



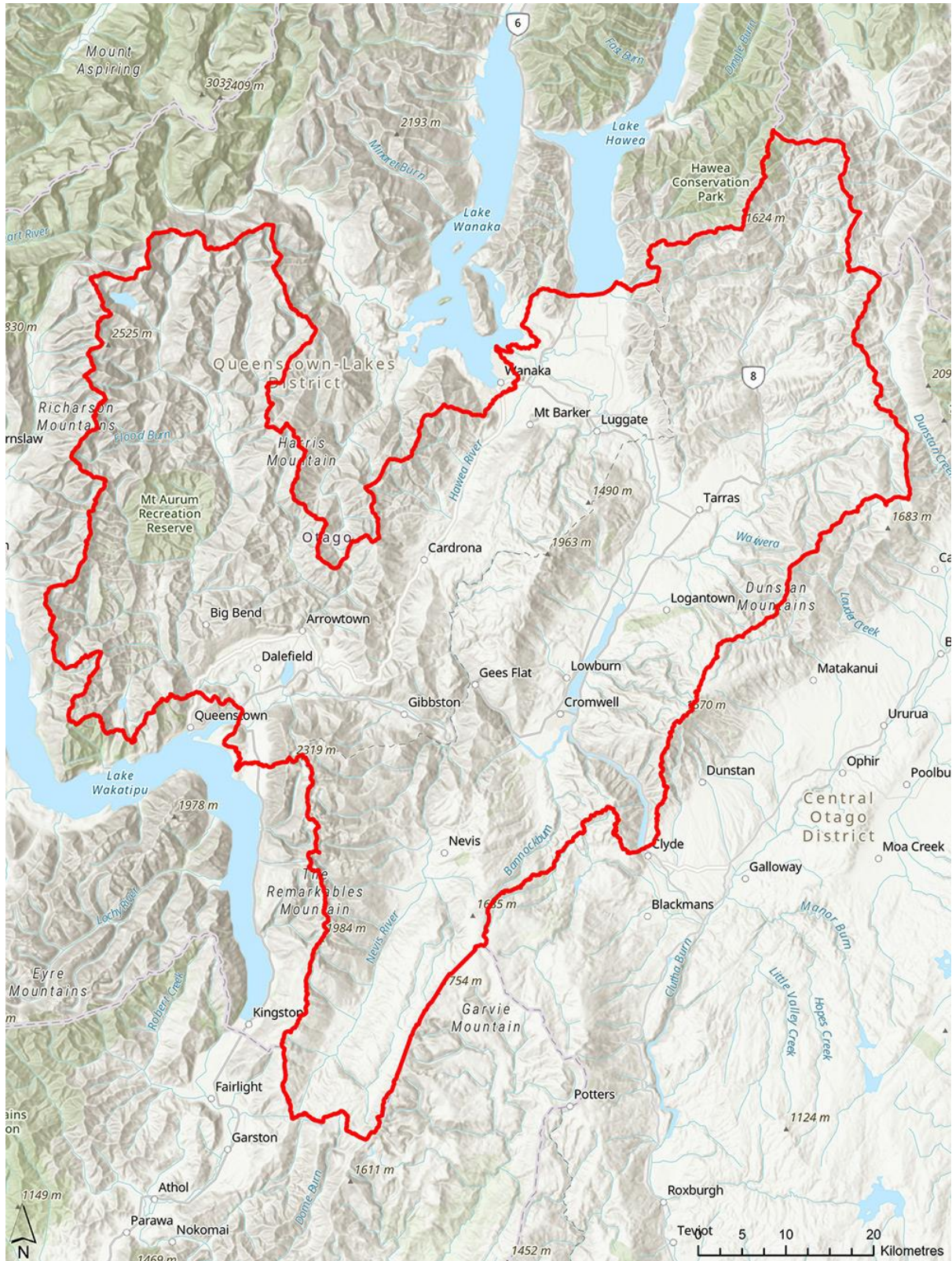
Clutha Mata-Au Freshwater Management Unit (FMU): Dunstan Rohe



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Map: Dunstan Rohe



Introduction

The Dunstan Rohe runs from the outlets of lakes Wanaka, Whakatipu and Hawea down to Clyde dam and includes the Kawarau, Nevis, Shotover, Upper Clutha Mata-au, Hawea, Cardrona, Arrow, and Lindis Rivers. Many smaller tributaries of the Clutha Mata-au are also included, such as the Lowburn, Amisfield Burn, Bannock Burn and Luggate Creek. The land area is approximately 509,000 ha.

The outflows of Lakes Wanaka and Whakatipu are unregulated. However, Hawea Dam controls the outflow of Lake Hawea. This rohe also includes Lake Dunstan, a run of river hydro lake created by the Clyde Dam.

These catchments contain diverse landforms from the rugged Kawarau gorge, tracts of native bush in the remote Shotover catchment, to extensive agriculture and fruit-growing areas.

Māori were drawn inland to this area by the mahika kai network, which was important for transporting people and resources such as pounamu from the interior to the coast. The rohe later supported gold mining and agricultural endeavours, creating a rich cultural heritage of structures and sites.

Situated around the south of Lake Dunstan, Cromwell is the largest urban centre included in this rohe. The current economic focus of the area is primarily tourism and agriculture, the latter ranging from internationally recognised viticulture and orchards to sheep and beef farming.

Science Summary

Soils and land use

The Dunstan rohe covers approximately 509,000 ha of land and extends from the Lindis river catchment in the northeast, and the Shotover river catchment in the northwest, to the Nevis river catchment in the south. It includes Lake Hayes and Lake Dunstan and the Clutha Mata-au River and its tributaries: the Cardrona, Arrow, Kawarau, Shotover, Lindis, Nevis among others.

Exotic grasslands, primarily used for farming, cover 37% of the rohe and 23% is conservation land. Sheep and beef are the dominant farming type (45%), followed by mixed livestock farming (sheep, beef, deer (15%)), sheep (5%). Dairy, nurseries/vineyards/orchards occur on 1% of the area.

The notable trends in land use change over the past three decades have been an increase in the conservation estate (by 293%), urban development (by 108%) and nurseries/vineyards/orchards (by 33%). The dry-stock farming has decreased by 25%, although it is still the most common land use in the Dunstan area.

The most frequent soil types in this rohe are Brown (53%), Pallic (29%) and Semi-arid (11%). Most Brown and Semi-arid soils are moderately or well-drained and permeable. However, some areas of Brown soils have poor drainage, including parts of the Lindis, Nevis and Luggate catchments. Semi-arid soils extend from the Lindis river catchment down to Bannock Burn. Raw soils occur in 4% of the rohe in alpine rock areas where erosion is active, for example, Centaur peaks and Mount Aurum.

Water Quantity

New Zealand's weather is affected most by westerly winds, which carry wet weather to the west of the main mountains and dry weather to the east coasts. The Southern Alps give the South Island sharp contrasts in weather and climate between the areas west and east of the Alps.

Parts of the Dunstan Rohe are in both areas, so the climate is very diverse. It includes some of the wettest, driest, warmest, and coldest places in New Zealand. Annual rainfall in the headwaters of the Shotover River is more than 3000mm per year, while in parts of the Upper Clutha Mata-au Valley, rainfall is less than 400mm per year. There is a steep rainfall gradient from west to east, with the Shotover headwaters only about 50 km from the low-rainfall Upper Clutha Mata-au area.

Air temperatures from -10°C to 36°C have been recorded in the Upper Clutha Mata-au Valley. In the headwaters of the Shotover River, where it is close to permanent snow and ice, temperatures less than -10°C are likely.

The diverse weather and climate results in a similar diversity in river and stream flows. There is abundant water in the rivers where rainfall or snow melt is plentiful, as in the Shotover, Kawarau and Clutha Mata-au Rivers headwaters. However, there is much less water in the smaller rivers and streams in the Upper Clutha Mata-au Valley, with only about 10% of the rainfall in the Shotover headwaters.

This rohe contains the large hydroelectricity reservoir, Lake Dunstan. Water use for other purposes varies in this rohe. Very little water is taken from the Shotover and Nevis Rivers, but there is significant water use in the Upper Clutha Mata-au Valley from the Clutha Mata-au river, and the Hawea and Dunstan lakes. Here, irrigation is the lifeblood of farming, and some of the streams run dry in summer.

Water Quality

Water quality across the Dunstan Rohe is generally very good. However, there is pressure on water quality in drier catchments where high water use, or high population growth rates occur. ORC regularly monitors the water quality and ecology of rivers and streams in the rohe. The combined results indicate the health of a river or stream, and long-term data are analysed to show trends in water quality over time. ORC has monitored many sites in this rohe for less than five years, so the current water quality state and trend results for these sites are interim.

Six of the sixteen river sites we monitor did not meet the required standard (national bottom line) for at least one measurement, according to the National Policy Statement for Freshwater Management (2020). Upper Cardona, Quartz Reef Creek, Mill Creek, Lindis at Lindis Peak and Clutha Mata-au at Luggate failed to meet the national bottom line for suspended fine sediment (visual clarity). The bacteria *E. coli* is measured to indicate safety for human contact. *E. coli* results did not meet the national bottom line at Upper Cardona and Kawarau at Chards. Aquatic insect life did not meet the national bottom line at Mill Creek. Two of the three monitored lakes, Lake Hayes, and Lake Johnson did not meet the national bottom line for chlorophyll-a, a measure of algae levels in the water. This result is consistent with the nutrient-enriched state of these lakes.

Despite most sites' very good water quality, we identified some degrading trends. In particular, the Cardrona River had 10-year degrading trends for *E. coli*, nutrients (nitrogen and phosphorus) and an aquatic insect life metric. Luggate Creek had 10-year degrading trends

for *E. coli*, nitrogen, and turbidity. Mill Creek had improving trends for nutrients and *E. coli*, but a degrading trend for turbidity.

Groundwater

Groundwater in the Dunstan Rohe has been greatly affected by glacial advances and retreats in the past. These cycles have created several large basins that hold relatively deep gravel aquifers and shallow alluvial ribbon aquifers near rivers. These include the Hawea Basin, Wanaka & Cardrona Basin, Whakatipu Basin, Cromwell Terrace Aquifer, Lower Tarras/Bendigo Aquifer, and the Lowburn Alluvial Aquifer. Groundwater use in the rohe is high, with approximately 1,000 completed bores registered with the ORC. The primary groundwater uses are domestic & stock water, irrigation, community supply, and monitoring. There are around 240 resource consents to abstract groundwater in the rohe, with a total annual consented volume of about 89.874 million m³/year.

ORC monitors groundwater quality in 16 State of Environment (SoE) bores across the rohe. The results generally suggest good groundwater quality with low *E. coli* and nitrate concentrations below the Drinking Water Standards limits in most bores. However, some bores (e.g. in Wanaka, the Wakatipu basin, and Lower Tarras) have had elevated *E. coli*, nitrate, and Dissolved Reactive Phosphorus (DRP) concentrations. These are likely to reflect the rapid development in this rohe. Arsenic concentrations in most monitoring bores are generally below the limit, although elevated concentrations were measured in some bores. These are likely to be caused by the local schist geology. As the schist is prevalent across the rohe, groundwater users should regularly test their bore water.

Biodiversity

The Dunstan Rohe includes rare and threatened ecosystems and species. Rare and vulnerable ecosystems associated with freshwater include ephemeral wetlands, inland saline ecosystems, lake margins, and wetlands. Although these ecosystems contribute disproportionately to national biodiversity, land use change and invasive species often threaten them. We usually know little about the extent or condition of these ecosystems, including in this rohe.

Many species depend on freshwater and ecosystems in the Dunstan Rohe, including fishes, invertebrates, plants, and birds. There have been 65 threatened freshwater-dependent species identified. The rohe provides habitat for native fishes, including three non-migratory galaxias, four migratory galaxias (whitebait), two eel and five bullies. Some of these fish are threatened, for example, the lamprey and all non-migratory galaxias. Freshwater invertebrates include koura, mussels, and threatened stoneflies. Threatened freshwater-dependent plants include *Chenopodium detestans* and *Triglochin paluste*. Many birds also depend on these ecosystems, permanently or transiently, including the threatened Australasian crested grebe and black-fronted tern. Some exotic fishes are found in the Dunstan Rohe, including goldfish, perch and four salmonids. Many native freshwater species are under threat and continue to decline in numbers.

Wetlands

In the Dunstan Rohe above the treeline, shrubland and grassland give way to herbs. The natural vegetation below the alpine zone is forest, mainly beech with scattered conifers on

mountain slopes and poorer soils. The forested valley floors support tall and short tussock grassland with pockets of small-leaved shrubs and conifer woodlands. Early fires modified all these communities, which removed forests and expanded tussock grasslands on lower and mid-slopes in eastern mountains.

In the Dunstan Rohe, ten sites are recognised as Regionally Significant Wetlands. These are swamp (4 sites), fen (3), marsh (2), and bog (1). On the delta where the Upper Clutha Mata-au runs into Lake Dunstan, the Bendigo Wetland (244 ha.) has developed swampy, willow-edged river margins. This wetland provides a habitat for diverse wildlife, especially valuable for birds and angling. Further upstream, above Luggate, the Campbells Reserve Pond Margins (1 ha.) is a small marsh, spring-fed from seepage off the terraces above. Butterfield Wetland (2 ha.), on an old Hawea River terrace, is of similar origin, with a raupo-edged pond. Two sites in the Nevis Valley, Nevis Red Tussock Fen (44 ha.) and Schoolhouse Flat Red Tussock Fen (9 ha.), have communities of red tussock and various carex species distributed according to the soil wetness. At the head of the Nevis, in its Roaring Lion catchment, is New Zealand's largest string bog system, which also extends into the Nokomai catchment, Southland. This system combines terraced tarns, fens, bogs, and snowbanks. In the Queenstown area, Lake Hayes Margins (17 ha.) has lake fringes of raupo, crack- and grey-willows, and some carex swamp. Moke Creek Swamp (1 ha.) and Moke Lake Bog (12 ha.) have both bog and swamp types. In one of the heads of the Shotover, the Polnoon, the Church Hill Wetland Complex (103 ha.) occupies a fault-derived basin with glacial moraines, bogs, fens, tarns, and ephemeral wetlands. Two additional sites are Queenstown Hill; a Conservation Covenant-protected site of cushion bog and tarn communities; and the head of Pisa Range Roaring Meg, with sedge and cushion bogs and tarns.