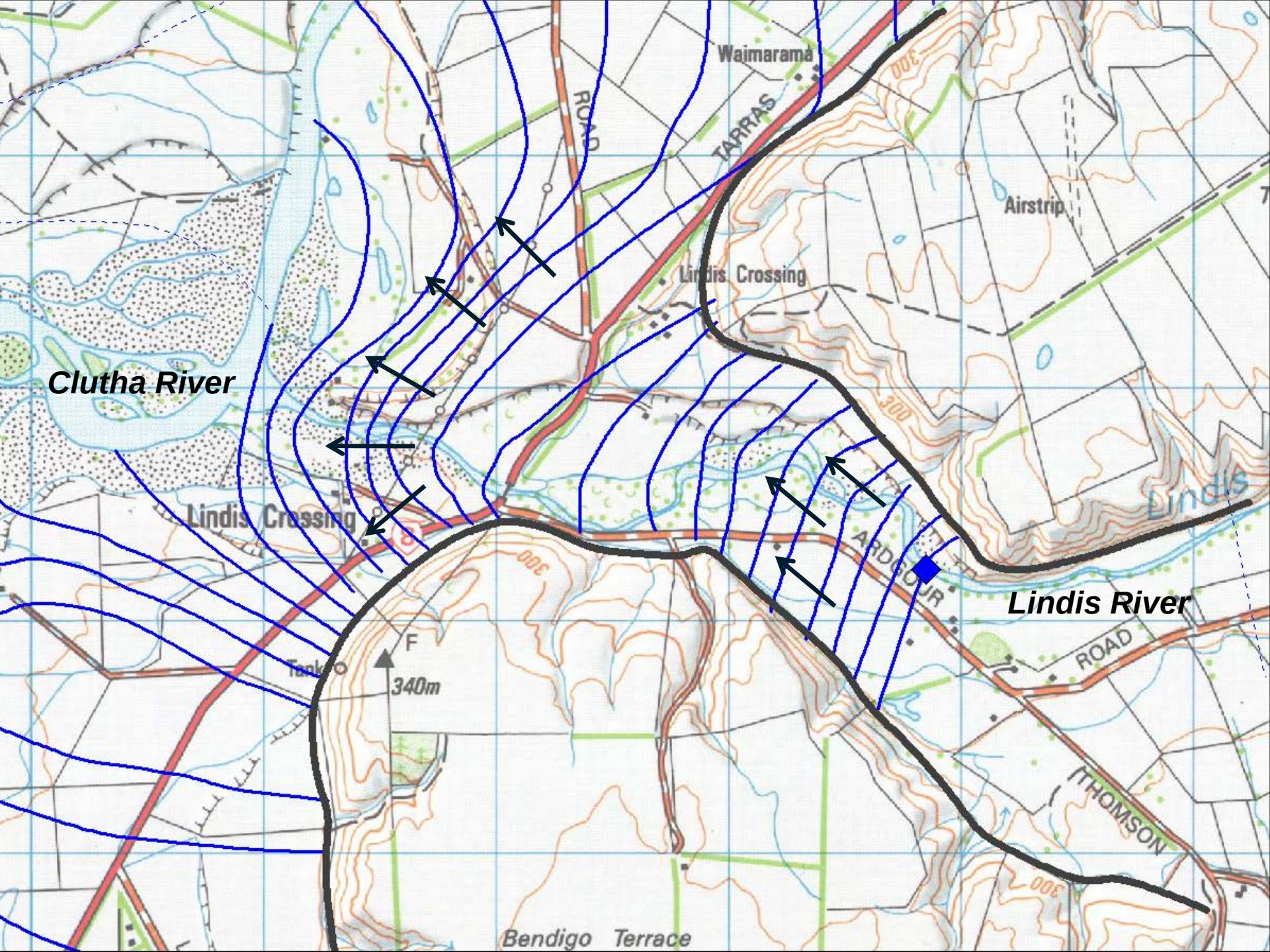




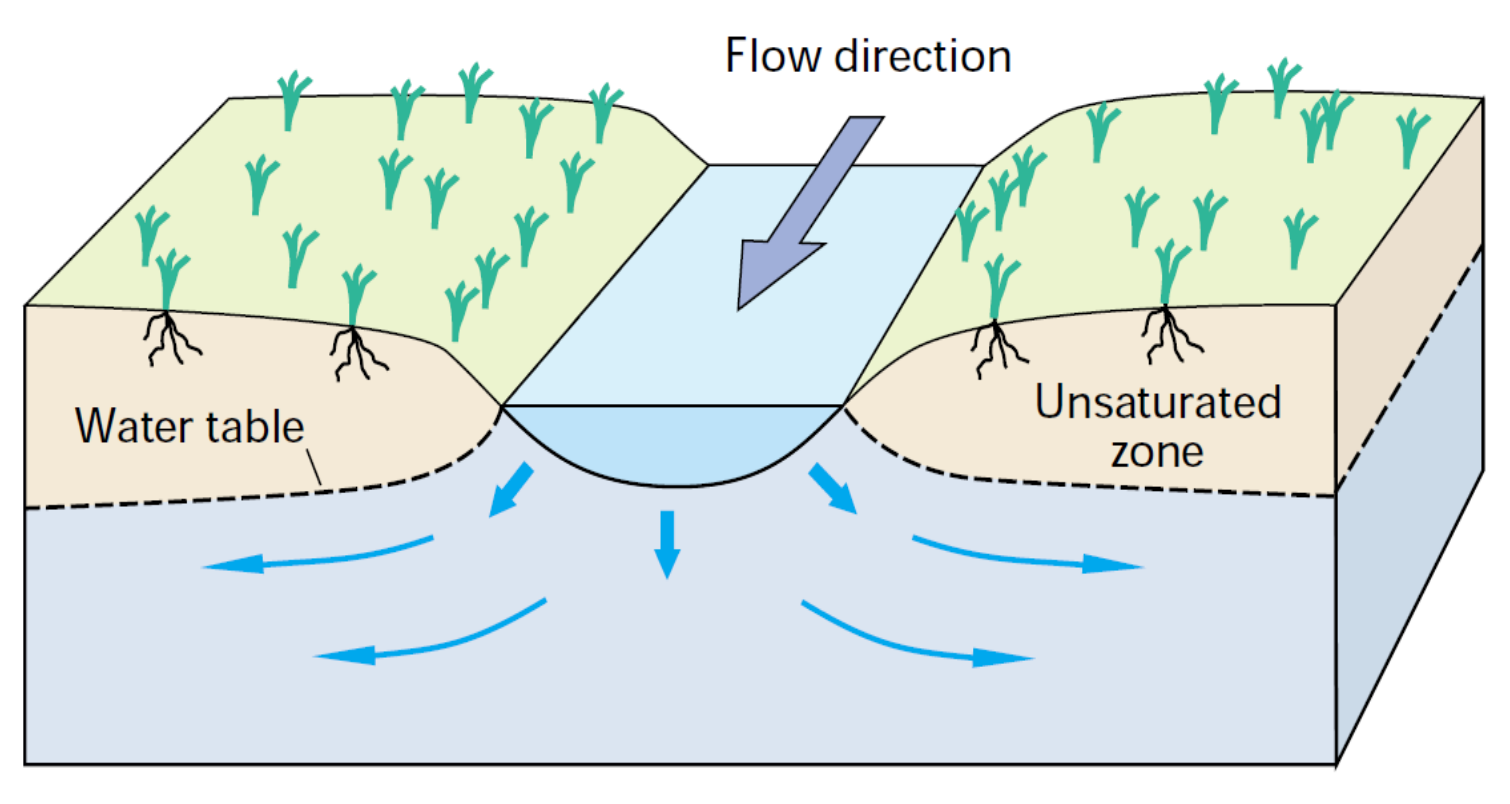
Simulation Results

- Lower Tarras & Bendigo aquifers are closely linked to the Clutha River
- There is plenty of water available in the Clutha River & in these terraces, but not where the Lindis meets the Clutha
- The impact of all groundwater pumping on the Lindis is currently ~90 l/s
- During low flow, this dries the river bed up by ~500m


Allocation zones
Lower Tarras allocation zone
Bendigo allocation zone
Ardgour Valley allocation zone
Lindis Alluvial Ribbon Aquifer
Roads
Clutha River and Lindis River
Entire groundwater basin
Tarras
Lower Tarras allocation zone
18.8Mm3/year
Clutha River
Lindis River
Bendigo allocation zone
29Mm3/year
Bendigo
0
4,000
meters


Clutha River
Lindis River
Lindis Crossing
Lindis Crossing
Waimarama
ROAD
TARRAS
Airstrip
300
ARDGOUR
ROAD
THOMSON
F
340m
Bendigo Terrace

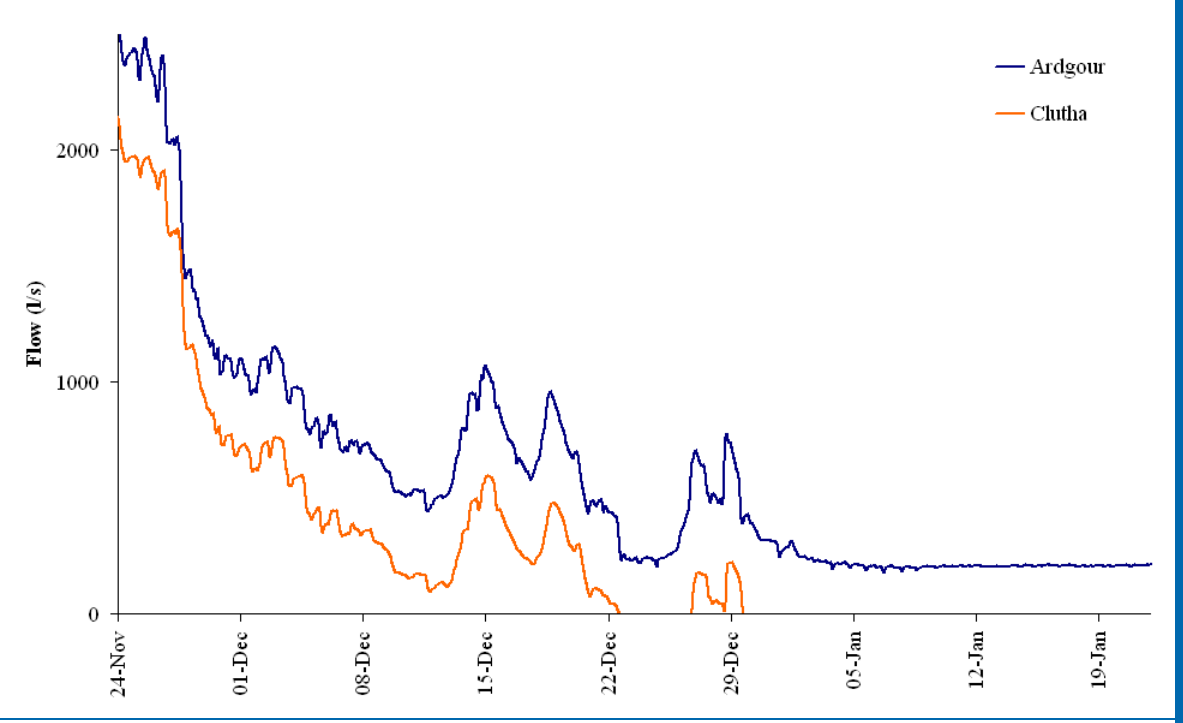
As the Lindis River emerges from the valley, it loses flow to the ground



The rate of loss depends the level of the river, and also the groundwater level in the fan

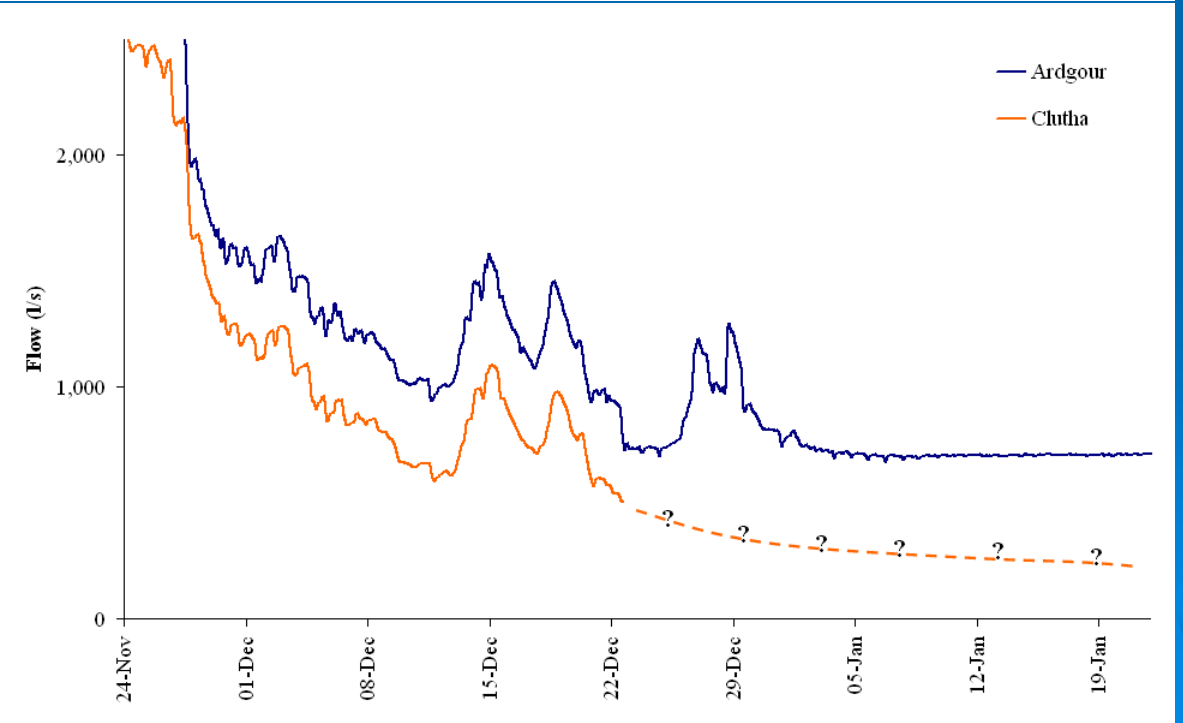
- When the rate of groundwater drainage is greater than the rate of inflow, the Lindis River goes dry

- This can happen:
  - If Lindis River flow is low (flow < 350 l/s)
  - If groundwater losses are high (pumping)
  - ? Naturally in a prolonged recession?



- Monitored flow

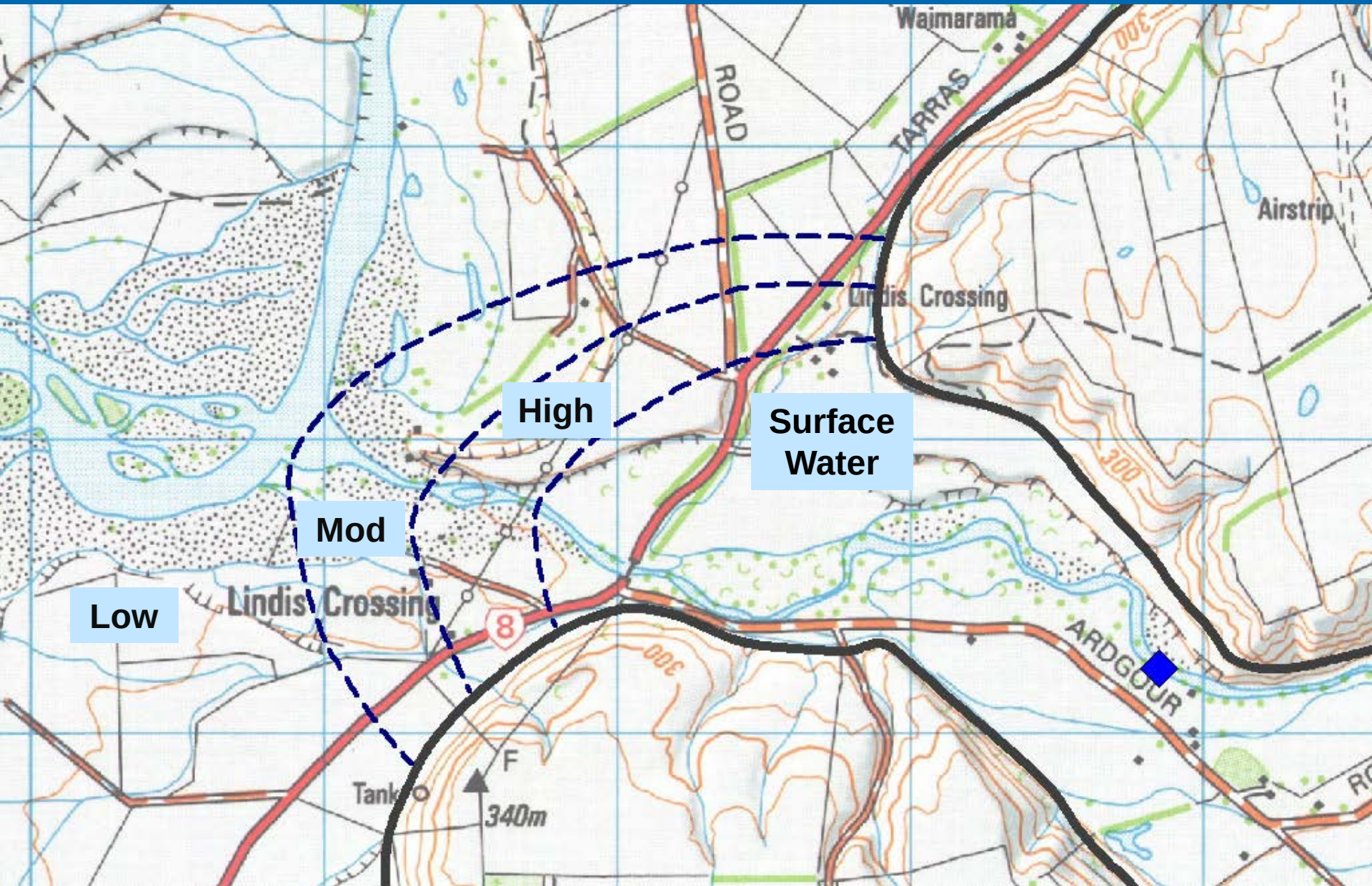
  The river dries up below the bridge



- Enhanced flow

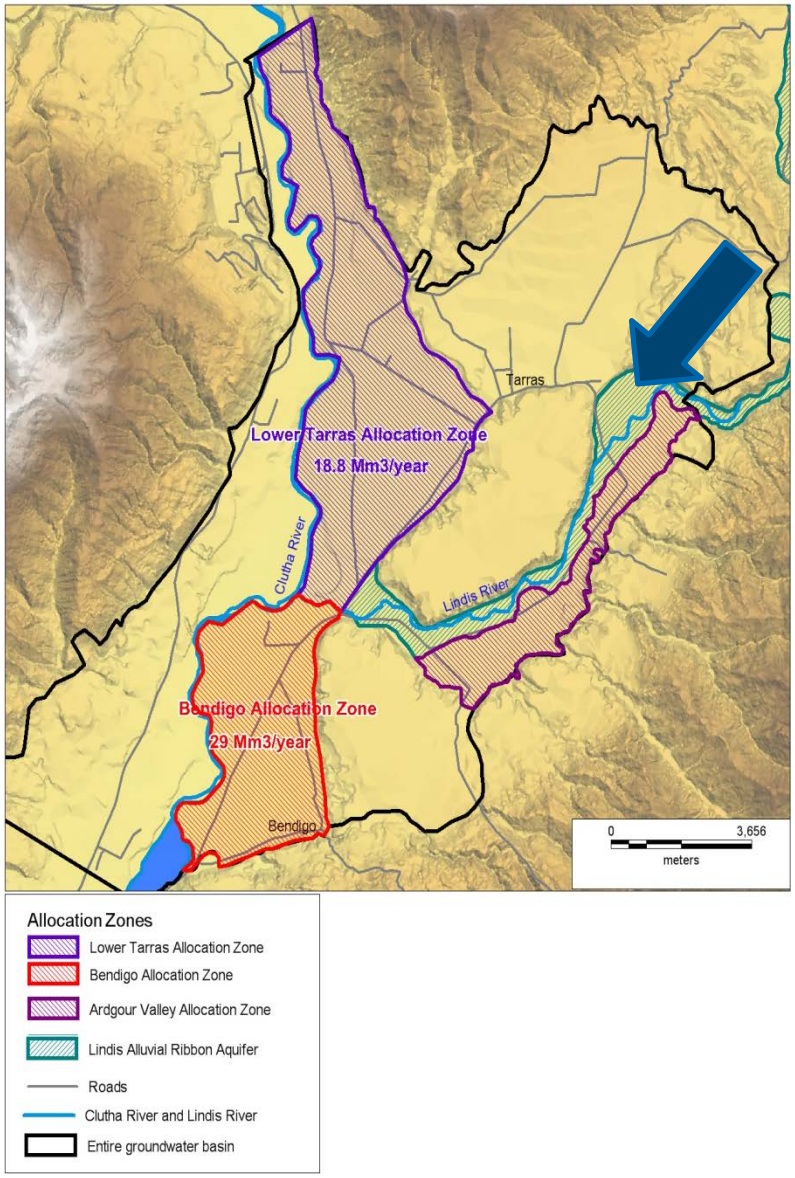
  We don't know for sure if groundwater levels below the bridge will sustain flow over a prolonged dry period

Effect of pumping on river



Lindis Alluvial Ribbon Aquifer

- Effective from April 2010 (PC1C)
- Implications
  - GW takes within aquifer are managed as surface water
  - GW takes are included in primary allocation
  - Takes are subject to surface water restrictions i.e. minimum flows and rationing
  - Permitted taking for domestic and stock water are excluded



Sources of water

- Current availability of water:

  - Lindis River *(fully allocated)*

  - Lindis Alluvial Ribbon Aquifer *(fully allocated)*

  - Ardgour Valley allocation zone *(depends on location)*

  - Clutha River *(allocation available)*

  - L.Tarras allocation zone (*allocation available)*

  - Bendigo allocation zone (allocation available)

- Need to management all these sources together - interconnected