



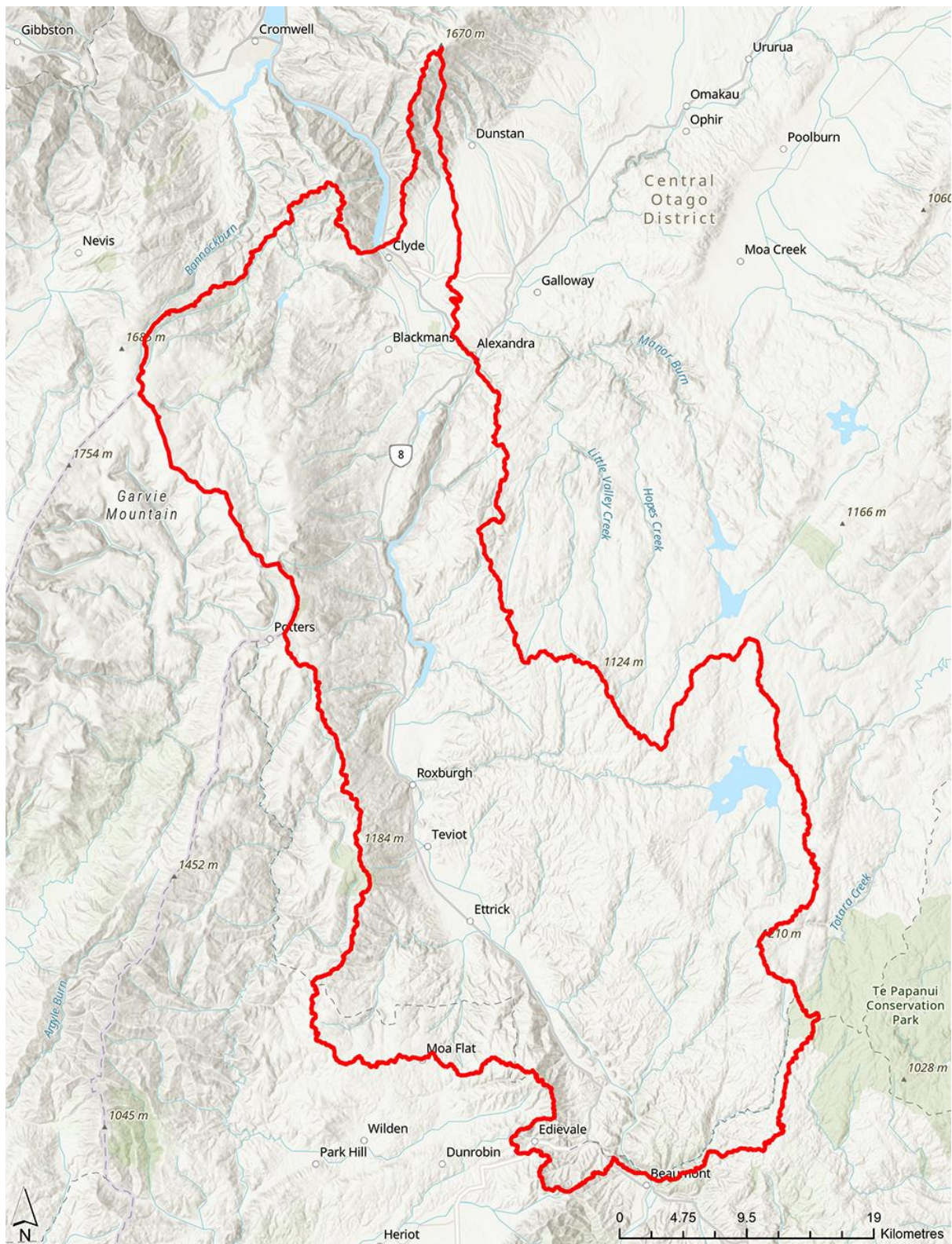
Clutha Mata-Au Freshwater Management Unit (FMU): Roxburgh Rohe



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Map: Roxburgh Rohe



Introduction

As the Clutha Mata-Au FMU is large, it has been divided into five rohe (areas).

The Roxburgh Rohe is home to more than 2,000 people. It extends from the Clyde Dam to Beaumont, encompassing the Clyde, Alexandra, and Roxburgh urban settlements. The rohe includes some important tributaries for the Clutha Mata-Au, such as the Fraser River (or The Earnscliffe), Benger Burn, Teviot River, and Beaumont River. The man-made Lake Roxburgh is situated roughly in the middle of the rohe along the Clutha Mata-Au River, while the Fraser and Teviot River catchments host the Fraser Dam and Lake Onslow respectively.

The Clutha Mata-Au River is important in Kāi Tahu traditions and history. There is an ongoing relationship of mana whenua with wāhi tupuna and mahika kai values. This area has galaxiids, wetlands, and landscapes with high natural character.

Science Summary

Soils and land use

The Roxburgh Rohe covers approximately 180,000 ha of land and extends from the Waikerikeri creek catchment in the north to the Beaumont river catchment in the southeast. It contains the Teviot River and Lake Onslow, with the Clutha Mata-Au River running right alongside the township of Roxburgh. The Fraser and Teviot rivers feed into the Clutha Mata-Au River. Alexandra and Clyde are the most populated urban areas in this rohe.

Low and high-producing grasslands are the most common land covers, occupying 32% and 29% of the rohe. These grasslands are mainly used for farming. Tall tussock grasslands cover 24%, and exotic forests cover 2% of the rohe. The exotic forests are mostly species such as *Pinus radiata*, Douglas fir and Eucalyptus.

The primary land use in the Roxburgh Rohe is drystock farming (77%), comprising, sheep and beef (65%); mixed sheep, beef, and deer (6%); and sheep farming (6%). Conservation estate covers approximately 10% of the rohe, with forestry and nurseries/vineyards/orchards covering 2% of the area. The notable changes in land use over the past three decades have been a 10-fold increase in conservation estate, expansion of forestry (by 156%), and an increase in nurseries/ vineyards/orchards (by 17%). The area used for dry-stock farming decreased by 12%, but still remains the primary land use in the Roxburgh area.

The soil types in the rohe include Anthropic, Brown, Pallic, Semi-arid, Podzols, Organic, Gley, Recent and Raw. The Brown, Pallic and Semi-arid soils are the most common and cover 54%, 26%, and 17% of the rohe. Most of the sheep and beef farming are on these soil types. The Semi-arid soils are generally well drained, while Pallic and Brown soils have variable drainage, with moderate to slow permeability.

Water Quantity

Westerly airstreams dominate the weather in New Zealand with rain-bearing weather systems bringing heavy rain to the west of New Zealand. In the east, we get much lighter falls due to the sheltering effect of the Southern Alps, creating a rain shadow. This effect is typical in Central Otago, where the Roxburgh Rohe is situated.

A mountain range on the western border of the Roxburgh Rohe also provides a sheltering effect from rain coming from the southwest. Heavier rain from the southwest falls at the tops of this mountain range, but the rainfall quickly decreases towards the east.

The Roxburgh Rohe is in the heart of Central Otago and is subject to typical weather conditions for this area with generally hot, dry summers and cold, frosty, dry winters. Mean annual rainfall ranges from about 1200mm on the Obelisk/Old Man Mountain ranges, around 900mm on the hills south of the mountains, to about 360mm near Alexandra, and 450-500mm further south. Temperatures can range from more than 38°C in summer to -10°C in winter. Evaporation in the rohe is very high, especially in the lowlands, where it usually exceeds precipitation, hence there is a moisture deficit.

Rivers and streams originating in this rohe do not have large flows and generally have very low flows in summer. However, the Clutha Mata-Au River, which runs through the centre of this rohe, has a healthy flow throughout the year.

Water use for irrigation is high from all the rivers and streams in this rohe due to the extreme dryness in the spring, summer, and autumn months. In summer, the smaller streams and rivers can run dry due to both natural losses to groundwater and irrigation abstraction. Hydroelectricity generation at Roxburgh Dam is also an important control on water quantity in the rohe.

Water Quality

Water quality in the Roxburgh Rohe is generally good. However, there are signs of degraded water quality in some indicators we measure, particularly in the Benger Burn. Potential pressures on water quality include pastoral farming, orcharding and plantation forestry. At times these stresses on water quality may be made worse by low flows in the tributaries. ORC monitors the water quality and ecology of rivers and streams in the rohe at four sites: Teviot River, Fraser River, the Clutha Mata-Au River at Millers Flat and Benger Burn. The results indicate the health of a river or stream, and we analyse long-term data to look at trends over time. We have monitored some sites in this rohe for less than five years, so current water quality results for these sites are provisional.

The monitoring results show that *E. coli* (human health indicator) and suspended fine sediment (visual clarity) did not meet the required standard (national bottom line), according to the National Policy Statement for Freshwater Management (2020) at three sites. These were the Benger Burn, Clutha Mata-Au, and Teviot River sites.

For the river sites, only the Clutha Mata-Au River at Millers Flat has enough data for trend analysis. The analysis for this site shows likely improvements in nutrients over 20 years but

decreased visual clarity. The results for Lake Onslow are mixed, with degrading trends over ten years for ammoniacal nitrogen and chlorophyll-a (a measure of algae in the water) but improving trends for visual clarity. Ammoniacal nitrogen can enter waterways via effluent and sewage and is toxic to aquatic life at high concentrations.

Groundwater

The Roxburgh Rohe contains several recognised groundwater basins and associated aquifers. The basins include Alexandra Basin in the north (including the Dunstan Flats, Earnsclough Terrace, and some of the Manuherikia Claybound aquifers), Roxburgh (Roxburgh East & West aquifers) and Ettrick basins. The aquifers in the rohe are mainly found in glacial outwash deposits. There is high variability in aquifer geology, parameters (e.g. water table depth, transmissivity), and groundwater interaction with surface water bodies (e.g. the Bengier Burn, Fraser, Clutha Mata-Au, and Manuherikia Rivers) across the rohe. Water loss from surface water bodies and irrigation schemes are important sources of recharge for groundwater. The primary uses of groundwater are domestic, stock water, community supply and irrigation. Some areas, e.g., Ettrick, are experiencing rapid development and land use changes, likely to pressure groundwater quality and availability.

Groundwater quality results vary across the rohe. The results from two ORC monitoring bores in the Alexandra basin indicate good groundwater quality, with no exceedances of the NZ Drinking Water Standards for arsenic, *E. coli* or nitrate. The results from the Roxburgh basin show no exceedances of the *E. coli* or arsenic limits. However, nitrate concentrations are between 1/3 to 1/2 of the limit (11.3mg/L). This suggests that it is prudent to monitor nitrate concentrations in this area. The results from two monitoring bores in Ettrick are poorer than the other areas, with several *E. coli* exceedances in both bores. Groundwater nitrate concentrations are also high, ranging between around 1/2 and 85% of the limit. There were no exceedances of the dissolved arsenic limits in either bore. This area's rapid land use changes and development will likely worsen these issues.

Biodiversity

Rare and threatened freshwater-related species and ecosystems are found in the Roxburgh Rohe. The ecosystems include rare and vulnerable freshwater-related ecosystems, such as braided rivers, ephemeral wetlands, lake margins, and wetlands. These are particularly sensitive to human pressures, including land use change and invasive species. We usually know little about the extent and/or condition of these ecosystems.

Diverse species depend on freshwater habitats and ecosystems in the Roxburgh Rohe, including fishes, invertebrates, plants, and birds. The Roxburgh Rohe has had 40 threatened freshwater-dependent species identified within its area. The threatened freshwater fishes include the Clutha flathead galaxias, Teviot flathead galaxias, dusky galaxias, and lamprey. Threatened freshwater invertebrates include a moth, a true bug, and a stonefly. *Triglochin palustris* and *Crassula multicaulis* are examples of freshwater-dependent plants found here that are threatened. Many native birds depend on freshwater ecosystems, permanently or as transient residents, including the threatened Australasian crested grebe and black-fronted tern. Information is often missing at a species level, particularly for freshwater invertebrates,

non-vascular plants, and algae. Exotic fishes found in the rohe include perch and three salmonids. Many native freshwater species are under threat and continue to decline in number.

Wetlands

Twelve sites are mapped as Regionally Significant Wetlands in the current Regional Plan: Water for Otago ('RPW'). These are classified as inland saline (4 sites), ephemeral wetland (1), fen (3), and marsh (4). Wetlands are common in upland areas, with copper tussock, sedgeland and herbfield the most widespread plant types in the rohe. The streams draining into Lake Onslow from the south (Boundary and Fortification Creek) are perhaps the most distinctive and impressive upland wetlands in Otago, if not nationally. The northern parts of the rohe, on the margins of the Manuherikia, support several saline wetlands.

The inland saline sites are all in the Conroys Gulley area: Conroys Dam Inland Saline Wetland Management Area (18 ha.), Conroys Road Inland Saline Wetland Complex (7 ha.), Chapman Road Inland Saline Area (7 ha.), and Blackmans Inland Saline Wetland Management Area (12 ha.). They are mainly hillside toe slopes, intermittently wet with seepage from groundwater. These areas have saline and alkaline soils and support salt-tolerant plants that otherwise occur in coastal salt marshes. They also have some annual species that are dormant in dry seasons, which is unusual in native plants.

Flat Top Hill Ephemeral Wetlands (5 ha.) form on surface depressions of hill-crest plateaus. These wetlands also have native annual plants that tolerate both ponding and drought.

The most extensive wetlands in the rohe occupy the valleys that feed Lake Onslow from the south. These wetlands are Fortification Creek Wetland Management Area (526 ha., includes the Teviot River South Branch), Boundary Creek Fen (94 ha.), and Middle Swamp (67 ha.). In these fen wetlands, valley floors with gentle gradients have developed meandering systems on a smaller scale and at a higher altitude than the broad scroll plains of the upper Taieri. These have complex patterns of sinuous stream channels, cutoffs, oxbows, and old river channels. Copper tussock grassland grows in the alluvial flats, along with sedgelands, turf communities in the hollows, aquatic plants, and sphagnum fens at the valley sides.

The RPW also identifies four small marsh sites in the Etrick to Roxburgh area: Island Block Pond Marshes (4 ha.), Upper Black Stream Marshes (3 ha.), Rigney Pond Marshes (0.5 ha.), and Gilmour Road Marsh (1 ha.).

A significant wetland not currently listed in the RPW is Teviot Swamp. This is a large fen complex found in a basin at the head of the south branch of the Teviot River at 1000 m altitude. Fed by groundwater and seepages from the top of the Lammerlaws range, sphagnum moss is the main peat-forming plant on the wettest ground. As water movement changes with time across the fen fans, the vegetation changes to cushion plants. In the uppermost tributaries, the moss and cushion communities are part of small string bog systems, with pools in terrace sequences. Other fingers of valley wetlands at upper altitudes also occur in the heads of the Fraser River, west of Alexandra