# The Bendigo–Tarras groundwater basin Summary 2010

Otago Regional Council

## Introduction

The Bendigo-Tarras area has a very dry climate, and groundwater from the underlying aquifer is increasingly being relied upon for water to irrigate pasture and grapevines.

The Otago Regional Council has developed a groundwater model of the Bendigo-Tarras groundwater basin. As a result of this modelling a technical recommendation is being made to establish three allocation zones within the basin, with limits on the volume of groundwater able to be taken from each zone. This information is summarised in this information sheet. See the report *The Bendigo and Tarras Groundwater Allocation Study* (June 2010) for the full technical findings.

## Groundwater

Groundwater occurs within sediments that lie within a depression in the underlying schist rock. Geophysical data was used to define the depth and permeability of the sediments (see back page). Permeability varies between highly permeable sandy-gravel deposits close to the Clutha River/Mata-Au, and lower-yielding silty sand deposits near Tarras. The extent of the groundwater basin is shown on Figure 1.

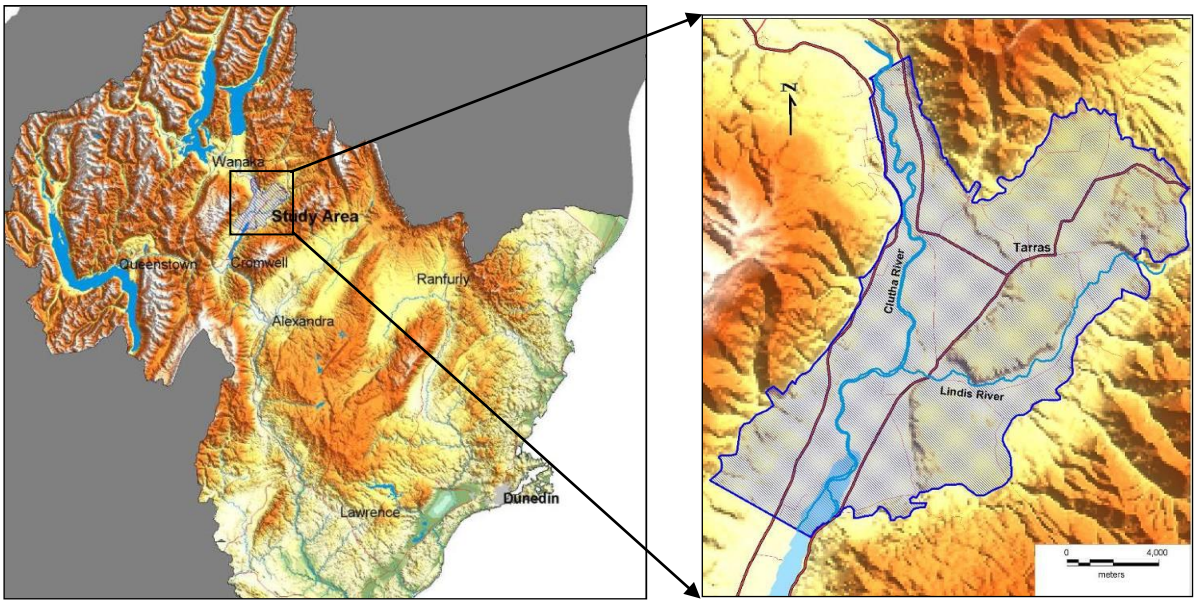



**Figure 1: Location of the Bendigo-Tarras groundwater basin study area**

## Aquifer-river interaction

Taking groundwater near a river can cause river water to flow into the aquifer, recharging the groundwater system. There are two major river systems in the Bendigo-Tarras area, and both are integrated with the groundwater system.

The Clutha River/Mata Au flows at about 250 $m^3/s$, and groundwater takes near the Clutha River/Mata-Au can cause recharge to the aquifer. The lower reach of the Lindis River often flows at 400 l/s or less during summer and groundwater takes near the Lindis River can put stress on already very low river flows.

**There is currently an alluvial ribbon aquifer defined within the Regional Plan: Water for the Lindis River and groundwater takes in this area are subject to flow restrictions as though they are surface water takes.**

**Groundwater modelling**

Modelling of the groundwater basin was carried out to assess the affect of cumulative long-term pumping on river flows and groundwater levels, and to determine the total amount of water that can sustainably be taken from the aquifer. The model was based on current knowledge of the aquifer, river systems and rainfall. Rainfall recharge of the aquifer occurs sporadically and requires large rainfall events to saturate soils. In the last ten years rainfall recharge has been low. Once the model was calibrated, the effects of taking different volumes of groundwater were studied, at two different flows for the Lindis River. The scenarios modelled are summarised in Table 1.

**Table 1. Summary of groundwater modelling undertaken**

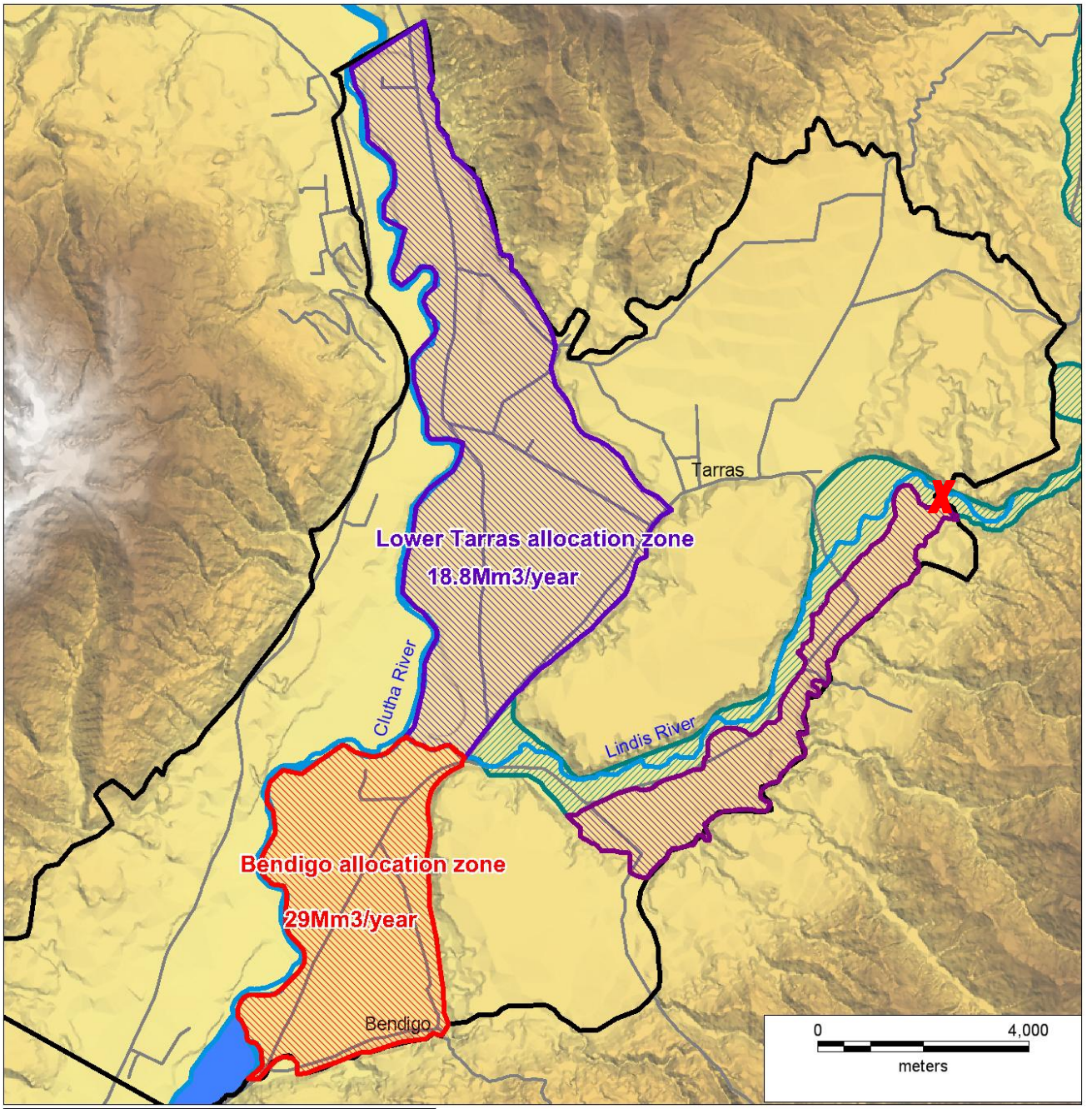
| Scenario | Flow of the Lindis River at X | Groundwater taken from aquifer | What the scenario shows | Results |
|---|---|---|---|---|
| **1** | 1000l/s | None | Base scenario for calibrating the model. | Model fits well to what is observed in monitoring bores. |
| **2** | 1000l/s | Current allocation (8.89 $Mm^3$/year) | The impact of taking all groundwater consented. | Flow in lower reaches of Lindis River reduced by 90 l/s. |
| **3** | 500l/s | Current allocation (8.89 $Mm^3$/year) | The impact of pumping all consented groundwater in dry conditions. | Lindis River is dry for 600m before reaching the confluence with the Clutha River/Mata-Au. |
| **4** | 500l/s | None | Groundwater levels during dry conditions if no groundwater is taken. | Lindis River flows to confluence and groundwater levels in vicinity of the lower Lindis River drop by 0.5 m. |
| **5** | 500l/s | Double current allocation excluding Lindis River buffer | The impact of taking additional groundwater in dry conditions. | As pumping is increased more recharge is induced from the Clutha River/Mata-Au to balance the pumping. |
| **6** | 500l/s | The pumping volume that causes groundwater levels to decrease by 2m within Bendigo and Tarras allocation zones. | How much groundwater can be taken without significant adverse affects on the aquifer or Lindis River. | Using a buffer there is no further impact on Lindis River flow and large volumes of recharge from Clutha River/Mata Au to Bendigo and Tarras allocation zones. |

The results of the modelling shows large quantities of groundwater are potentially available for abstraction from the aquifer as there are high volumes of recharge from the Clutha River/Mata-Au. Increasing groundwater abstraction in the vicinity of the lower reach of the Lindis River will adversely affect river flows.

**Suggested limits**

The lower terraces on the eastern side of the Clutha River/Mata-Au are sub-divided into two allocation zones (Figure 2). The recommended limit for groundwater abstraction from the Lower Tarras allocation zone is 18.8$Mm^3$/year and for the Bendigo Allocation Zone it is 29$Mm^3$/year. Current consented allocation is only 12% of the Lower Tarras allocation zone recommended limit and only 13% of the Bendigo allocation zone recommended limit. Recharge from the Clutha River/Mata-Au to the Lower Tarras allocation zone was modelled as 68.5 $Mm^3$/year and in the Bendigo allocation zone it was modelled as 58.4$Mm^3$/year.

Groundwater takes within the Lindis alluvial ribbon aquifer are closely connected to the Lindis River and are currently managed as surface water takes with restrictions imposed during periods of low river flow (Regional Plan: Water). Outside of the ribbon aquifer, but still within the Ardgour Valley (Ardgour Valley allocation zone), an annual groundwater allocation of 189,600$m^3$/year is suggested.




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

X Position of Lindis River flow at edge of groundwater basin

**Figure 2: Recommended groundwater management zones in the Bendigo-Tarras groundwater basin.**

## New information for defining aquifer extent

Geophysical data was used to define the shape of the groundwater basin. The low permeability silts underlying the area have a strong signature in the geophysical data. A combination of cross-sections and resistivity maps was used to interpret the data (Figure 2).

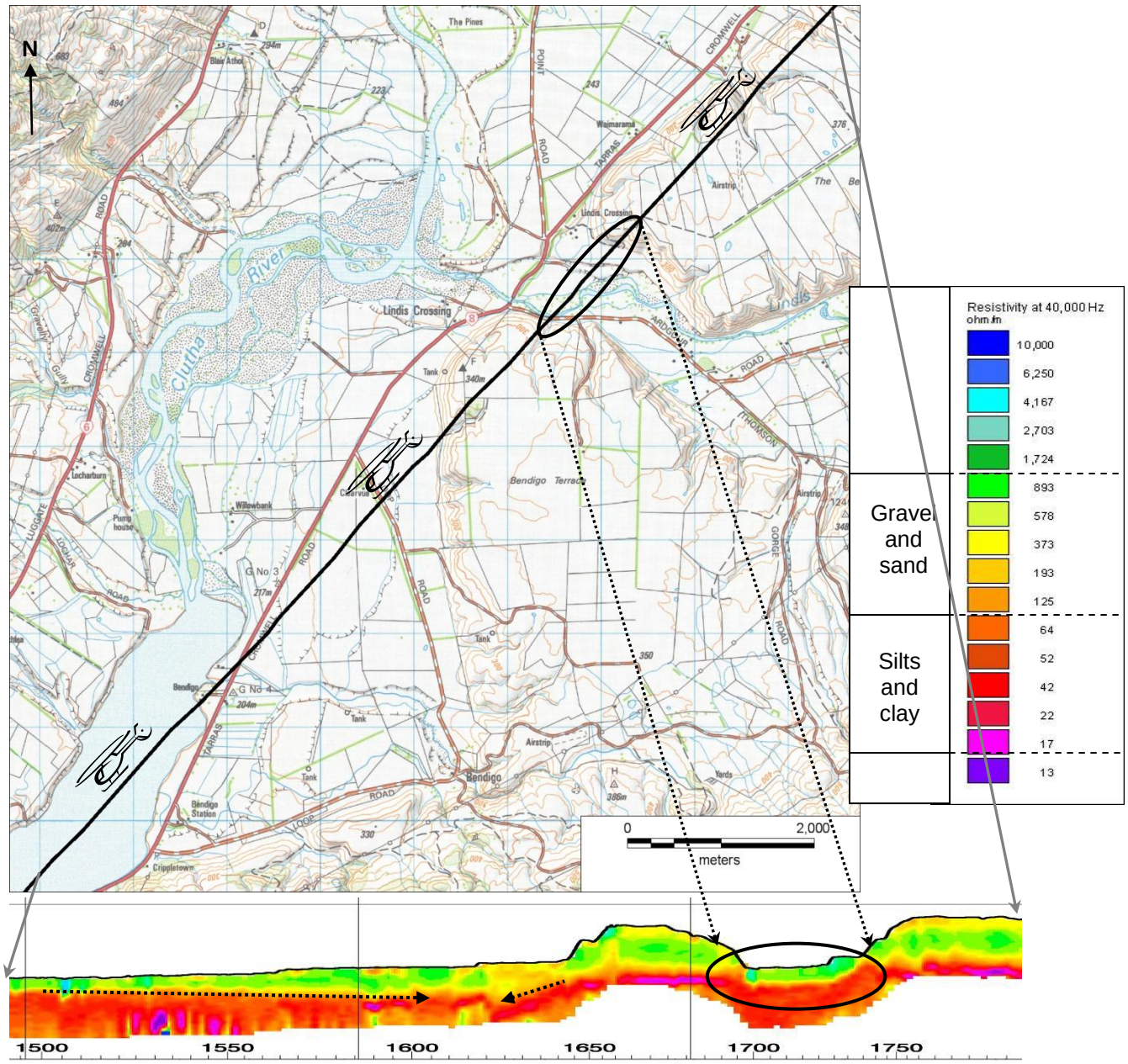



**Figure 3: Geophysical profile through Bendigo area. Highlighted on the cross-section are the dips seen in the underlying silt (red and orange hue) and the Lindis alluvial ribbon aquifer (yellow and green hue) contained by the underlying silt sediments.**

### Glossary

**Permeability**
A measure of the ability of a porous material (rock or unconsolidated material) to transmit fluids.

**Aquifer**
An underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt, or clay) from which groundwater can be usefully extracted using a bore.

**Groundwater recharge**
A hydrologic process where water moves downward from surface water to groundwater.

Full report available at : **www.orc.govt.nz**

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