




Natural Character, Riverscape & Visual Amenity Assessments

Clutha/Mata-Au Water Quantity Plan Change – Stage 1
Prepared for Otago Regional Council

15 October 2018



Document Quality Assurance

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1.0 Introduction

Otago Regional Council (ORC) has commissioned a natural character, riverscape and visual amenity assessment to assist with the preparation of a proposed plan change to the Regional Plan: Water for Otago (Water Plan). The proposed plan change relates to:

Allocation limits and associated minimum flows for:

- The main stem of the Clutha River/Mata-Au between:
 - Lake Wanaka outlet and the head of Lake Dunstan;
 - Clyde Dam and the head of Lake Roxburgh;
 - Roxburgh Dam and the mouth of the Clutha River/Mata-Au;
- The main stem of the Kawarau River; and
- The main stem of the Hāwea River; Allocation limits and lake levels for;
 - Lakes Dunstan and Roxburgh (Hydro lakes);
 - Lakes Hāwea, Wakatipu and Wanaka (Source lakes).

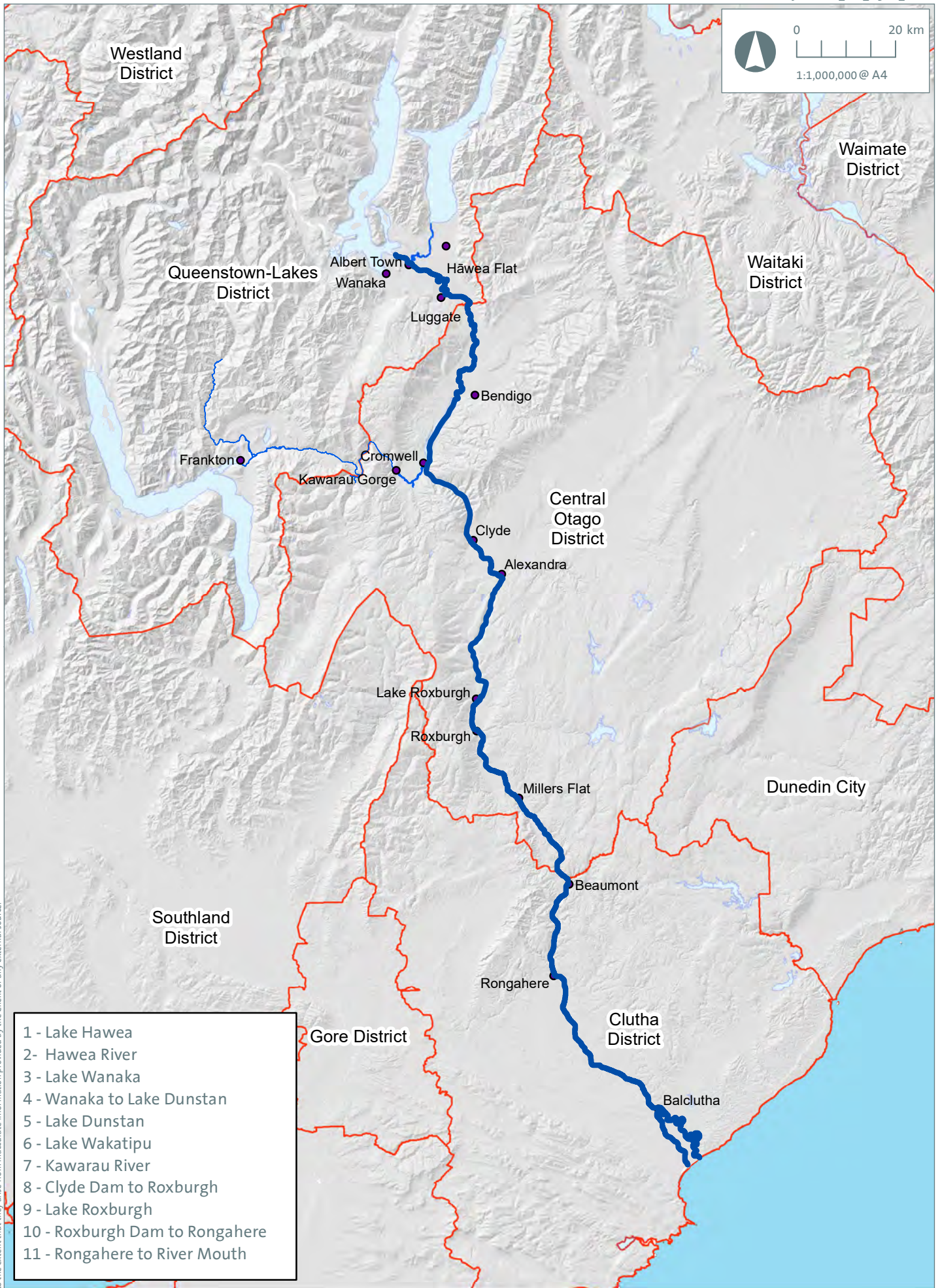
This assessment is part of Stage 1 as a baseline study of the plan change process. Its purpose is to describe and analyse the current riverscapes, levels of natural character and visual amenity.

1.1 Project Scope

The project involves three separate but interrelated assessments; a riverscape description, a natural character assessment and a visual amenity assessment.

The study area for these assessments was identified by ORC and divided into 11 'reaches' listed below; (refer **Figure 1**)

- Lake Hāwea
- Lake Wanaka
- Lake Wakatipu
- Lake Dunstan
- Lake Roxburgh
- Hāwea River
- Clutha Mata-Au between Lake Wanaka and Lake Dunstan
- Kawarau River
- Clutha Mata-Au between Lake Dunstan (Clyde Dam) and Lake Roxburgh
- Clutha Mata-Au between Lake Roxburgh (Roxburgh Dam) and Rongahere
- Clutha Mata-Au between Rongahere and river mouth



- 1 - Lake Hawea
- 2 - Hawea River
- 3 - Lake Wanaka
- 4 - Wanaka to Lake Dunstan
- 5 - Lake Dunstan
- 6 - Lake Wakatipu
- 7 - Kawarau River
- 8 - Clyde Dam to Roxburgh
- 9 - Lake Roxburgh
- 10 - Roxburgh Dam to Rongahere
- 11 - Rongahere to River Mouth

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Assessment Limitations and Assumptions

Regional Scale Study

The study area for this project is extensive and essentially considers some of the largest waterbodies in the South Island. While the study area has been divided into 11 sub areas (or reaches), each of these typically encompass large geographical areas. At a regional scale each of the waterbodies can be considered to be relatively homogenous. However, if considered at a finer scale there would be obvious diversity of elements and qualities within each water body.

This assessment has been undertaken at a regional scale, inevitably resulting, to an extent, in an 'averaging' effect where very good or high value attributes can at times, balance out poorer or low value attributes. Notwithstanding this, the assessment has identified obvious differences in the attributes and qualities between the reaches.

Hydro Lakes - Lake Dunstan and Lake Roxburgh

Lakes Dunstan and Roxburgh are the flooded valleys of the Clutha River/Mata-Au where the river was dammed to develop the hydro power scheme in the 1950s and 1990s. For the purposes of this natural character assessment these lakes have been assessed as lakes rather than rivers, (albeit artificially created lakes). The lakes have been in place for some time, they have naturalised to lake systems to some degree and will remain as lakes for the foreseeable future. Consequently, in terms of on-going management decisions it is pragmatic to assess their naturalness in terms of lake elements, patterns and processes. The flow related attributes were however rated as very low given that they are managed for electricity generation.

Natural Character a Culmination of Many Factors

Natural character is essentially a measure of the naturalness (or modification) of the natural elements, patterns and processes that comprise a waterbody (refer to Section 2.2 for detailed description). The process to assess the level of natural character involves an understanding of the many systems and attributes that contribute to a waterbody including abiotic, biotic and experiential factors. Consequently, this requires input from a range of technical disciplines such as river hydrology and morphology, aquatic and terrestrial ecology, water quality and landscape architecture. This assessment is based on a desktop review of relevant available data, expert input and review by ORC staff and a site survey. The site survey was carried out over 2 days (13th and 14th June 2018) visiting 59 locations accessible from public roads.

1.2 Statutory Context

The Resource Management Act 1991 (RMA) requires regional councils to manage the taking and use of water and manage the quantity, level and flow of water bodies. The National Policy Statement for Freshwater Management 2017 (NPSFM) requires regional councils to set allocation limits and minimum water levels/flows for all freshwater management units and ensure efficient water use.

In order to meet the requirements of the NPSFM, the Otago Regional Council (ORC) is now preparing a series of changes to the provisions in the Regional Plan: Water for Otago (Water Plan). These plan changes seek to set allocation limits (primary and supplementary) and associated minimum flows for the surface water and connected groundwater resources of several Otago catchments.

Section 32 of the RMA directs regional councils to identify and assess the environmental, economic, social and cultural impacts (cost and benefits) of water quantity plan changes. Natural character, riverscape and visual amenity values together contribute to the economic, environmental and social and cultural wellbeing in the following ways:

- the quality of life experienced by New Zealanders.
- areas with high natural character often support high value biodiversity and ecosystems
- supporting tourism and film industries and can strengthen local economies by attracting residents and investment to an area, as well as tourists.

2.0 Riverscapes, Natural Character and Visual Amenity

Rivers and lakes are dynamic and complex features set within a broader landscape context. They are often a visual, ecological and recreational focus in a landscape as well as providing physical links throughout their catchments. Rivers and lakes and their margins have natural character, amenity and landscape values that require consideration in water allocation decisions particularly relating to how changing river flows and lake levels can affect those values.

Many aspects of riverscapes, natural character and visual amenity are inevitably interrelated and overlapping. The sections below describe each of the three assessments and the matters taken into consideration for each.

2.1 Riverscape Descriptions

The term riverscape refers to the particular landscape qualities associated with the features of a river and its margins and can be thought of as a subset of the wider landscape. It simply indicates that it is the river component of the landscape that is being considered, rather than the whole catchment context. For this project the riverscape section of the report also includes the descriptions of the lakes and their margins.

The riverscape is described for each of the identified reaches of this project in terms of the landform (river channel/ lakeshore morphology), land use (including recreation), and vegetation cover. The description provides the contextual landscape setting for each of the reaches/lakes.

2.2 Natural Character of Rivers Lakes and their Margins

The Resource Management Act (Section 6(a)) considers as a matter of national importance:

...the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development.

Natural character is a term used to describe the naturalness of an environment. The definition¹ used for this study is:

Natural character is a term used to describe the naturalness of river/lake environments. The degree or level of natural character within an environment depends on:

- The extent to which natural elements, patterns and processes occur

¹ A definition that has been widely adopted by landscape architects and other resource management practitioners.

- The nature and extent of modifications to the ecosystems and landscape/riverscape.
- The highest degree of natural character (greatest naturalness) occurs where there is least modification.
- The effect of different types of modification upon the natural character of an area varies with the context and may be perceived differently by different parts of the community.

The natural character of rivers and lakes may be affected by structural modifications (e.g. the construction of dams, water take structures groynes, stopbanks, bridges or boat ramps), changes in appearance resulting from particular flows or lake levels (in the most extreme case a dewatered river channel), or by longer term effects of river flow regime/lake level changes such as vegetation encroachment onto river beds, the loss of river braids, extent of lake margin etc. Dams, bridges, and infrastructure associated with water takes are examples of built modifications that may be in or close to the river/ lake bed. However, roads, structures and buildings occurring further from the river/ lake on adjacent land may also have effects on the natural character of a water body.

The methodology used for this natural character assessment is based on previously developed guidelines for river assessment² and the recent development of the natural character assessment methodology for the coastal environment.

2.2.1 Natural Character Assessment – Methodology

The key factors considered to assess the naturalness of the lakes and rivers relate to the degree of intactness of the natural elements, patterns, processes, and extent of any physical modifications to landforms or presence of built structures. It also includes the perceptual or experiential component of naturalness.

Natural elements incorporate all key river elements, such as the water, bed and banks, as well as particular attributes occurring within the river environment, such as geological formations, native vegetation and fauna. Exotic species also have natural characteristics that can positively contribute to natural character. However, their presence will reduce levels of natural character from 'pristine' because they have been introduced and displace indigenous vegetation.

Natural patterns take the channel and the riparian edge into account, as well as patterns created by humans on adjacent land, such as shelterbelts, land use boundaries, etc.

Natural processes include river/ lake dynamics, flows and currents, erosion, freshes and floods, and regeneration processes of riparian vegetation and ecological health.

Experiential/perceptual- relates to how we experience naturalness, the sense of untamed remoteness, the sounds and smells of a place and how natural it appears and feels.

² FRST 2009. Prepared by Boffa Miskell and NIWA *Riverscape and Flow Assessment Guidelines*

2.2.2 River and Lake Components

For the purposes of the natural character assessment the rivers and lake have been considered to comprise three components; Context, Margin, and Active bed.

Context

Refers to the wider landscape context of the catchment adjacent to the lake/river, and considers the land use, landform and vegetation cover that contributes to the overall character of the river/lake.

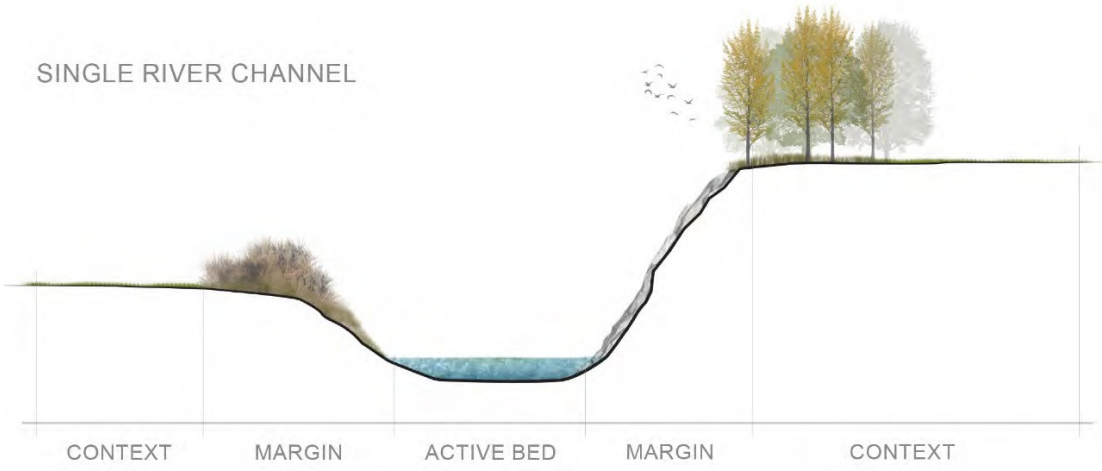
Margin

Refers to the strip of land between the active bed and the wider landscape context, including the banks. River processes, patterns and influences will be evident in the margin, such as occasional flooding, historic banks and channel patterns. From locations within the river/lake margin the active bed is the visually dominant feature. The margin is typically narrow and may incorporate terraces, banks, stopbanks, abandoned riverbed, floodplains, river and tributary confluences and built infrastructure. Generally topographic features define the extent of the margin as they extend between the top and base of banks or terraces. Vegetation type boundaries can also define the margin extent, such as where riparian scrub or planting meets grazed pasture in the landscape context.

Active Bed

- **River:** For single stem, incised rivers the active bed comprises the river channel. For wider riverbeds and those with a braided character the active river bed includes wetted areas/channels and may include dry margins, islands, banks, abandoned channels and bars of a braidplain that form part of the river's natural migration across the riverbed, as well as flood channels, and side channels.
- **Lakes:** Includes varying lake shore extents for the typical range of lake levels. The landward extent of the active zone is often delineated where permanent terrestrial vegetation meets the bare gravel/rock substrate.

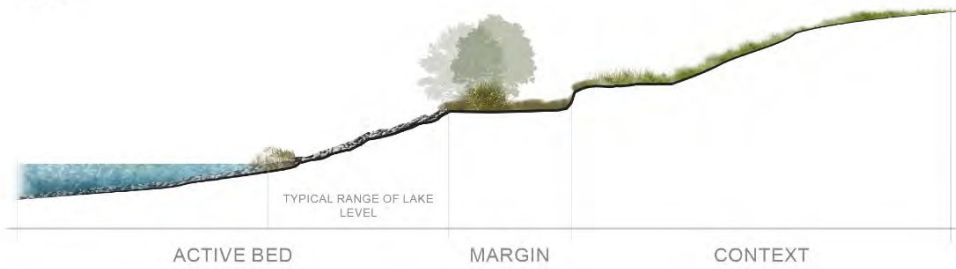
SINGLE RIVER CHANNEL



BRAIDED RIVER



LAKE



2.2.3 Structure of the Natural Character Assessment

Each component of the river or lake has been assessed separately using a set of attributes that incorporate the abiotic and biotic factors specific to river and lake systems as below. The experiential component of natural character has been considered for the complete river/lake rather than for each component separately.

Assessment Criteria Natural Character

| River / lake Component | Attribute groupings | Lake/river Natural Character Attributes |
|---|---------------------|---|
| Active bed | Abiotic | Flow regime characteristics and levels, managed or natural flows. |
| | | River channel /lakebed substrate morphology including modifications/ structures e.g. boat ramps, dams, diversions |
| | | Water Quality-if available indicator of ecological health |
| | Biotic | Aquatic ecology, flora/fauna, habitat, pest species |
| Margin | Abiotic | Modification and structures- buildings, quarries, stopbanks, bridges roads, |
| | Biotic | Terrestrial ecology, (also describe braided riverbeds) e.g. vegetation and bird habitat |
| Context | Abiotic and Biotic | Land modification/land use / vegetation. Urban, agriculture, |
| All (focus on active bed and margin) | Experiential | Views, sounds, sense of naturalness, wildness remoteness |

A Five-Point scale was used to assign an overall level of natural character to each of the river/lake components.

| Very High | High | Moderate | Low | Very Low |
|--|--|---|--|--|
| Very High levels of natural character due to Very Low or no levels of modification | High levels of natural character due to Low levels of modification | Moderate levels of natural character due to moderate levels of modification | Low levels of natural character due to High levels of modification | Very Low levels of natural character due to Very High levels of modification |

2.3 Visual Amenity Assessment

Amenity values have been defined in the RMA as:

...those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes.

The focus as part of this report is on the visual aspect of amenity (recreational values of the water bodies are covered as part of a separate assessment).

Descriptions and evaluation of the visual amenity of the river reaches/lake will not be broken down into components as for natural character assessment as the river environment can only be experienced visually in its entirety.

Attributes that contribute to visual amenity (its pleasantness, and aesthetic coherence) are:

- **In river** - flow level, wetted surface/ dry channel, water clarity, water colour, water movement, light reflection
- **River margins** - vegetation, signs of human modification, litter, seasonal colour, exposed river/ lake margin (e.g. substrate of margin, algal proliferations)
- **Potential viewing audience** - visibility of the lake/river, popularity of the location, recreational uses, outlook for nearby residents or roads

3.0 Clutha Catchment Description

The Clutha River/Mata-Au flows for 338 kilometres (km) (Te Ara, Otago places - Clutha River/Mata-Au) southeast through Otago, making it the country's second longest river. It is also the largest volume river in New Zealand with a mean flow of 614 m³/s, discharging 6% of the South Island's freshwater into the Pacific Ocean at Molyneux Bay (ORC, 2016). The power of the swift waters comes from the large scale of the catchment area, which at more than 21,000 km², represents two-thirds of the area of the Otago region.

The Clutha River/Mata-Au system is fed by three large lakes, Lakes Hāwea, Wakatipu and Wanaka, their headwaters deep in the Southern Alps. From this alpine-subalpine region, the river flows through Central Otago's block mountain landscapes with arid valleys and gorges and limited areas of fertile terraces and fans, to hard-rock downlands and out to the coastal plains and delta at the sea. The Kawarau River, draining Lake Wakatipu, is its largest tributary, joining the Clutha/Mata-Au at Cromwell.

There are three dams along the Clutha River/Mata-Au, at Roxburgh, Clyde, and Hāwea. The structures modify the local landscape character as well as artificially regulating lake levels and river flows and impacting on levels of sediment and its movement downstream. Gravel extraction occurs along the length of the river as well as in the Hawea and Kawarau rivers.

The waters above Balclutha are generally of a higher quality than below, where water quality deteriorates as a result of several high volume wastewater discharges.

Vegetation in the wider catchment is predominantly tall tussock, found on the higher elevation land and exotic grassland on the valley floors and the coastal plains. Small pockets of indigenous forest remnants and regenerating shrubland can be found, largely in the higher valleys but also along the lake and river margins in places. There are also regionally significant wetlands along the main stem of the Clutha River/Mata-Au. Exotic poplars and willows heavily dominate the river banks.

Twenty-three native fish species have been recorded from the wider Clutha catchment as well as koura/freshwater crayfish. Native fish include koaro, bully species, longfin and shortfin eels, common smelt, inanga, giant kokopu, torrentfish, and black flounder. Five sport fish species have been recorded within the Clutha catchment: brown and rainbow trout, Chinook salmon, brook char and perch (Unwin, 2016).

The catchment also provides diverse habitat for a wide variety of birds and other fauna, both exotic and indigenous.

There are many values associated with the river and catchment; as a source of food and gold, water for electricity and irrigation, as well as for its scenery, wildness and recreation opportunities. The Clutha/Mata-Au River is well recognised for its remarkable speed, colour and water clarity. The Upper Clutha between Lakes Wanaka and Dunstan in particular, rarely discolours with the rocky substrate often clearly visible under the water. In contrast, its tributary, the Kawarau River carries large levels of fine silt from the Shotover, influencing turbidity downstream.

The Clutha/Mata-Au River is also an area of Statutory Acknowledgement for Ngāi Tahu, including Lake Hāwea, Lake Wanaka, Te Wairere or Lake Dunstan, and Whakatipu-wai-Maori or Lake Wakatipu. The river and lakes were part of a mahika kai trail leading inland from the eastern coast and were also significant for the transportation of greenstone from the west.

Settlement of the Upper Clutha basin by Europeans began in the 1860s driven by gold mining and pastoralism. Historic mining sites on the edges of the river are still identifiable by the scouring caused by sluicing and by the location of stone tailings and cottage remnants.

Today land use varies along the river including protected conservation and crown land, grazing properties ranging from extensive sheep stations in a more natural landscape to more highly developed farms, orchard and vineyard areas. Central Otago produces around 45% of the nation's stonefruit, the river supporting a fruit and viticulture corridor.

There are a few built-up urban areas and many small settlements while state highways and local roads extending along much of the river corridor. has.

The predominant recent land use change in the catchment is the conversion of tall tussock grassland to high producing exotic grassland while new subdivisions and vineyards are also changing the immediate riverside landscape. Didymo is present throughout the catchment, and lake snow can be found in the headwater lakes. Lagarosiphon is also present in the catchment and is being managed in Lakes Wanaka, Dunstan, and Wakatipu and Kawarua River.

In 1984, the Clutha River/Mata-Au was included in a National Inventory of Wild Scenic Rivers, compiled to establish the scenic, recreational and other attributes for any river considered nationally important³. Today, the river continues to be appreciated for its recreational and scenic values. There are many public recreational areas taking in views of the river although close views from the water's edge are limited at times by riverside vegetation (predominantly willows) and by high banks.

The rivers and lakes in the catchment are widely used for recreation activities, particularly fishing, as well as swimming, and boating (largely in the lakes). Cycling along the river margins is also increasingly possible in many areas and growing in popularity.

The Kawarau River and its tributaries, including Lake Wakatipu, and the Shotover and Nevis Rivers, are the subject of a water conservation order, the Kawarau Water Conservation Order (KWCO), to maintain the rivers' wild and scenic, scientific and recreational values

³ National Water and Soil Conservation Authority (1984) the inventory was never completed or given statutory recognition

4.0 Assessments - by Reach

4.0 Lake Hāwea

Lake Hāwea is a snow and glacier-fed lake at the head of the Clutha/Mata-Au catchment, located in a broadly north-south orientated glacial valley at an altitude of 348 metres (m). Fed primarily by the Hunter River, the broader catchment area extends some 1,340 km². At its southern end, the lake discharges into the Hāwea River, a short tributary of the Upper Clutha.

The lake forms a narrow, steep-walled basin approximately 35 km long, 384 m deep and covers an area of some 140 km². It is naturally dammed to the south by an ancient terminal moraine which was extended by an artificial dam across the lake outlet in the 1950s.

The lake and impressive glacially scoured slopes enclosing it contain high visual and scenic values and are highly legible in terms of past formative processes. The lake is identified in the Proposed Queenstown Lakes District Council (QLDC) District Plan as part of an Outstanding Natural Landscape (ONL).

The northern head of the lake is defined by the steep sided slopes of the Young and Huxley mountain ranges to the west and east and by the Hāwea River valley flats to the south. Other hills separate Lake Hāwea from Lake Wanaka to the west as well as the narrow ridge known as The Neck where the two lakes almost join. The Dingle Burn and Timaru River are key features, flowing into the lake from the east and are also surrounded by high peaks.

For Māori, the Wanaka and Hāwea area was a food gathering area and natural crossroads to access pounamu on the West Coast. Today, the small settlement of Hāwea, set back from the lake's southern shore is home to a growing population. Beyond the township, the foothills and ranges comprise a mix of extensive pastoral farming and conservation land with the northern arm of the lake surrounded by the Hāwea Conservation Park. Hāwea Flat to the south of the township is dominated by pastoral farming with more intensive use in irrigated areas.

The dominant vegetation cover on mid slopes and spurs surrounding the lake is tussock grassland with areas of beech forest and modified kanuka and grey shrubland. Gentler slopes between the ranges and the lake consist largely of pasture and mixed regenerating scrubland. The Hāwea flats in particular have seen a change to more intensively farmed paddocks and new dwellings. Farming has modified vegetation patterns but overall the Lake's context appears as a largely natural landscape. Overall the past glacial and fluvial processes remain highly legible, including the more recent tributary fans along the lake shore and the impressive braided delta of the Hunter River at the head of the lake.

The lake is well used, primarily in the summer, for fishing, boating (motor-boats and kayaking) and swimming. The surrounding landscape also offers a range of recreational activities including tramping, hunting and cross-country skiing.

While the northern end of the lake in particular has a strong sense of remoteness, wildness and a high level of naturalness, the flats at the southern end of the lake comprise the main area of modification. As well as containing the growing township of Hāwea, the southern end also contains the dam structure across the lake outflow, which artificially controls the lake's water levels. When the dam was first formed as part of the Roxburgh hydroelectric scheme, the lake was raised 20 m above natural storage levels. The lake level fluctuates within an 8 m operating range with an allowable minimum level of 338 m above the datum, providing storage for both Roxburgh and Clyde power stations.

The other key area of modification is State Highway (SH) 6 to Haast which follows the southwest margins of the lake. Farm access tracks encircle the lake on or near its margins.



Lake Hāwea control gate - Lake Hāwea levels can fluctuate by up to 8.0 m resulting in changing exposure of the shoreline

| NATURAL CHARACTER – Lake Hāwea | | Degree of Natural Character |
|--------------------------------|---|-----------------------------|
| Active bed | <p>Outfall has been artificially controlled since 1958. The previous uncontrolled water level was 326.42 m. The original minimum controlled level was set at 328.87 m and a maximum of 345.32 m above datum. These levels have been adjusted to today's typical 8 m operating range between 338 m-346 m above datum but can be exceeded under the Flood Management Plan (Dam Water Permit, Consent No. 2001.384).</p> | High |
| | <ul style="list-style-type: none"> • Inflows remain a natural process - Nor-westerly storms tend to provide the most significant inflows, particularly in spring and summer, when rapid snow melt can exacerbate flood flows. • One consented groundwater take at the lake. • Besides the water level and resulting artificial shoreline and the floating booms associated with the outfall, there are few other modifications. Overall the active bed is subject to legible, predominantly natural processes - alluvial and glacial – such as the obvious colluvial slopes and fans that extend into the lake. • Silver Island, located within the lake, is clad with regenerating indigenous vegetation and has a highly natural character. • The lake supports significant areas for development of juvenile trout and salmon, and significant presence of eel, trout, and salmon identified in Schedule 1A of the ORC Regional Plan: Water. Koaro have also been identified (NIWA Freshwater Fish map). • The dams obstruct migratory fish species. • No major threats from exotic pest plants. • A 1986 survey for the NZ Journal of Marine and Freshwater | |

| | | |
|---------------------|--|-----------|
| | <p>Research (Clayton, Schwarz, Coffey, 1986) found the submerged vegetation was impoverished compared with that of Lake Wanaka. No vascular species were found - apparently associated with major water level fluctuations.</p> <ul style="list-style-type: none"> • Scenic value of the notable colour of the water identified (ORC Regional Plan: Water). • The lake water quality is classified as 'Good' in the ORC State of the Environment (SOE) report card on water quality and ecosystem health, 2017. | |
| Margin | <ul style="list-style-type: none"> • The Lake Hāwea township is close but set back from the lake shore so the margin here continues to demonstrate the processes of interaction between water and land and is clearly associated with the lake. • The dam structure and boat ramps negatively impact on natural character but comprise a small proportion of the overall lake margin. • Controlling the lake levels artificially increases or decreases the extent of lake margin exposed around the shoreline and potential for dust. • Gentler slopes between the ranges and along the lake shore consist largely of pasture and indigenous fernland. • Conservation areas e.g. Hāwea Conservation Area and Lake Hāwea (Western Shore) Recreation Reserve extend down to the margins in places. | High |
| Context | <ul style="list-style-type: none"> • The small settlement of Hāwea at the lake's southern shore is home to a small but growing population. Beyond the township, the foothills and ranges comprise a mix of extensive pastoral farming and conservation land with the northern arm of the lake surrounded by the Hāwea Conservation Park and Hunter Conservation Area. • The dominant vegetation cover on mid slopes and spurs surrounding the lake is tussock grassland with areas of beech forest, particularly in the gullies, and modified kanuka and grey shrubland. • More intensive pastoral farming on Hāwea Flat with some irrigated land. • The margin of Dingle Lagoon (just over one km from lake) is identified as a Regionally Significant Wetland in Schedule 9 of the ORC Regional Plan: Water and the Hunter River | Very High |
| | <p>Delta at the head of the lake is identified as a Significant Natural Area (SNA) in the Proposed QLDC District Plan.</p> <ul style="list-style-type: none"> • The lake is part of the ONL identified in the Proposed QLDC District Plan, as is much of surrounding landscape - excluding the outfall structure, township and Hāwea Flats. Silver Island is an ONF in the Proposed QLDC District Plan. • SH 6 extends along the southern part of the western shore and the farm access track network encircles the lake. • Modifications are minor in proportion to the overall context of the lake. | |
| Experiential | <ul style="list-style-type: none"> • Highly scenic, remote, large scale open landscape with wide and distant vistas. • Unique aqua blue colour of the lake and sloping gravel beaches. • High winds and waves contribute to a dynamic environment on windy days. • Presence of dust from exposed lake shore during low lake levels. • With minimal levels of modification beyond the settlement of Hāwea, much of the lake and surrounding landscape is perceived to be of high natural character. | Very High |

| VISUAL AMENITY - Lake Hāwea | | Degree of Visual Amenity |
|--|--|--------------------------|
| Nature of views, viewing audience | <ul style="list-style-type: none"> Overall, beyond the village, the Lake Hāwea landscape has a very high level of visual coherence, largely uncluttered by human development. The unusual clarity and colouring of the lake and impressive glacial slopes enclosing it contain high visual and scenic values and are highly legible in terms of past and present formative processes. The lake is well used, primarily in the summer, for fishing, boating (motor-boats and kayaking) and swimming. The surrounding alpine landscape means tramping and skiing are popular activities nearby. When lake levels are low, more of the shoreline is exposed which is considered unsightly by some. Popular tourist stop on SH6. | Very High |

4.1 Lake Wanaka

Lake Wanaka is situated immediately west of Lake Hāwea at the head of the Clutha/Mata-Au catchment. As with much of this area, the landforms are dominantly those of glacial origin. The lake occupies a steep-sided trough, to a depth of 311 m. The lake is 279 m above sea level and has a catchment area of 2,590 km².

The major rivers feeding the lake system are the Makarora and Matukituki. The delta systems where they meet the lake are dynamic, adding to the legibility of alluvial as well as glacial processes. The outflow is to the south-east via the Clutha River/Mata- Au.

Lake Wanaka has natural lake levels as the outflow has not been modified or controlled. The lake is identified in the Proposed QLDC District Plan as part of an ONL. Large areas of land around the lake are also identified as District wide ONLs or Visual Amenity Landscapes (VAL).

The mountains particularly around the north end of the lake are rugged and high. Other prominent hills include Mount Iron, Mount Brown and the truncated spur formations of Roys Peninsula and around Glendhu Bay - their distinctive forms expressive of glacial erosion. Key features in the lake are the islands.

Land cover on the lower slopes and margins is dominated by unimproved pasture with improved pasture on some flatter land and large areas of regenerating indigenous fernland along the eastern lakeshore. Tussock cover dominates at higher altitudes. Poplars and willows are also characteristic along the shores of the more accessible beaches.

In addition to ongoing sheep farming, the lake is located adjacent to the popular resort town of Wanaka, and is much used in the summer for fishing, jet skiing, boating and swimming. The nearby mountains and fast-flowing rivers allow for adventure tourism year-round, with jetboating facilities located nearby. Residential development is largely limited to the southern shores, primarily Wanaka township and growing residential areas between Roys Bay and Beacon Point. SH 6 passes close to the lake along the northeast margin between The Neck and Makarora

The Lake Wanaka Preservation Act (1973) prevents the alteration of water levels in Lake Wanaka and the Upper Clutha River/Mata-Au (to the Hāwea River confluence) in addition to seeking to maintain or improve water quality in Lake Wanaka.



Wanaka township and residential areas provide an urban context to this part of the lake shore.

| NATURAL CHARACTER - Lake Wanaka | | Degree of Natural Character |
|---------------------------------|---|---|
| Active bed | <ul style="list-style-type: none"> The lake outlet is one of a few remaining on large lakes in the South Island which has not been modified and controlled. The quality of and natural range of water levels in Lake Wanaka are protected by the Lake Wanaka Preservation Act 1973. Lake Wanaka is classified as being in an oligotrophic state and as having good water quality on Land Air Water Aotearoa's (LAWA) Trophic Level Indicator (TLI). The major inputs into Lake Wanaka are the Makarora and Matukituki Rivers, both of which have glacial origins and high water quality (LAWA). The immediate catchment is likely to contribute some nutrient input into the lake i.e. stormwater from the township of Wanaka and runoff from fertilised agricultural areas. There are a small number of ground and surface water take consents around the southern shore and two lake intakes providing the town's water supply (Small percentage of the lake volume). A marina, jetty and boat ramps at Wanaka modify the natural character of this part of the lake. The lake occupies a legible, glacial-formed steep-sided deep valley. The delta systems where the Makarora and Matukituki Rivers meet the lake are dynamic, adding to the legibility of alluvial as well as glacial processes. The delta of the Makarora River is listed in the Geological Society's inventory of important geological sites and landforms. Mou Waho, Mou Tapu and Te Peka Karara Islands all have a high natural character, being clad in regenerating indigenous forest and pest-free. Ruby Island has a somewhat modified character but is a readily identifiable and | <p>Very High</p> <p>Low at developed waterfront area of jetty structures, moorings and boat ramps</p> |

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| | <p>significant feature.</p> <ul style="list-style-type: none"> • Schedule 1A of the ORC Regional Plan: Water identifies significant presence of eel, trout and salmon, significant indigenous aquatic vegetation and a rare association of aquatic plants, the presence of indigenous fish species and invertebrates threatened with extinction. Other fish identified in the lake include koaro and common bully (NIWA Freshwater Fish map). • The southern end of the lake including all the inlets south of Roys Peninsula is a lagarosiphon area under the ORC Regional Pest Management Plan and 'lake snow' also occurs here. | |
| Margin | <ul style="list-style-type: none"> • Development on the lake margins is largely limited to the southern shores, primarily Wanaka township e.g. boat ramps, paths, carparks and roads close to the lake shore at Roys Bay. • SH 6 passes close to the lake along the northeast margins. • In many places, particularly along the eastern margins, lake shore vegetation includes indigenous fernland with excellent examples of seral community vegetation (of shrublands towards forest). Poplars and willows are also characteristic. • Regionally Significant Wetlands listed in Schedule 9 of the ORC Regional Plan: Water include Makarora Flat Swamp Complex, Minaret Bay Swamp, The Neck Wetlands (between Lakes Wanaka and Hāwea). • Proposed QLDC District Plan SNAs near the lakeshore are Minaret Burn, Minaret Bay/Snag Bay, Albert Burn, Craigie Burn, East Wanaka Creek (Stevensons Arm). | <p>High</p> <p>Low at urban/residential development Wanaka / Beacon Point</p> |
| Context | <ul style="list-style-type: none"> • Farming land use modifications have altered the vegetation with high and low producing pasture and vineyards now covering most of the lower slopes and basin landscape at the southern and northwest end of the lake with tussock succession cover at higher altitudes. • Hāwea Conservation Park down to lake shore at northeast head of lake. Other Protected areas on the lake margins include Matatiaho Conservation Area, Minaret Burn Mouth Conservation Area, and the Scenic Reserves on the two main islands. • In the Proposed QLDC District Plan, the lake is part of an ONL, the islands are ONFs, as is Roys Peninsula and much of surrounding landscape excluding Wanaka Basin/ Hāwea flats. • Urban residential settlement and infrastructure associated with Wanaka township wraps around the southern shores between Roys Bay and Beacon Point but is relatively contained along the lake, development focusing inland in the basin/flats area. Elsewhere around the lake, built form is very limited. | <p>Very High</p> <p>Low at urban/residential development Wanaka / Beacon Point</p> |
| Experiential | <ul style="list-style-type: none"> • The distinctive peaks and landforms are highly expressive of glacial erosion. • The grand scale of the lake and mountain landscape dwarfs people, inspiring a sense of awe. • The lake is a key element in the landscape and part of the identity of the district and region. | <p>Very High</p> |

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| | <ul style="list-style-type: none"> • Beyond the modified township area, the lake is dominated by a very strong sense of remoteness with few man-made structures. • The clear waters of the lake change colour with the weather and provide scenic reflections. | |
|--|--|--|

| VISUAL AMENITY - Lake Wanaka | | Degree of Visual Amenity |
|---|---|---------------------------------|
| <i>Nature of views, viewing audience</i> | <ul style="list-style-type: none"> • Scenic values of the lake identified in Schedule 1A of the ORC's Regional Plan: Water include the unmodified lake level, water quality, and the colour of the water. • The lake is valued for providing a wide range of recreational opportunities. | Very High |
| | <ul style="list-style-type: none"> • In a recent community survey of Otago lakes (Catchment Otago, 2017) many respondents particularly noted that in addition to water activities they enjoyed looking at the lake, the view, and taking photos. • Overall, the lake and mountain landscape has a very high level of visual coherence, with minimal human modification, its scenery and accessibility drawing high numbers of tourists. | |

4.2 Lake Wakatipu

Lake Wakatipu has a distinctive 'dog-leg' shape which gives the narrow glacial valley three main sections; the northern end from Glenorchy to White Point/Mt Nicholas, the middle section between White Point and Queenstown/Frankton, and the southern arm from Frankton to Kingston. The lake is New Zealand's longest, some 80 km in length and up to 5 km wide and covers an area of 289 km². It is drained by the Kawarau River from the eastern end of the Frankton Arm, which joins the Clutha River/Mata-Au below Lake Dunstan.

The lake is located 308 m above sea level at the southern end of the Southern Alps, between steep-walled ranges; between the Humboldt Mountains and Richardson Ranges at the lake's head, while The Remarkables and Tapuae - o - Uenuku Hector Mountains enclose the lake to the southwest. The main rivers to feed the lake are located on its western end, with the Rees and Dart Rivers providing the most significant inflows at their large braided delta areas. Other rivers and streams have created distinctive steep fans, such as the Greenstone and Von Rivers.

These steep mountain slopes extend down to the lake shore, glaciers having carved the lake's narrow basin some 380 m deep. Glacial, tectonic and subsequent processes of weathering and erosion are evident in this landscape. Frankton is located on the former glacial moraine that contains the lake to the east and many prominent roche moutonnées, such as Peninsula Hill, are clear signs of the historic glacial processes in the area.

Much of the land at the lake edge on the eastern Queenstown to Glenorchy side of Lake Wakatipu is covered in regenerating shrubland and young forest with a high plant diversity. Tall tussock land remains dominant on the upper slopes while fernland and low producing grassland dominate the lower slopes with pockets of improved grassland on flatter land.

Settlements around the lake shore include Queenstown and Frankton and the villages of Kingston, Glenorchy and Kinloch. The focus of settlement and human modification around the

lake is on Queenstown and the Frankton Arm. This area has a character which is different to that of the rest of the lake, surrounded by urban development and areas of exotic forest.

Beyond the scenic settled landscape of the Wakatipu Basin, the foothills and ranges are rugged and comprise a mix of extensive pastoral farming and conservation land. The southern side of the lake is high country farmland that is difficult to access and very remote in character.

The lake is identified in the Proposed QLDC District Plan as part of an ONL and large areas of the land around the lake are identified as District Wide ONL or VAL. The Kawarau River Water Conservation Order also applies to Lake Wakatipu. Outstanding characteristics identified in the Water Conservation Order include the lake’s fishery; scenic characteristics; scientific value, in particular water clarity and bryophyte (non-vascular plant) community; recreational purposes, in particular boating; as well as its significance in accordance with tikanga Maori.

The lake and wider area is also a popular venue for adventure tourism, with jet boating, ski fields, paragliding, bungee jumping and tramping tracks within easy reach.



With the exception of the modified Frankton Arm and Queenstown urban area, Lake Wakatipu exhibits a high level of natural character.

| NATURAL CHARACTER - Lake Wakatipu | | Degree of Natural Character |
|-----------------------------------|---|--|
| Active bed | <ul style="list-style-type: none"> • Lake Wakatipu is considered to have very good water quality on the LAWA Trophic Level Indicator (TLI). It was rated 'Excellent' in the ORC's SOE report card, 2017. The Dart and Rees Rivers flow into the head of the lake, both of which have glacial origins and high water quality however the immediate catchment is likely to contribute some nutrient input into the lake, especially around the township of Queenstown. • There are two lake intakes providing Queenstown's water supply. • The Kawarau River Water Conservation Order also | <p>Very High*</p> <p>* With the exception of the developed waterfront area of Queenstown/Frankton Arm with jetty structures, moorings and boat ramps</p> |

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| | <p>applies to Lake Wakatipu to protect outstanding values, prohibit damming and maintain water quality standards.</p> <ul style="list-style-type: none"> The historic control gates at the outlet were built for mining purposes and are not in use, so management of the lake level is essentially a natural process. | <p>which has a Low level of natural character.</p> |
| | <ul style="list-style-type: none"> There are large numbers of boat moorings, jetties, slipways, and boat sheds extending into the lake bed in the vicinity of Queenstown and the Frankton Arm. Swimming, boating and fishing are all commonly enjoyed recreational activities on the lake. Lake Wakatipu is New Zealand's longest lake. The narrow basin reflects the glacial, tectonic and subsequent weathering and water processes. The lake also has an unusual natural 'tide' or seiche which causes the water to regularly rise and fall about 10 centimetres. Schedule 1A of the ORC Water Plan identifies values in the lake including absence of aquatic pest plants, juvenile development area for trout and salmon and significant presence of trout, salmon and eel, significant riparian vegetation, significant habitat for the indigenous koaro, and rare association of aquatic plants. The exotic lake weed Lagarosiphon is found in Frankton Arm, extending into the Kawarau River. Didymo (or lake snout) is also found in the wave wash zone. | |
| Margin | <ul style="list-style-type: none"> Jetties, slipways, and boat sheds occupy the lake margins primarily in the vicinity of Queenstown and the Frankton Arm while the road to Glenorchy and SH6 and associated bridges follow the lake shore closely in places. Pasture grassland occupies pockets of the lake margins around the middle reach and southeast arm however there are large stretches of indigenous fernland with regenerating shrubland and young indigenous forest elsewhere. The southern shore of the lake in particular contains minimal development, apart from small nodes around the high country station buildings. The road to Glenorchy follows the northern shore all the way from Frankton. | <p>High*</p> <p>*With the exception of the developed urban area of Queenstown/ Frankton Arm which has a low level of natural character .</p> |
| Context | <ul style="list-style-type: none"> There is a strong cultural overlay around Lake Wakatipu. The focus of settlement and human modification around the lake is on Queenstown and the Frankton Arm though there are smaller clusters of houses close to the lake in other areas such as pockets south of Queenstown along SH6, and at Kingston and Glenorchy. Beyond these margins and the settled landscape of the Wakatipu Basin, the foothills and ranges generally comprise a mix of extensive pastoral farming and conservation land. Tall tussock land remains dominant on the upper slopes while large areas of fernland, matagouri/grey scrub and low producing pasture are found on the lower slopes. | <p>High on southern and western side</p> <p>Moderate to Low along Frankton Arm and at Kingston</p> |

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| | <ul style="list-style-type: none"> • Lake is ONL in Proposed QLDC District Plan excluding Frankton Arm and Queenstown Bay. Pig Island and Pigeon Island are ONFs. • The main SNAs bordering the lake shore include Halfway Bay Lakeshore, and 12 Mile Bush and lake face shrublands at Mt Creighton/ Bobs Cove. • Regionally Significant Wetlands identified in Schedule 9 of the ORC's Regional Plan: Water include Kinloch Wetland, Glenorchy Lagoon Wetland (less than one km from lake), and Mount Nicholas Lagoon (just over one km from lake). | |
| Experiential | <ul style="list-style-type: none"> • The significance of the mountains at the head of Lake Wakatipu, including Pikirakatahi (Mount Earnslaw), to Ngāi Tahu has been formally recognised by the Crown which has given this area the special status of 'topuni'. The area is also protected as conservation land. • The lake is a key element in the landscape and part of the identity of the district and region. • The grand scale of the lake and mountain landscape dwarfs people, inspiring a sense of awe. A recent community survey (Catchments Otago, 2017) found that among community uses of the lake, residents identified peace, quiet and communing with nature. • Beyond the modified Frankton Arm, the lake and landscape setting also convey a very strong sense of wildness and remoteness. • The clear waters of the lake change colour with the weather and provide scenic reflections. | Very High |

| VISUAL AMENITY - Lake Wakatipu | | Degree of Visual Amenity |
|--|---|---------------------------------|
| Nature of views, viewing audience | <ul style="list-style-type: none"> • The high scenic and aesthetic values of the lake and mountain landscape are well recognised and draw high tourist numbers. • There are many publicly accessible waterfront and elevated areas where views to the lake can be appreciated. The Catchments Otago Survey (2017) found that lakeside walking and cycling were the most common use, followed by sitting by the lake, and picnicking as well as a variety of other active watersports. • Scenic values associated with lake and noted in Schedule 1A of the ORC's Regional Plan: Water include the clear blue colour of the water, river deltas and beaches, and the particularly uncommon beach features between Rat Point and White Point. • The poplars and willows that frequently line the lake shore reduce the biotic natural character but contribute to changing colours of the seasons and the area's scenic values. | Very High |

4.3 Lake Dunstan

Lake Dunstan (Te Waiwera) is a man-made lake on the Clutha River/Mata-Au. Located between Bendigo and the Clyde Dam, it was formed in 1992-94 as a result of the construction of the Clyde Dam and its hydro power station.

The shallow lake is enclosed by the steep rocky walls of the Dunstan Range along its eastern margin and the gentler slopes and terraces of the Pisa Range and Cairnmuir Mountains to the west.

While the main lake extends some 15 km from Bendigo to Cromwell, Lake Dunstan also includes the arm between Cromwell and the Clyde Dam through the Cromwell Gorge as well as a smaller western arm where the Kawarau River joins the lake.

SH 8 follows most of the eastern lake shore, affording easy access, while SH 6 also follows part of the lake north of Cromwell.

Despite the close proximity of the road, the eastern margins north of the Cromwell bridge remain relatively undeveloped overall with the exception of some vineyards. The presence of extensive rock outcrops and naturalised and indigenous shrubland helps to maintain a sense of naturalness.

The landscape to the west is more modified and includes development such as intensive pastoral use, vineyards, orchards and lifestyle blocks, with houses close to the water margin, as well as a large gravel extraction area. The settlements of Pisa Moorings, Lowburn and Cromwell are located on these western banks and slopes. Much of the land between the highways and the lake where it is narrow or discontinuous has been developed or set aside for recreational use, including inlets, jetties, boat ramps, open grassed areas and amenity tree planting.

Below Cromwell the lake becomes very narrow, more like a river enclosed in a natural gorge. While the landscape was substantially drowned following the dam construction and retains some earthworks scars, modification of tributary confluences with the lake such as culverts under SH8. SH8 is cut into the east slope of the gorge close to the lake edge. There are few built structures and the gorge displays impressive rock formations.

Remnants of alluvial gold and quartz reef mining activity are present in places through the valley, most notably at Northburn (Quartz Reef) and Bendigo (Loganstown).

Outside the settled areas and the west side of the lake north of Cromwell, the dominant vegetation community is low producing grassland and exotic thyme shrubland. Remnant grey shrubland and sparse short tussock are located throughout the gorge as well as pockets of kanuka woodland.

Lake Dunstan provides water for irrigation for nearby stone fruit orchards and vineyards, and is a major recreational lake, with facilities for boating, waterskiing, fishing, parapenting, and rowing. A cycle trail is proposed on the west side of the gorge between Cromwell and Clyde and a number of walking/ biking tracks follow the western shore around Cromwell.

The lake is known for its exotic sports fish population of brown trout, rainbow trout, and Chinook salmon. Longfin eel, koaro, and bully have also been found here (NIWA Freshwater Fish Map).

The lake weed/ pest plant lagarosiphon creates a nuisance for recreational activities along parts of the lake shore and is being managed by ORC/Land Information New Zealand (LINZ).



Cromwell urban area at the confluence of the two major arms of Lake Dunstan, the flooded river valleys of the Kawarau River and Clutha River/Mata-Au.

| NATURAL CHARACTER - Lake Dunstan | | Degree of Natural Character |
|----------------------------------|---|-----------------------------|
| Active bed | <ul style="list-style-type: none"> • A man-made lake formed on the Clutha River/Mata-Au as a result of the construction of the Clyde Dam and hydro power station in 1992. Beyond Cromwell the lake continues but becomes very narrow, resembling more a river enclosed in a natural gorge. • 1 metre operating range - Lake levels are kept relatively stable with a normal operating range of between 193.5 m and 194.5 m above datum. • Several consented water takes on the lake, particularly along the main lake and Kawarau arm; fewer in the gorge. • Aggradation and formation of a delta is occurring in the Kawarau arm where the Kawarau River enters Lake Dunstan. Here, waters are shallow with moving sand bars. The large delta at the head of the lake is included in the Wanaka to Dunstan river reach. • The lake is considered oligotrophic, and the ecological health was rated 'Excellent' in the ORC's SOE report card on water quality and ecosystem health, 2017. • The lake has extensive beds of the invasive weed, lagarosiphon. • The presence of fish including longfin eel, galaxiid, common and upland bully, rainbow trout, perch, and koaro are identified on the NIWA Freshwater Fish map. • The lake provides an artificial koaro rearing habitat and may be boosting adult koaro populations upstream⁴. • Modifications to the active bed include booms and dam/power | Moderate - Low |

⁴ ORC ecologist comment on draft report , August 2018

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| | <p>station infrastructure at the Clyde Dam, bridges, and the works to create the groynes, causeways and artificial 'harbours' and beaches on the margins.</p> | |
| Margin | <ul style="list-style-type: none"> • The eastern lake shore remains relatively undeveloped overall with the western margins considerably more modified. • Bridge at Cromwell – Dead Mans Point, at Lowburn on SH8, and across Kawarau River arm (Bannockburn) • Tarras-Cromwell Road and SH8 follow close to margins of upper lake on both sides. Cromwell-Clyde road follows east bank of lower lake. • Cromwell town oxidation ponds are located next to the lake. • The presence of extensive rock outcrops and naturalised and indigenous shrubland in the gorge section help maintain a sense of naturalness through the lower lake. • The margins are dominated by low producing grassland, grey scrub and thyme and exotic vegetation, primarily pockets of willows. | Moderate |
| Context | <ul style="list-style-type: none"> • The particularly legible terraces near Lowburn, known as Sugarloaf, are identified by the Central Otago District Council (CODC) District Plan as an Outstanding Natural Feature (ONF) while the Cromwell Gorge is an ONL. • The landscape to the west of the northern arm is more modified and includes development such as intensive pastoral use, vineyards, orchards and residential blocks, with houses close to the water margin, as well as a large gravel extraction area. The settlements of Pisa Moorings, Lowburn and Cromwell are located on these western slopes. • While retaining some earthworks scars and the noticeable stabilization benching, there are few built structures beyond the dam. Infrastructure associated with the dam includes roading, a causeway and carparks. • Dominant vegetation community is low producing grassland and exotic thyme shrubland and remnant manuka/kanuka shrubland. • Displays impressive rock formations. | Moderate High |
| Experiential | <ul style="list-style-type: none"> • The Cromwell Gorge and the relatively unmodified northwestern shore at the foot of the Dunstan Mountains provide a sense of wildness. • Scenic experience of reflections of the ranges and autumn colours in the still lake. • Legibility of the old river terrace landforms is weakened in places by development. The modification of the lake shore north of Cromwell reduces the sense of naturalness in this area. • The close proximity of the road to the lake along most of the eastern shore introduces traffic noise which reduces the naturalness of the lake shore experience. | Moderate High |

| VISUAL AMENITY – Lake Dunstan | | Degree of Visual Amenity |
|---|--|---------------------------------|
| <i>Nature of views, viewing audience</i> | <ul style="list-style-type: none"> • The roads on either side of Lake Dunstan offer good viewing opportunities for travellers including access to many pullover areas and lakeside reserves. • The ranges surrounding the lake are dry, rolling and tor-studded, creating distinctive skylines and a rugged character, particularly noticeable through the Cromwell Gorge. • From Cromwell north, the west side of the lake has a relatively developed, disparate character including a large area of gravel extraction which reduces visual amenity. However, where the large scale of the distinctive outwash terraces and dry, rocky schist ranges dominate views, the level of aesthetic coherence and visual amenity remains high. • Some scenic value provided by autumn colours of exotic trees in the basin. • Where the pest plant lagarosiphon is visible, its presence reduces visual amenity. | High |

4.4 Clutha River/Mata-Au Clyde Dam to Lake Roxburgh (Alexandra)

This short reach of approximately 12 km begins at the base of the Clyde Dam and flows towards Alexandra. There is no clear distinction between the end of the river and the head of the lake, but the confluence with the Manuherikia River past the Alexandra Bridge has been used as an arbitrary limit.

The flow of the Clutha River/Mata-Au in this section is controlled by discharges from the Clyde and Roxburgh Dams. The single thread river flows in a sinuous form lined with willows, poplars and other exotic species such as lupins. Vegetation in the wider landscape is dominated by pasture, shelterbelts and vineyards.

The reach is characterised by the modified land use and built form close to the margins, primarily associated with the towns of Clyde and Alexandra which spread towards one another on the east bank, as well as roads and quarries. The Earnsclough Dredge Tailings are a historic reserve on the west bank, the exposed gravel mounds adding to the sense of modification in this landscape.



Flowing under the historic bridge at Clyde - river flows in this reach are regulated by the Clyde Dam upstream.

| NATURAL CHARACTER – Clyde Dam to Lake Roxburgh (Alexandra) | | Degree of Natural Character |
|---|---|------------------------------------|
| Active bed | <ul style="list-style-type: none"> • The inflow is artificially regulated at the Clyde Dam. • A small number of water takes consented through this reach • The dam has an effect on the amount of sediment moving down the Clutha River/Mata-Au. Larger sediment becomes trapped behind the dams causing degradation issues downstream (NIWA, 2000). • While not identified on the NIWA Freshwater Fish Map, fish likely to be found in this reach will be the same species as those at Lake Roxburgh and include brown trout, longfin and shortfin eel, rainbow trout, koaro, perch, and salmon⁵. • Didymo has been found in the Clutha River/Mata-Au system, reducing the level of natural character due to potential impacts on indigenous habitat. • There are 2 gravel extraction points between Clyde and Alexandra, modifying the active bed. | Moderate |
| Margin | <ul style="list-style-type: none"> • The dam and associated industrial infrastructure are immense physical modifications to natural character at their location. • Other modifications in the river margins include bridges at Clyde and Alexandra, boat ramps, modified embankments/flood protection at Alexandra, a quarry area, and transmission pylons/poles. • Vegetation along the river margins is dominated by willows and frequent pockets of poplars. | Moderate High |

⁵ ORC ecologist comment on draft report , August 2018

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|---------------------|--|---------------|
| Context | <ul style="list-style-type: none"> • Vegetation on the north side of the river in the wider landscape is dominated by high producing grassland and pines, and on the southern side, shelterbelts, vineyards and orchards. • Land use along this reach is modified, primarily associated with the urbanisation of Clyde and Alexandra, as well as roads and quarries. • There are a number of parks and reserves of different sizes providing access or views towards the river in Clyde and Alexandra. • A large block of pine trees at the northwest entrance to Alexandra was planted to keep the sandy soil in place. • The Earnsclough Dredge Tailings are a historic reserve on the west bank displaying extensively disturbed ground. | Moderate |
| Experiential | <ul style="list-style-type: none"> • The dam infrastructure is visually dominant, particularly when experienced from below and cues to the artificial flow of the reach. • The sound of the powerful force of water when released through the dam. • The built up and modified nature of much of the context reduces the opportunities to experience a sense of wildness or remoteness along this reach. • When in close proximity to the river, the ‘big river’ presence of the Clutha/Mata-Au is inescapable. The combination of the river’s immense water volume, power, currents, turbulence, unique clarity and colour and sometimes sounds inspire a sense of awe and respect. | Moderate High |

| VISUAL AMENITY - Clyde Dam to Lake Roxburgh (Alexandra) | | Degree of Visual Amenity |
|--|---|---------------------------------|
| Nature of views, viewing audience | <ul style="list-style-type: none"> • The disturbed ground and piles of gravel, both historic and current, visible adjacent to the river margins reduces the scenic qualities of the riverscape. • Greater visual amenity where the single thread river cuts through higher terraced embankments due to increased separation from the modified context. • Historic bridges at Clyde and Alexandra with stone piers adds to scenic qualities and visual interest. • Seasonal colours of the exotic riparian vegetation add to visual amenity. • Where didymo is seen it reduces visual amenity. • The dam and associated industrial infrastructure dominate the surrounding riverscape. Their industrial character diminishes the scenic qualities of the river and landscape however some viewers, such as those with an interest in hydro power may enjoy the view. | High |

4.5 Lake Roxburgh

Lake Roxburgh is a man-made lake on the Clutha River/Mata-Au approximately 28 km in length between the Roxburgh Dam and Alexandra. The dam at Roxburgh is the lowest, and earliest of the three dams, constructed in the 1950s as part of the Clutha Power development. It also incorporates the second of the two hydro power stations on the river.

Much like lower Lake Dunstan, Lake Roxburgh is characterised by its shallow, narrow form and schist gorge landscape. Lake Roxburgh is even more tightly contained within steep rocky hillsides, typically little more than 200 m apart with occasional small shingle or gravel beaches/fans at the mouth of creeks.

The primary vegetation around the Lake Roxburgh landscape is tall tussock land, thyme and briar scrubland, low producing grassland and indigenous grey scrub.

The lake is used as a sports fishery with brown trout, rainbow and occasional landlocked Chinook salmon usually present. Eel and koaro have also been found here (NIWA Freshwater Fish map).

Aside from the water levels, modifications are minimal and the lack of road accessibility provides remote recreation opportunities. Lake Roxburgh Village lies below the dam. Built development on the lake margins is focused at the dam structure and around the township of Alexandra at the head of the lake, where the piers and abutments of the old and new bridges are situated in the river. Elsewhere the main modifications are very low scale and associated with historic mining activity and walking and cycling trails. Boat ramps are located at Alexandra and the Roxburgh Dam, used for accessing water based recreational activities including boating, swimming, water skiing, and fishing.



The long narrow form of Lake Roxburgh snakes its way through steep rocky and sparsely vegetated hill country.

| NATURAL CHARACTER - Lake Roxburgh | | Degree of Natural Character |
|--|--|------------------------------------|
| Active bed | <ul style="list-style-type: none"> • A man-made lake with a dam and hydro power station operating since the 1950s (earliest on the river). Both inflow and outflow are managed. • The lake has a normal operating range of 2.45 m between 130.15 m and a maximum lake level of 132.6 m above datum. Consent allows the level to be reduced to 129 m in some conditions. • There are no consented water takes, ground or surface water. • Recorded fish species include brown trout, longfin and shortfin eel, rainbow trout, koaro, perch, salmon (NIWA Freshwater Fish map). However, as migratory fish including eel, lamprey, salmon and koaro, cannot get into Lake Roxburgh due to the dam, numbers are likely to be declining. Consent requires Contact Energy Limited to establish a system for downstream passage of adult eels past the Roxburgh Dam. | Moderate - High |
| Margin | <ul style="list-style-type: none"> • The dam and associated industrial infrastructure are immense, but localised physical modifications to natural character at their location. • There are few signs of human development along the margins other than boat ramps and the piers and abutments of the old and new bridges. • Elsewhere the main modifications are associated with historic mining activity and walking and cycling trails. • Vegetation along the lakeshore is predominantly modified with grassland and exotic scrubland and willows but also includes some indigenous grey scrubland e.g. matagouri. | Moderate-High |
| Context | <ul style="list-style-type: none"> • The lake is located within a schist gorge landscape. The township of Alexandra is located at its head but otherwise the area is extensively farmed or in conservation land - the large area along the western slopes is Flat Top Hill Conservation Area. • The primary vegetation around the Lake Roxburgh landscape is tall tussock land (particularly dominating the eastern slopes of the lake), and low producing grassland, and mixed grey scrubland. | High |
| Experiential | <ul style="list-style-type: none"> • Between Alexandra and the dam, the lake and gorge are essentially undeveloped other than through extensive farming and historic mining. Together with the very limited access, and gorge-like landform, the area offers those who do visit, a high degree of remoteness. • The vivid colour of the water is memorable. • Sense of river's history provided in visible reminders of mining left in the landscape. • The sound of motorised boats in the gorge reduces the sense of naturalness and remoteness however a jet boat enables cyclists and walkers to connect the two sections of the trail so some sound is likely to be experienced in a positive light. | High |

| VISUAL AMENITY – Lake Roxburgh | | Degree of Visual Amenity |
|--|--|--------------------------|
| Nature of views, viewing audience | <ul style="list-style-type: none"> • With very limited road access other than at the ends of the reach and to McKenzies Beach on the east bank, the primary viewing audience is limited to cyclists and those on the water. • The scenic qualities of the lake are reduced at the dam by the surrounding development while visibility from public areas at Alexandra is limited by vegetation. • For those who do access the gorge, the steep high rocky bluffs, turquoise water, and the historic mining relics offer a very high level of aesthetic coherence and visual amenity. • The seasonal colours of the riparian willows add to scenic values along the gorge. | High |

4.6 Hāwea River (Lake Hāwea to Clutha confluence)

The Hāwea River drains Lake Hāwea. The relatively short river flows some 9 km southeast through the Hāwea Flats to join the Clutha River/Mata-Au at Albert Town, just below Lake Wanaka.

Flows in the Hāwea River are controlled by Contact Energy Limited via the Hāwea Dam in order to generate hydroelectric power at the Clyde and Roxburgh Dams below. The mean annual flow at Camphill Bridge is 66 m³/s however flows fluctuate frequently. Consents require a minimum discharge of 10 m³/s below the Hāwea Dam at all times and a maximum discharge of 200 m³/s, except during flood conditions.

The river terraces and level outwash plains introduce strong horizontal patterns to the wider glacial landscape, expressive of the force of the river in forming the landscape. The river is narrow at the Hāwea outlet and widens somewhat and takes on a more sinuous form towards its confluence with the Clutha/Mata-Au.

The river flows through a predominantly settled agricultural landscape with vegetation dominated by high producing grassland, irrigated land and some blocks of exotic pines. The ecology of the low-lying area has been significantly modified by pastoral farming, however significant areas of remnant and regenerating indigenous vegetation are present throughout the wider basin.

Willows and poplars are present along the margins for much of the river's length while the terraces and margins at the southern end are clad with regenerating scrub and have a higher natural character.

The river is popular for a variety of recreational activities including fishing and kayaking. A walking and cycling track follows alongside the river from Wanaka to Lake Hāwea.



Hāwea River - the river bed has been modified to create the standing wave at the whitewater park at Camphill Bridge.

| NATURAL CHARACTER - Hāwea River | | Degree of Natural Character |
|---------------------------------|--|-----------------------------|
| Active bed | <ul style="list-style-type: none"> • Flows are artificially controlled by Contact Energy Limited via the dam. • Consents require a minimum discharge of 10 m³/s below the Hāwea Dam at all times and a maximum discharge of 200 m³/s, except during flood conditions (must not exceed 800 m³/s in the Clutha River/Mata-Au at the Cardrona Confluence). The flow regime means river levels can rise and fall quickly, the size and frequency of fluctuations reducing natural character. • The main physical modification to the river is the dam structure at Lake Hāwea. • Works at the Hāwea Whitewater park at Camphill Bridge have physically modified the river bed. 30 m³/s of water are released under a regular regime to create a standing wave in the river for recreational users, such as kayakers. • Other physical modifications include two bridges (one a minor structure for walking/cycling only). • There are a few consented water takes on the river. • The river is narrow at the Hāwea outlet and takes on a more sinuous form towards its confluence with the Clutha/Mata-Au, with no artificial diversions. • Schedule 1A of the ORC's Regional Plan: Water identifies values in the river including a significant fish spawning area and for juvenile development, and significant presence of trout, salmon and eel. The Plan also notes the absence of aquatic pest plants, however didymo has been found here. | Moderate |

| | | |
|---------------------|---|------------------|
| | <ul style="list-style-type: none"> Water quality in the river (Camphill Bridge) is rated excellent in the ORC's SOE report card on water quality and ecosystem health, 2017. | |
| Margin | <ul style="list-style-type: none"> Disturbance to the river margins is limited and primarily comprises the dam and associated infrastructure, farm and recreational tracks as well as the relatively small scale bridge structures. Along the upper reaches near Hāwea Township a water race and tracks follow the true left bank. Willows and poplars are present along the margins for much of the river's length while the terraces and margins at the southern end are clad with regenerating manuka/kanuka scrub and have a highly natural character. Schedule 9 of the ORC's Regional Plan: Water lists Butterfield Wetland and Campbells Reserve Pond Margins as Regionally Significant Wetlands connected with this river. | Moderate High |
| Context | <ul style="list-style-type: none"> The river flows through a predominantly settled agricultural landscape with some 'lifestyle' housing development close to the river margins (e.g. off Te Awa Road) and the Hāwea oxidation pond. (No deterioration in water quality has been attributed to the pond). Vegetation is dominated by grassland - low producing closer to river margins, high producing beyond, some irrigated - and some blocks of exotic pines. The river also flows through Albert Town Conservation Area and Recreation Reserve and a marginal strip (protected area) SNA sites nearby at Te Awa Rd (QLDC District Plan) on the old river terrace represent good examples of native grassland community. The ecology of the low-lying area has been significantly modified by pastoral farming, however significant areas of remnant and regenerating indigenous vegetation are present throughout the wider basin. A walking and cycling track follows alongside the river from Wanaka to Lake Hāwea, part of the Te Araroa Trail. | Moderate High |
| Experiential | <ul style="list-style-type: none"> Where the river loops, the terraces and level outwash plains are expressive of the force of the river in forming the landscape. Aside from the Camphill Bridge, there is limited public road access to the central sections of the river, creating some opportunities for a sense of remoteness particularly where there are pockets of indigenous vegetation. However, the irrigated farmland and more frequent appearance of dwellings very close to the margins, particularly at the northern end of the reach, reduces the natural character in places. | High |

| VISUAL AMENITY - Hāwea River | | Degree of Visual Amenity |
|--|--|--------------------------|
| Nature of views, viewing audience | <ul style="list-style-type: none"> • A walking and cycling track follows alongside the river from Wanaka to Lake Hāwea, part of the Te Araroa Trail, enabling good views to the river for recreationalists that can be enjoyed away from busy public roads. • The relatively open, settled, rural landscape means that views incorporating the river and surroundings are more pleasantly scenic, including appreciation of the changing seasonal colours, rather than striking or impressive. • The dam structure reduces the visual amenity of the upper river near the Lake Hāwea outlet, although the grass cover and low level of associated infrastructure means it integrates more readily into the landscape than the larger dams further down the Clutha/Mata-Au. • Where visible, the presence of didymo reduces visual amenity. | High |

4.7 Clutha River/Mata-Au between: Lake Wanaka outlet and Lake Dunstan

The Clutha River/Mata Au has its source in Lake Wanaka, a particularly significant outlet in that it is one of the few major lakes in the District which remains unmodified.

In these upper reaches between Lakes Wanaka and Dunstan, the Clutha River/Mata-Au flows southeast through the Wanaka/Hāwea basin before turning southwest to cut through the schist fault block mountains of the Pisa and Dunstan Ranges.

The river form is mostly narrow and single thread, contained between impressive, steep terrace faces with a rock and gravel substrate and occasional alluvial landforms of outwash and fan gravels, boulder deposits and side channels. Between Wanaka Airport and Luggate the river forms a series of distinctive loops. Downstream of the Lindis confluence, transitioning to the delta at the head of Lake Dunstan, the river channel widens to a braided meandering form. The extensive delta at the head of Lake Dunstan is identified as a Regionally Significant Wetland in the ORC's Regional Plan: Water (Bendigo Wetland). Sediment deposition and the gradual formation of the river delta have occurred since the lake was formed in the early 90s.

The river's well-defined terrace sequence forms are a distinct geological feature of the Upper Clutha valley, part of the peri glacial period when sedimentation from that time was eroded down by the Clutha River/Mata-Au.

The landscape context contains large-scale landforms and the high-lying terraces are open, dominated by pasture with vineyards, shelterbelts, and isolated areas of kanuka. Apart from farming modifications including tracks, fence lines and occasional buildings, built form is largely limited to the urban area around Albert Town. Roads are typically located at a distance from the margins, with only two bridges crossing the river. Open views are available and enable legible association between river landforms; terraces and their faces and the active river flood plain.

Vegetation along margins/ terraces faces comprises wilding pines and Douglas fir, kanuka shrubland, matagouri/briar shrubland, exotic grassland, and short tussock grassland. Willows line the river in many places, with occasional groups of Lombardy poplars. The shallow delta at the head of Lake Dunstan is favoured waterfowl habitat and is now a wildlife reserve.

The river on this reach is said to offer challenging big river fishing, with rainbow and brown trout the main species targeted by anglers, and the occasional Chinook salmon.



Clutha River/Mata-Au just above the Luggate bridge - with river margins dominated by exotic vegetation and kanuka prominent on the series of old river terraces.

| NATURAL CHARACTER – Lake Wanaka to Lake Dunstan | | Degree of Natural Character |
|---|---|-----------------------------|
| Active bed | <ul style="list-style-type: none"> This river reach is particularly significant in that the outlet at Lake Wanaka is the only one of the major lakes which remains unmodified and damming is prohibited. However, the flow is partially controlled below the Hāwea River confluence due to the management of lake levels at Lake Hāwea via the Hāwea River. There are a high number of consented water takes along this reach. The river retains its natural course with bends and loops with no artificial diversions. Downstream of the Lindis confluence the narrow river channel widens to a braided meandering delta at the head of Lake Dunstan where no significant changes have been made to the shape of the river and its floodplain. Due to natural erosion and sedimentation the river migrates within the terraces (ORC, Oct 2014). The sediment deposition since construction of the lake has produced a slowly prograding delta. | Very High |
| | <ul style="list-style-type: none"> The tributaries of the reach provide a significant habitat for Clutha flathead galaxiid (threatened indigenous fish species), as well as habitat for longfin eel, koaro and bully. The river also supports trout and salmon and significant trout and salmon spawning and juvenile development, riparian vegetation of significance to aquatic habitat, and a significant range of indigenous waterfowl (ORC Regional Plan: Water, and the NIWA Freshwater Fish map) | |

| | | |
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| | <ul style="list-style-type: none"> • Didymo has been found in the Upper Clutha/Mata-Au. • The shallow delta at the head of Lake Dunstan is favoured waterfowl habitat and is now identified in Schedule 9 of the ORC's Regional Plan: Water as a Regionally Significant Wetland (Bendigo wetland). The wetland has a high diversity of indigenous habitat types and flora and fauna, including nationally or internationally rare or threatened species. | |
| Margin | <ul style="list-style-type: none"> • Much of the river's margins in this reach lie within a narrow corridor of conservation land indicating that development will be limited and natural character values are likely to improve or be maintained over time. • Physical development within the margins is currently largely limited to two bridge crossings, pylons/overhead transmission lines, occasional pump stations and minor farm and recreational tracks. • Vegetation along margins is modified, however in addition to the exotic grassland and ubiquitous willows, poplars and wilding conifers, there are also areas of kanuka/ manuka shrubland, matagouri/briar shrubland and short tussock grassland, adding to the level of naturalness. • Between the Lindis confluence and the lake, willow cover along with broom and lupins is much more widespread. | High |
| Context | <ul style="list-style-type: none"> • The landscape context is dominated by pastoral land use (with some more intensively irrigated areas). SH 6 and SH 8A run through the valley. Apart from recreational tracks and farming modifications including tracks, fence lines and occasional buildings, development and particularly built form is sparse and largely limited to the urban area around Albert Town. However, there are a growing number of rural/lifestyle properties very close to the margins on old river terraces which could begin to impact on natural character e.g. subdivision near confluence with Lindis River. • Particularly impressive features in the landscape are the remnant older outwash surfaces between Bendigo and Tarras - Bendigo Terrace and The Bend Terrace where the former valley wide outwash surface has been eroded away, shaped and sculpted by river action into extremely well defined, large scale landforms. Along with Sugarloaf near Lowburn, they are considered to be the best examples in the country; described in the New Zealand Journal of Geology and Geophysics as "spectacular flights of terraces cut in glacial outwash gravels and tributary fans". | High |
| | <ul style="list-style-type: none"> • These dry outwash plains are critical habitats for a number of threatened plant species (such as the nearby Mata Au Scientific Reserve which supports a remnant of semi-arid ecosystem and of threatened plants and rare beetles). • They were also important breeding habitat for seasonally-migrating wading birds, such as banded dotterel. Recent more intensive agricultural practices have resulted in losses of some gravel habitat. As described, residential development has also occurred on some of these habitats. • Treated wastewater is discharged onto land at the Wanaka Airport near the river. Likelihood of groundwater contamination has been assessed as minimal. • The Clutha/Mata-Au is identified as an ONF in Proposed QLDC District Plan. | |
| Experiential | <ul style="list-style-type: none"> • Open views are available and enable legible association between | High |

| | | |
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| | <p>river landforms; terraces, terrace faces and active river floodplain.</p> <ul style="list-style-type: none"> • The proximity of the surrounding mountain ranges, the terrace formations, the presence of pockets of indigenous vegetation, and limited modification/dominant extensive (rather than intensive) pastoralism means there are some opportunities for wildness and remoteness. • However, the more frequent appearance of rural/lifestyle properties very close to the margins could begin to impact on the experience of natural character. • The unusual turquoise waters cue to the river's glacial source lakes. • The noise of the water flowing over low rapids cues to the river's speed and volume. • In close proximity to the river, the 'big river' presence of the Clutha River/Mata-Au is inescapable. The combination of the river's immense water volume, power, currents, turbulence, unique clarity and colour and sometimes sounds inspire a sense of awe and respect. | |
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| VISUAL AMENITY - Lake Wanaka to Lake Dunstan | | Degree of Visual Amenity |
|---|---|---------------------------------|
| <i>Nature of views, viewing audience</i> | <ul style="list-style-type: none"> • The glacial colour of the waters, its unusual clarity and the contrast with the dominant colours of the surrounding landscape all add to visual amenity. • Seasonal colours of the exotic riparian vegetation contribute to the river's scenic values. • Impressive context of old river terraces enhances visual amenity of the wider riverscape. • Entrenched nature of the river channel limits visibility from public roads however openness of surrounding terraces provides occasional elevated views where the river's sinuosity, force, and colour can be appreciated, particularly from adjacent walking/cycling tracks. • The river is often experienced by boat, including kayaks and jet boats. • The areas of indigenous vegetation, particularly kanuka shrubland, matagouri/briar shrubland and short tussock grassland have high visual amenity. • The presence of didymo where visible reduces visual amenity. | High |

4.8 Kawarau River (Lake Wakatipu to bottom of Kawarau Gorge/Lake Dunstan)

The Kawarau River is a major tributary in the Clutha River/Mata-Au catchment, draining Lake Wakatipu from the end of the Frankton Arm then flowing east to join the Clutha River/Mata-Au at Lake Dunstan.

Apart from alluvial and colluvial gravel river terraces through the Wakatipu Basin and Gibbston Valley, for much of its length (59 km) the river is characterised by the deeply entrenched narrow

rocky channel it flows through. Cutting through schist, the narrowest, steepest section is well known as the rugged Kawarau Gorge.

The river is joined by numerous tributaries contributing to a mean flow of 225 m³/s. Many rapids and currents characterise the middle and lower reaches of the gorge in particular.

The Kawarau River and its tributaries, including the Shotover and Nevis Rivers are the subject of the Kawarau Water Conservation Order (KWCO) which has been applied to recognise and maintain the rivers' values. The upper part river is also identified in the Proposed QLDC District Plan as within an Outstanding Natural Landscape (ONL), as is the gorge in the CODC District Plan.

The KWCO recognises, among other things, the wild and scenic character of the Kawarau River gorge, scientific values (particularly associated with the return flow in the upper section when the Shotover River is in high flood) and the recreational values (in particular rafting, jetboating, and kayaking) are outstanding in the Kawarau River.

Historical characteristics of the Kawarau River include a natural feature known as 'the natural bridge', the Kawarau Suspension Bridge and the numerous relics of past goldmining era scattered along its banks.

SH 6 from Cromwell to Queenstown, part of the major tourist route, follows alongside the river so that it can be easily seen throughout its length.

Trout and salmon are found in the river, as are longfin eel, and it is a significant habitat for koaro.

Land use along the river corridor varies from roads and urban housing to farming, intensive viticulture, and subdivisions. Development is most noticeable around Frankton and the Gibbston Valley area with limited modifications (including historic goldmining activity) elsewhere.

Vegetation in the wider corridor is a combination improved, pasture and vineyards on valley terraces and unimproved pasture and exotic scrub on the hillslopes. The river margins are largely in grassland and introduced and regenerating shrubland communities.



The Kawarau River cuts through the dramatic steep sided rocky gorge. The cloudy water is a result of the Shotover River sediments.

| NATURAL CHARACTER - Kawarau River | | Degree of Natural Character |
|-----------------------------------|---|-----------------------------|
| Active bed | <ul style="list-style-type: none"> The river is the subject of the Kawarau Water Conservation Order (KWCO) to protect its outstanding values including by prohibiting damming. Identified values include natural and scientific values particularly associated with the return flow in the upper section of the Kawarau when the Shotover River is in high flood. Flows through a deeply entrenched narrow channel of schist - the narrowest, steepest section is well known as the rugged Kawarau Gorge which has a wild and scenic character. Many rapids and currents characterise the middle and lower reaches of the gorge in particular. The most notable rapids are the Chinese Dog Leg rapid near Gibbston, and the Nevis Bluff rapids. The river has a significant presence of trout, salmon, eel, significant habitat for koaro. While didymo has been found here, the ORC Regional Plan: Water notes the river is free of aquatic pest plants upstream of Lake Dunstan. Water quality is rated 'Good' in the ORC's SOE report card on water quality and ecosystem health, 2017 - the river's turbidity influenced by the Shotover catchment. The Kawarau is one of the main sources of sediment for the Clutha/Mata-Au, primarily from the Shotover. Evidence suggests that the Shotover River sediment is increasingly obstructing the flow of the Kawarau River (Strong and Davies). | Very High |
| Margin | <ul style="list-style-type: none"> The margins are steep slopes and rock bluffs with a low level of modification. Physical modifications in the margins are limited largely to occasional transmission pylons, road and suspension bridges, pipework associated with the Roaring Meg Power Station, historic mining activities which are small in scale, and tourism related amenities, primarily the Goldfields Mining Centre. The river margins comprise areas dominated by bare rock, grassland, areas of introduced shrubland communities, poplars and willow. They also include areas of regeneration, extending into the wider context, where the shrubland is heavily dominated by matagouri and sweet briar but also includes <i>Coprosma propinqua</i> and to a lesser degree <i>Olearia odorata</i>. The Shotover Confluence River Swamp, located on a terrace at the historic confluence of the Shotover and Kawarau Rivers, is listed as a Regionally Significant Wetland in Schedule 9 of the ORC's Regional Plan Water. The regenerating Kawarau Faces are identified as an SNA in the Proposed QLDC District Plan. | High |
| Context | <ul style="list-style-type: none"> Land use along the river corridor is largely extensive farming, particularly in the wider landscape. However, the elevated river terraces through Gibbston Valley to Frankton and Lake Wakatipu comprise a variety of development from urban housing to intensive viticulture, subdivisions and some conservation land. Infrastructure associated with the Roaring Meg Power Station can be seen from the road as part of the Kawarau River valley landscape. Vegetation in the wider corridor is predominantly in improved pasture and vineyards on valley terraces and unimproved pasture and exotic scrub on the hillslopes. | High |

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| | <ul style="list-style-type: none"> • The Pisa Conservation Area extends down to the river margins and meets the Arrow Junction Conservation Area at the Kawarau Bridge, and Lepidium Kawarau Habitat Conservation Area on the south bank. • The river is identified within a larger ONL in the Proposed QLDC District Plan and in the CODC District Plan. | |
| Experiential | <ul style="list-style-type: none"> • Despite its murkiness, the turquoise colour of the water is highly memorable and contrasts with the dark surrounding rock. • The sound and legibility of the force of the water increases the sense of naturalness. • Sense of river's history provided in visible reminders of mining left in the landscape. • Despite the proximity of the road in places, and sounds of jetboats in the lower gorge, the enclosing landform and movement of the river are so dominant that human modifications are experienced as relatively insignificant, particularly through the gorge - the river is experienced as an impressive wild feature. | Very High |

| VISUAL AMENITY - Kawarau River | | Degree of Visual Amenity |
|--|---|---------------------------------|
| Nature of views, viewing audience | <ul style="list-style-type: none"> • SH 6 follows alongside the river. Together with occasional lookout areas with interpretation and pedestrian suspension bridges, this accessibility enables good opportunities for travellers to view and appreciate the river. • The narrow valley and incised river highlight its force while the schist river walls are distinctive and together with the rapids and currents in the river add to the impressiveness and expressiveness of the scene. • The high enclosing ranges make the river and terraces the central focus in a scenic valley landscape. The scale and lack of modification across the mountains increases the sense of naturalness in spite of development on the terraces between. | Very High |

4.9 Clutha River/Mata-Au between: Roxburgh dam to

4.1 Rongahere

The reach between Roxburgh Dam and Rongahere is a distance of some 60 km in which the river remains confined to a single channel, typically less than 150 m wide between the elevated Old Man and Lammerlaw schist ranges. The wider river corridor is characterised by a narrow, clearly defined valley, with occasional alluvial flats.

Land use along the corridor is dominated by hill country pastoral farming with the flats in more intensive use, orchards and vineyards. However, the Rongahere Gorge provides a notable contrast to this, incorporating a considerable area of beech forest. The length of the river is lined with willows and dotted regularly with small settlements including the largest built up area of Roxburgh.

There are bridges at Roxburgh, Millers Flat, Horseshoe Bend and Beaumont, two of which are registered historic places. SH 8 meets sections of the reach while the Clutha Gold Cycle Trail utilises a minor gravel road alongside the east bank between Beaumont and Millers Flat. Otherwise, aside from the large concrete dam, structures on the margins and in-river modifications for most of the reach are very limited.

From Roxburgh to the Teviot-Ettrick flats, the river flows southeast through a mix of hill country and pockets of older flat valley fill deposits. Island Block is a distinctive topographic feature where the river swings east but the low-lying valley to the west appears to have also been a former channel.

South of Island Block, the valley tightens again and at Beaumont the river turns to wind south through the Rongahere Gorge, another section of steep hill country, clad mostly in a mix of exotic plantation forestry and remnant beech-podocarp forest. Lower pastoral hill country dominates the landscape to the east. Beech forested Birch Island/Moanui is a feature in the river as are the rock gardens – an intriguing pattern of rock outcrops in the river.

The Beaumont and Rongahere gorges are identified as outstanding natural features and represent the last major river flat and gorge of the schist peneplain or block mountain system of the Central Otago highlands.

The flow in this reach is controlled by the Roxburgh Dam and the water level may vary by up to 1.5 m under normal conditions. The formation of the Roxburgh Dam is also associated with bed level degradation immediately downstream of the dam.



At Beaumont the river cuts through the hill country, flowing between rocky banks.

| NATURAL CHARACTER – Roxburgh Dam to Rongahere | | Degree of Natural Character |
|--|---|------------------------------------|
| Active bed | <ul style="list-style-type: none"> • The flow in this reach is controlled by the Roxburgh Dam and the water level may vary by up to 1.5 m. • Several consented water takes between the dam and Island Block, • Confined to a single channel, typically less than 150 m wide cut through schist with occasional alluvial flats. • The volume of sediment transported through these reaches is likely to be reducing significantly due to the Roxburgh dam. • The channel bed below Roxburgh Dam has degraded by 6 m between 1948 and 2016 (ORC, 2017). Presumably due to starvation of sediment because of the Roxburgh Dam. | Moderate |
| | <ul style="list-style-type: none"> • There are 4 current and historic gravel extraction points in this reach. • The distinctive pattern of rock gardens/outcrops, including the larger Birch Island/Moanui, in the river add to the natural character of the reach. • The river in this reach maintains an excellent water quality according to both LAWA and the ORC's 2017 SOE report card on water quality and ecosystem health. • The river supports a significant range of indigenous fish species, including some threatened with extinction, and significant areas for fish spawning and development of juvenile fish. • Fish recorded here include eel, trout, salmon and lamprey. • The river also supports indigenous waterfowl, a significant remnant indigenous ecosystem at Birch Island/Moanui, and a rare association of aquatic plants above the confluence with Tuapeka (ORC Regional Plan: Water, Schedule 1A). | |
| Margin | <ul style="list-style-type: none"> • The dam and associated industrial infrastructure are immense physical modifications to natural character at their location. • Elsewhere, structures on the margins and in-river modifications are largely limited to a small number of bridges and occasional pylons/poles. Roads come close to the river margins in places. • Even outside the gorges, the river banks are often steep, high and incorporate rocky outcrops and populated with willows as well as pockets of poplars, broom, gorse and wilding conifers. • Birch Island/Moanui, and the bush of the gorge itself, has a covering of a mixed podocarp forest that includes sphagnum moss, mountain and silver beech as well as totara and matai. Both the gorge and the island are home to rare and nearly extinct insect species. | Moderate |
| Context | <ul style="list-style-type: none"> • Land use along the corridor is dominated by pastoral farming with high producing exotic grassland as well as intensive orchards and vineyards on the flats. • Regular small settlements occur along the river including the largest built up area of Roxburgh. There is a large area of conservation land in the gorges (Blue Mountains Forest Conservation Area). • The Beaumont/ Rongahere Gorges are clad mostly in a mix of exotic plantation forestry and large area of remnant beech-podocarp forest. • The gorges are identified as outstanding natural features. | High |

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| Experiential | <ul style="list-style-type: none"> • The riffles and sounds indicate where the fast flowing water partially breaks over the rocky outcrops. • The narrow, steep walled, and at times densely vegetated gorge sections provide a sense of remoteness. • The dam infrastructure is dominant in the localised area, particularly when experienced from below. The complex industrial elements and character are experienced as a sharp contrast to the simple patterns and elements present along much of the wider river in this reach. • The Clutha/Mata-Au has a sense of a powerful 'big river', which is inescapable when close by. The combination of the river's immense water volume, power, currents, turbulence, unique clarity and colour and sometimes sounds inspire a sense of awe and respect. This is further enhanced where the river encounters rapids and the 'rock garden' features. | High |
|---------------------|---|------|

| VISUAL AMENITY - Roxburgh Dam to Rongahere | | Degree of Visual Amenity |
|---|--|---------------------------------|
| Nature of views, viewing audience | <ul style="list-style-type: none"> • Clear views to the water from SH 8 are limited, often screened by high banks, vegetation or due to distance. However, the steep faces and presence of close vegetation through the gorge and glimpses of the river offer very high amenity and a distinctive contrast to much of the Clutha/Mata-Au riverscape. • Some viewing opportunities are available from the Teviot Road and there is good visibility for cyclists along much of the Clutha Gold Trail, particularly between Millers Flat and Beaumont. • The schist outcrops that begin to appear more frequently throughout this landscape add to the visual amenity of the riverscape, from occasional islands to rock embedded in the margins and the steep hillsides and rocky bluffs above. • The clarity of the water also adds to visual amenity. • Seasonal colours of the exotic riparian vegetation are enjoyed. • The dam, power station and associated infrastructure, including substation, transmission lines and pylons and artificial embankments dominate the riverscape at this location. Their industrial character diminishes the scenic qualities of the river and landscape however some viewers, such as those with an interest in hydro power may enjoy the view. | High |

4.10 Clutha River/Mata-Au: Rongahere to Molyneux Bay

The lower Clutha/Mata-Au remains predominantly a single thread river upstream of Balclutha. As it flows to the sea at Molyneux Bay however, the reach below Balclutha has a less stable channel alignment with gravel bars and islands becoming a feature as well as visible tidal effects. Stopbanks line the lower sections of the river from Barnego downstream to prevent flooding of the adjacent land, including Balclutha Township. The surrounding landscape changes markedly, decreasing in altitude and relief.

At Tuapeka Mouth the river enters a noticeably more open low, rolling downlands landscape, often entrenched in alluvial terraces.

The landscape has a sparsely settled rural character with farmhouses and small villages scattered alongside the river, connected via a number of local roads, some of which closely follow the river margins in places. Pastoral farming is the dominant land use with vegetation cover comprising high producing grassland, occasional shelterbelts and scrub in gullies and on terraces and hill slopes. A feature of the lower part of this section are remnant totara trees, near Totara Island.

Balclutha is the largest settlement on this reach, the township extending across both sides of the river, the bridge and stopbanks locally modifying its margins. Here, the character of the river changes markedly to become a low-lying landscape that comprises the historic floodplain of the river. Downstream of the last bridge, the river divides into two branches, the Koau Branch which flows on the southern side of the delta and the smaller, meandering Matau Branch.

The river branches wind across a flat fertile coastal plain of coastal and river alluvium. Between them they enclose a large, 'island' called Inch Clutha comprising farmed paddocks divided by shelterbelts and minor roads and occasional dwellings. High, continuous stopbanks have been built along either side of the channels as flood protection and willow typically defines the river banks.

The lower Clutha River/Mata-Au provides diverse habitat from coastal shoreline, estuarine, brackish lagoon, gravel beds, swamps, riparian willow and pasture, supporting many fish species, marine gull species as well as wading and some inland bird species (ORC, 2017).



Matau Branch of the river at Stirling bridge - the lower reaches of the river flow across flat land and old floodplains, largely contained by stopbanks and lined with willow.

| NATURAL CHARACTER - Rongahere to Molyneaux Bay | | Degree of Natural Character |
|---|---|------------------------------------|
| Active bed | <ul style="list-style-type: none"> • Flows still controlled by Roxburgh Dam though the fluctuations are less evident in this lower reach. • A number of consents for surface and groundwater takes between Clydevale area and the coast. • Remains predominantly a single thread river as it flows to the sea at Molyneux Bay however gravel bars, braided beds and islands becoming a feature, often entrenched in alluvial terraces. This low-lying, flat land located between Balclutha and the Pacific Ocean is known as the Clutha Delta formed by a combination of natural processes, most recently characterised by the interaction of estuarine and fluvial processes (ORC, Natural Hazards, 2016). • The volume of sediment transported through these reaches is likely to be reducing significantly as the effects of the Roxburgh Dam sediment starvation are expressed. The dams contribute to channel stability problems in the lower alluvial reaches through reduced sediment input and an unnatural flow regime (NIWA, 2000). • Several gravel extraction sites. • From Balclutha, downstream of the last bridge, the river divides into two branches Koau and Matau, enclosing a large 'island' called Inch Clutha. • Aerial photography shows changes in river morphology of this reach such as fewer areas of gravel and more backwater areas (ORC, 2017) • Schedule 1A of the ORC's regional Plan: Water identifies the reach below Balclutha as a significant fish spawning area (including inanga) and development area for juvenile trout and salmon, the significant presence of eel, trout and salmon, a significant range of indigenous fish species and regionally significant presence of gamebirds. • Other fish identified on the NIWA Freshwater Fish map include common bully, lamprey, giant bully, inanga, common smelt, and black flounder. • River provides diverse habitat from coastal shoreline, estuarine, brackish lagoon, gravel beds, swamps, riparian willow and pasture, supporting many fish species, marine gull species as well as wading and some inland bird species (ORC, 2017). • The river measured at Balclutha maintains an excellent water quality according to LAWA and the ORC's 2017 SOE report card. However, the Clutha District Council (CDC) District Plan notes that quality deteriorates below Balclutha due to several wastewater discharges. • Below Balclutha, modification of the delta began in the late 1800s with ad-hoc drainage and flood protection infrastructure. Current flood protection system includes engineering works in the form of pump stations, outfall structures, training lines and floodbanks, built along either side of the Koau and Matau channels, modifying the active bed and margins. • Apart from flood protection works below Balclutha, physical structures in the river are largely limited to occasional bridgepiers and pylons/poles. • Some channel diversions have been undertaken (at Shaws Island, Willowmead) but generally the natural meandering channels are unmodified. | Moderate |
| Margin | <ul style="list-style-type: none"> • From 4 km upstream of Balclutha, the engineered stopbanks, pump stations etc and bridges (at Balclutha and along the Matau branch) modify the river margins. | Moderate |

| | | |
|---------------------|--|----------|
| | <ul style="list-style-type: none"> • Between Rongahere and Balclutha physical modification in the margins is minimal, primarily limited to the bridge and boat ramp at Clydevale, the Tuapeka Mouth ferry structures and occasional pylons/poles. • The tidal area of the reach is also valued for whitebaiting and associated fishing structures can be found in places. • Willows and pasture line the river margins throughout this reach, grazing often close to the river's edge including on the grassed stopbanks. • Regionally significant wetlands listed in Schedule 9 of the ORC's Regional Plan: Water include Rigney Pond Margins, Culcairn Oxbow Marsh, Finegand Lagoon Marsh, Clutha/Mata-Au Wetlands, Clutha River/Mata-Au Mouth Lagoon, Molyneux Bay Swamp | |
| Context | <ul style="list-style-type: none"> • The landscape has a sparsely settled rural character with farmhouses and small villages scattered alongside the river however these are limited and typically well set back from the margins. • Pastoral farming is the dominant land use. Vegetation cover comprises high producing grassland, occasional shelterbelts and scrub in gullies and on terraces and hill slopes. A feature of the lower part of this section are remnant totara trees, near Totara Island. • At the time of European arrival, the Clutha Delta was covered in dense swamp vegetation, such as flax and rush, only broken by the narrow strips of forest and scrub on the margins. • Some local roads closely follow the river margins adding a low level of development to the river context. • Land use on the delta includes rural, residential, commercial and industrial activities with associated roads and buildings. The predominant land use is agriculture. Balclutha is the largest settlement on this reach. The more northern Matau branch passes through the townships of Stirling and Kaitangata. • Balclutha extends across both sides of the river, the built form and infrastructure locally modifying the riverscape. | Moderate |
| Experiential | <ul style="list-style-type: none"> • High stopbanks and the high arch of the bridge at Kaitangata increases awareness of the landscape as a river delta/flood plain. • The experience of natural character gradually reduces from north to south as the extent of obvious modification increases. • The visible proximity of stock and grazed pasture on the river and coastal edge reduces the sense of naturalness. • The visible tidal effects and occasional views of islands add to the sense of naturalness and legibility of the river's geomorphology and proximity to the coast. • At Balclutha and approaching the coast, the degree of human intervention becomes most noticeable with the urban setting and continuous channelisation. Despite the visible sand dunes, the rural working landscape right to the edge of the dunes and the flood protection works reduce the sense of remoteness often anticipated in the coastal environment. • The 'big river' presence of the Clutha/Mata-Au is inescapable when viewing it from close by. The combination of the river's immense water volume, power, currents, turbulence, unique clarity and colour and sometimes sounds inspire a sense of awe and respect. | Moderate |

| VISUAL AMENITY - Rongahere to Molyneux Bay | | Degree of Visual Amenity |
|---|---|---------------------------------|
| <i>Nature of views, viewing audience</i> | <ul style="list-style-type: none"> • Some roads closely follow the river margins enabling river views (particularly from bridges and occasional laybys) however the presence of willows and high stopbanks limits also visibility for long sections. • The presence of engineered channels reduces the river's visual amenity in these sections. • The occasional island and the pocket of totara and distinctive rock outcrops in the upper section of the reach add to the riverscape diversity and visual amenity. • While contributing less to natural character, the predominantly exotic riverside trees and shrubs add to visual amenity including through the changing seasonal colours of the exotic willows and poplars within an overwhelmingly green, cultivated grassland landscape. • The river's size and swiftness means that where visible, it forms a prominent natural, powerful and at times scenic feature within a working rural setting – this sense of the river's prominence typically increases travelling south to north as the river valley narrows. | Moderate High |

5.0 Conclusions

The Clutha River/Mata-au and its lakes and tributaries not only play an important role in commercial and recreational activity in the region, they support a range of significant values. These values and the extent to which they contribute to natural character and visual amenity vary throughout the catchment.

Some general trends can be observed when comparing the natural character and visual amenity ratings between reaches reach:

- The level of natural character is generally higher towards the top of the catchment. This means it is Lakes Hāwea, Wanaka, and Wakatipu, the uppermost reach of the Clutha River/Mata-Au between Wanaka and Lake Dunstan, and the Kawarau River, that tend to achieve the highest natural character ratings.

These source lakes are large, the mountains higher and more rugged and predominantly characterised by a strong sense of remoteness, wildness and high levels of naturalness. While there are large areas of modification such as the townships on the lake shores, they are currently subservient to the scale of the waterbodies and surrounding natural landscape.

The extent to which flows/levels are managed generally has a considerable impact on natural character. With the exception of Lake Hāwea and the Hāwea River, flows and lake levels at the upper end of the catchment are essentially natural. The dam at Hāwea reduces the natural character rating for the active bed of both the lake and the river.

- As the waters flow from lake to river and south to the sea, alpine landscapes change to more intimate river corridors that have a legible history of intensive agricultural land use and infrastructure. While much of the land use is rural, the river valleys are typically dominated by pastoral farming with high producing exotic grassland as well as orchards and vineyards; modifications that reduce natural character.

Although settlements tend to be small, the nature of the topography means roads have been developed alongside much of the river corridor which also impact on natural character. However, roading infrastructure also allows travelers to appreciate the visual amenity of the river in places.

- The dam structures at Roxburgh, Clyde, and Hāwea physically modify the active bed, margins and context, reducing natural character and visual amenity at a local scale. They also impact the naturalness of the wider riverscape through artificially controlling lake levels and flows as well as levels of sediment and its movement.
- The natural character ratings for the river and lake margins throughout the catchment tend to be lower than the ratings for the active bed and context. This is a reflection of the extent to which the margins are already modified due particularly to the dominance of willow and other exotic species.
- When compared to other reaches, Lake Dunstan has the lowest natural character rating for its active bed. While the lake has excellent water quality, provides valued recreational fishing opportunities and retains a high level of visual amenity, natural patterns and processes within the active bed are reduced considerably due to its artificial construction, flow regulation, and infrastructure along the shoreline.
- The river reach between Clyde and Lake Roxburgh at Alexandra is considered to have the lowest natural character rating for its context due to extent of development close to the margins. Modification is primarily associated with the towns of Clyde and Alexandra which spread towards one another on the east bank, as well as roads and quarries.
- While the catchment overall is appreciated for its recreational and scenic values and generally achieves high visual amenity ratings, it is the upper end that attracts most visitors where the glacial, alpine landscape is impressive and highly legible.

The table below summarises the ratings for natural character and visual amenity for each reach.

Summary Table

| | Active Bed | Margin | Context | Experiential | Visual amenity |
|---|---|---|---|--------------|----------------|
| Lake Hawea | H | H | VH | VH | VH |
| Lake Wanaka | VH Low at developed waterfront area of jetty structures, moorings and boatramps which has a Low level of natural character | H Low urban/residential development Wanaka Beacon Point | VH Low at urban/residential development Wanaka / Beacon Point | VH | VH |
| Lake Wakatipu | VH With the exception of the developed waterfront area of Queenstown/Frankton Arm with jetty structures, moorings and boat ramps which has a Low level of natural character. | H With the exception of the developed urban area of Queenstown/ Frankton Arm which has a Low level of natural character. | H on southern and western side Moderate to Low along Frankton Arm and at Kingston | VH | VH |
| Lake Dunstan | ML | M | MH | MH | H |
| Clutha (Clyde Dam to Lake Roxburgh/Alexandra) | M | MH | M | MH | H |
| Lake Roxburgh | MH | MH | H | H | H |
| Hawea River | M | MH | MH | H | H |
| Clutha (Wanaka to Dunstan) | VH | H | H | H | H |
| Kawarau River | VH | H | H | VH | VH |
| Clutha River (Roxburgh Dam to Rongahere) | M | M | H | H | H |
| Clutha River (Rongahere to Molyneux Bay) | M | M | M | M | MH |

6.0 How Changing Flows Can Affect Natural Character and Visual Amenity Values

Natural character is a combination of the natural elements, patterns, and processes of a river system. When changes occur to elements (e.g. extraction of gravel), effects on natural character can be localised so that natural patterns and processes are able to essentially continue. When changes begin to affect natural processes (such as water flow), natural character is likely to decrease more markedly.

A reduction in flow or lake level can induce change in rivers and lakes that primarily has the potential to be reflected in the ecological integrity and quality of river ecosystems. The experiential aspects of natural character may also be impacted however often (though not always), effects would have to be greater before a reduction in flow or lake level would result in an adverse 'natural' experience.

River flow affects a range of habitat factors including current, water depth, wetted area, substrate, dissolved oxygen levels and water temperature. Indicators of impacts can be a very shallow water depth, a reduction in the wetted area or reduced water movement compared with what might be expected or for longer durations than might be expected. Changes such as these tend to be more noticeable in shallow, braided rivers than in single thread, incised rivers like the Clutha River/Mata-Au.

In order to evaluate the effect on natural character of changing flows/lake levels, the effects needs to be considered separately for each of the river/lake components, (i.e. active bed, margin, context) as change flows/levels affect these components in very different way and by varying degrees.

Active Bed

When considering the active river bed in particular, a reduction in flow and especially the loss of flood flows, can reduce natural fluvial processes. This includes the movement and deposition of sediments and gravels that lead to the formation of river braids, bars, and islands.

Similarly, lowering lake levels is likely to increase the size of beaches/ exposed shoreline and sediment deposition

In addition to lower flows, rapid, frequent, or large changes to flows (for example, the flow regime at Hāwea River) are not conducive to supporting fish habitat, frequently dewatering the slower/shallower margins of the reach. These flows may also adversely affect benthic invertebrates, contributing to reduced food source availability for fish and birds⁶.

Conversely, invertebrate and fish taxa habitat quality and quantity all increase as flow declines, in the range between 80 m³/s to 370 m³/s, indicating that low flows can have a positive effect on some ecological aspects of natural character⁷.

⁶ 2018. Ecological Flow Regime Assessment for The Upper Clutha River/Mata-Au: Complementing Hydraulic-Habitat Modelling With Drift-Feeding Trout Net Energy Intake Modelling. ¹Cawthron Institute and ²National Institute of Water and Atmospheric Research. Prepared for Otago Regional Council

⁷ *ibid*

Physical habitat quality for cyanobacteria and algae, such as didymo are also predicted to improve with flow reduction, increasingly so at flows below 200 m³/s and especially below 100 m³/s.⁶ This would lead to adverse effects relating to the presence of these nuisance algae.

Margins

With regards to the margins, flow changes are important for abiotic features, such as gravel substrate banks as flood flows clear exotic weeds. These high flows that cover the margins are essential to maintain the quality of the gravel surface habitat for birds.

Values relating to terrestrial ecology in the riparian margins, eg vegetation and bird habitat, may be impacted by changes to flow or lake levels when the extent to which these communities are within or out of the water changes so that their ability to adapt and survive is affected.

Vegetation on the margins of most reaches on the Clutha River/Mata-Au is already modified so that effects of reducing flows on natural character are unlikely to be significant and would result in further colonisation of dry river margin areas.

Lowering or fluctuating lake levels can alter the hydrology of connected wetlands. An increased frequency or prolonged drying of the lake shore will detrimentally alter the wetland habitat

Context

Effects of reducing flows are unlikely to impact on the natural character of the wider riverscape or lake landscape context, other than through experiential attributes. For similar reasons, low flows may reduce the visual amenity of a river or lake, for example by resulting in large areas of exposed shoreline or river margins covered with dry sediment or algae. In such an instance, people's appreciation of that river's pleasantness, aesthetic coherence and even its cultural or recreational attributes could be reduced.

However, much of the Clutha/Mata-Au is a single braid, highly entrenched river, the steep banks and depth of substrate well below the water ensuring that any reduction in flow is likely to be difficult to notice. Those areas most sensitive to a change in flow regime are likely to be sections where the river takes on a shallower, more braided morphology, such as sections of the Hāwea River.

Visual Amenity

The effects of flow/level change on visual amenity values is very closely linked to recreation values. The effects will be greatest at the most frequented locations where people come into contact with river and lake margins. In particular low levels expose greater extents of bare margin which can be less attractive due the presence of sediments or algae. The effects will also be greatest in areas of high natural character/low modification where large exposed shores/river margins can appear incongruent with the typical patterns and processes where waterline adjoin vegetation.

Other factors

Many factors play a role in maintaining, improving or reducing natural character, including flows and lake levels. In addition to changing flows, the natural character of many of the reaches on the Clutha/Mata Au will also be susceptible to factors such as surrounding land use change (e.g. due to irrigation), particularly by additional structural modifications to the river, its margins or adjacent context.

For example, a new house on the river terrace is likely to be more noticeable in many instances than a change in appearance resulting from particular flows (unless reductions are extreme).

However, longer term effects of flow reduction such as vegetation encroachment onto the river or lake bed, will be more prominent and lead to effects on the natural patterns and processes of the river.

For these reasons, it is understanding the ecological impacts of reduced flows together with consideration of the maintenance flushing flows/floods and seasonal base flows that are most important in considering effects of flow thresholds on the natural character of the Clutha/Mata-Au catchment

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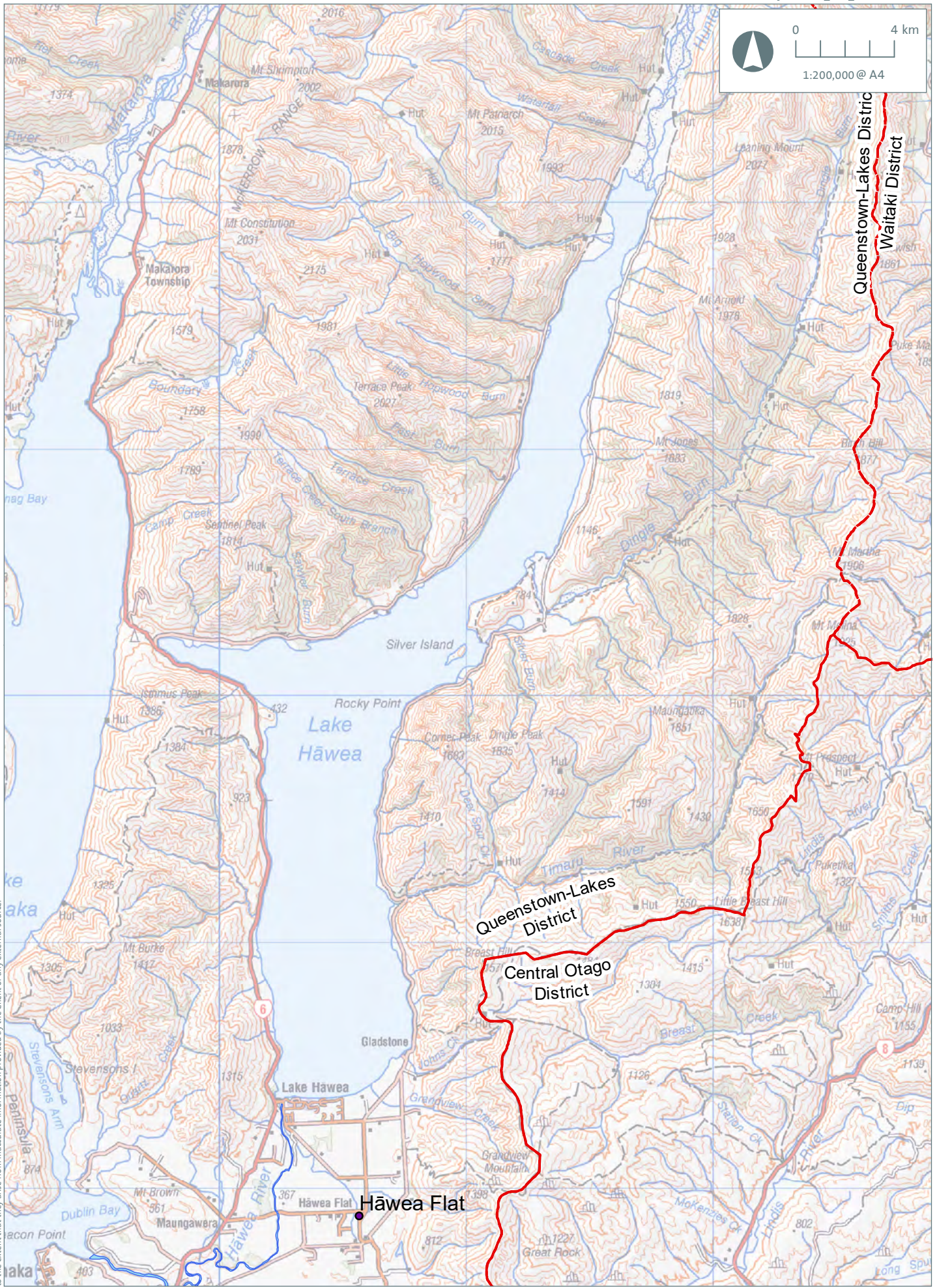
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CLUTHA MATA-AU RIVER STUDY
Lake Hawea
Date: 15 October 2018 | Revision: 1
Plan prepared for Otago Regional Council by Boffa Miskell Limited
Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: CMU | Checked: BFA



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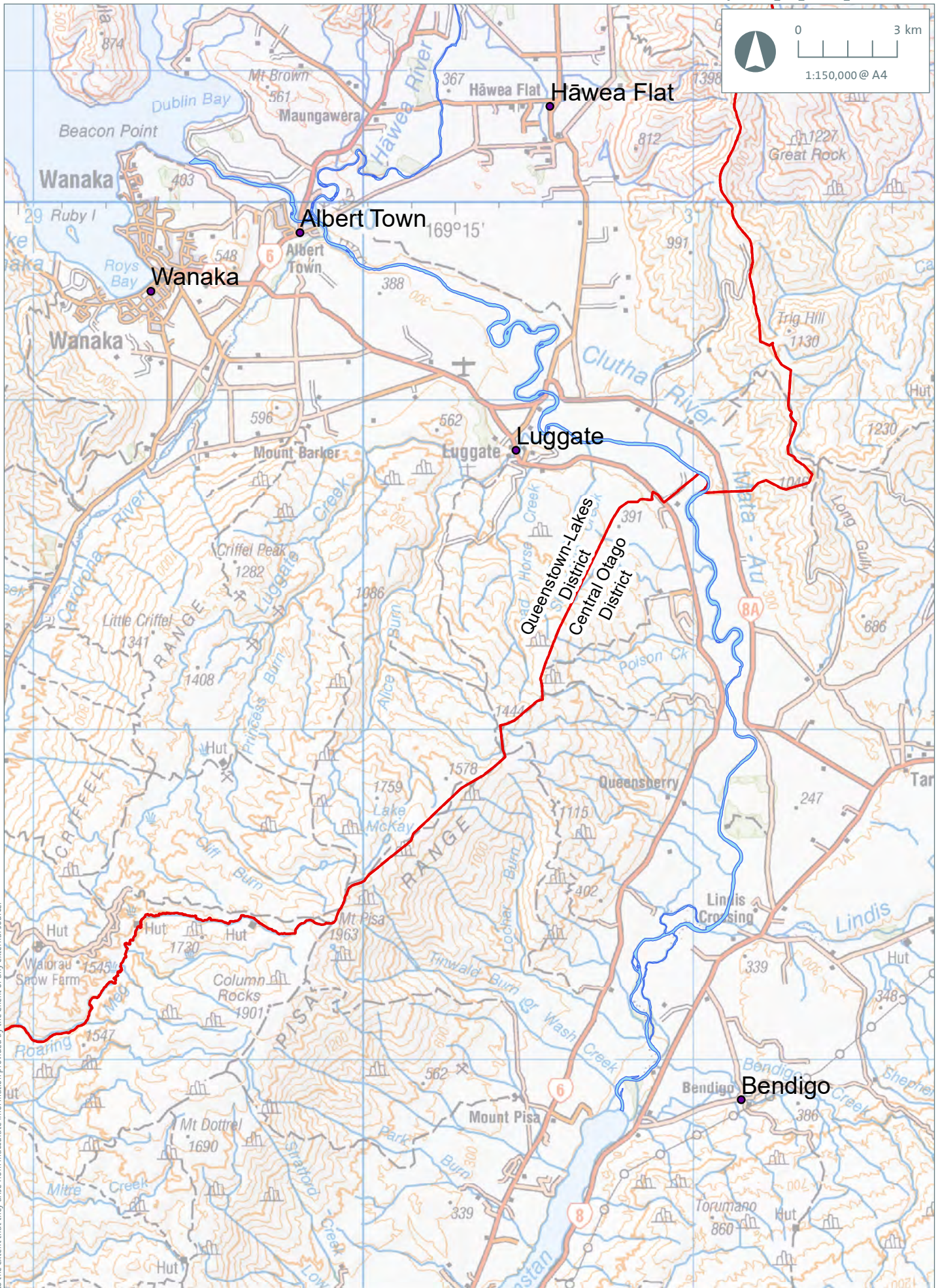


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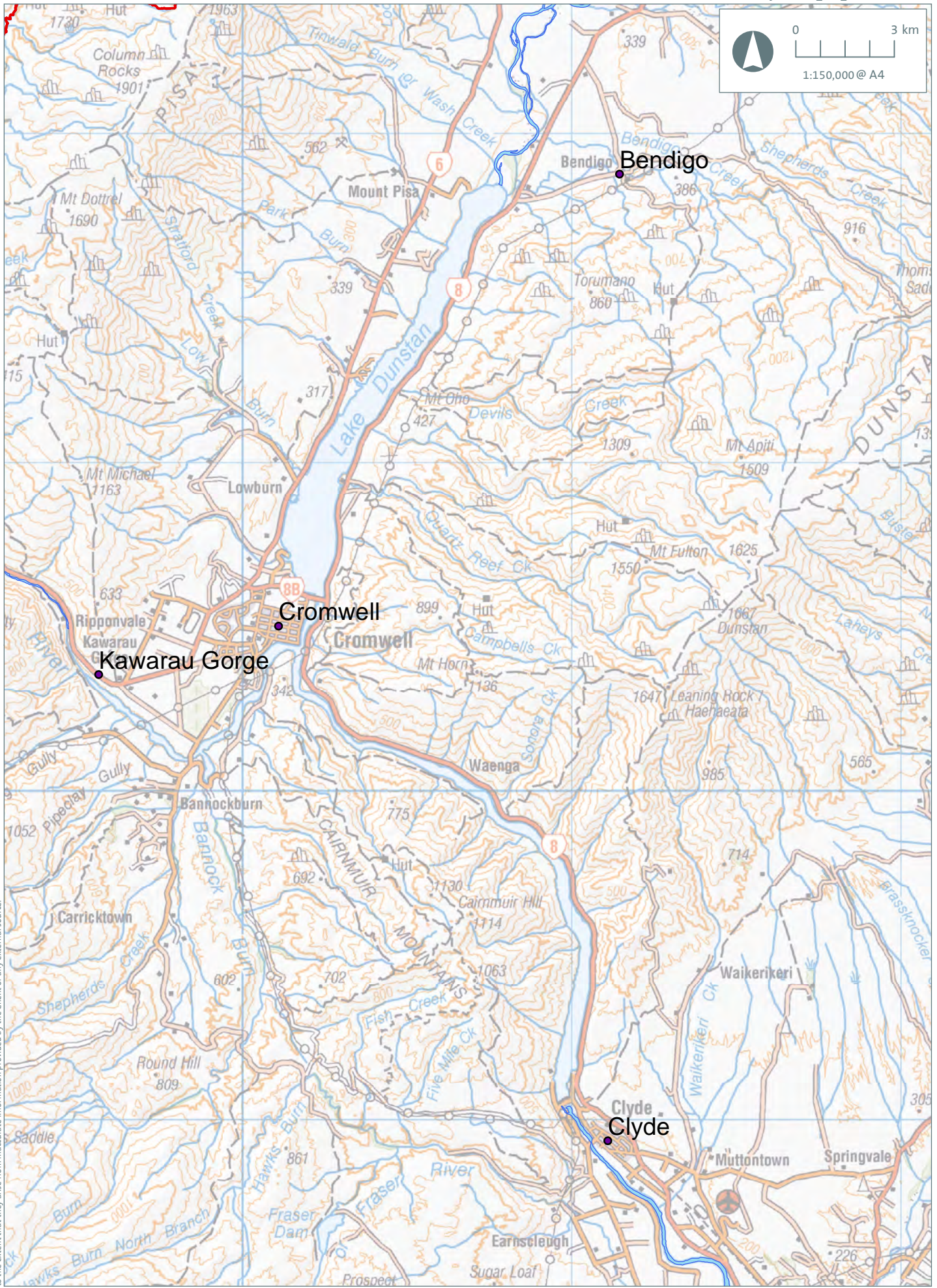
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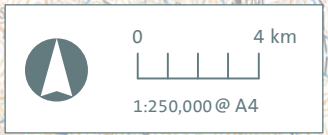
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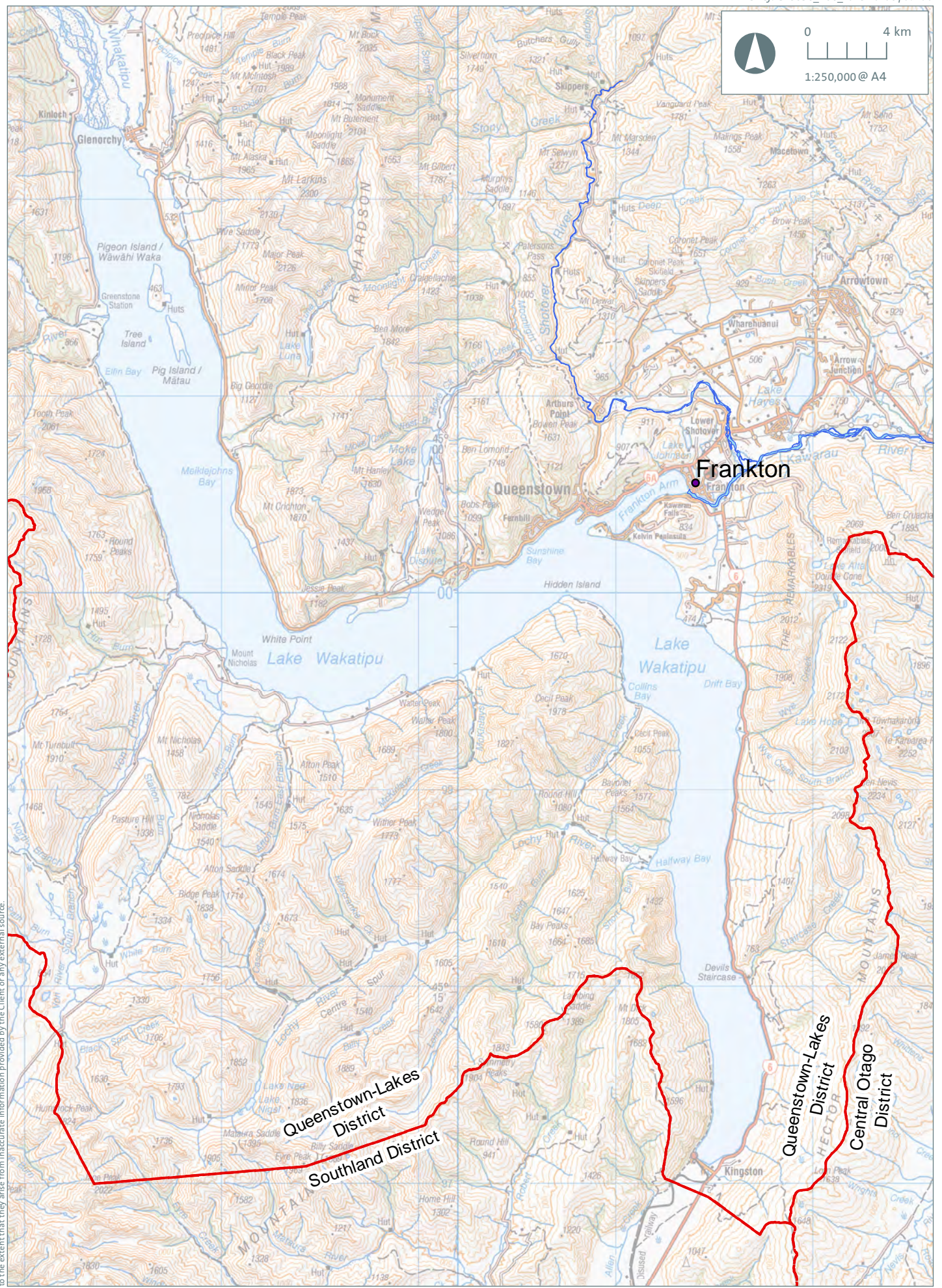
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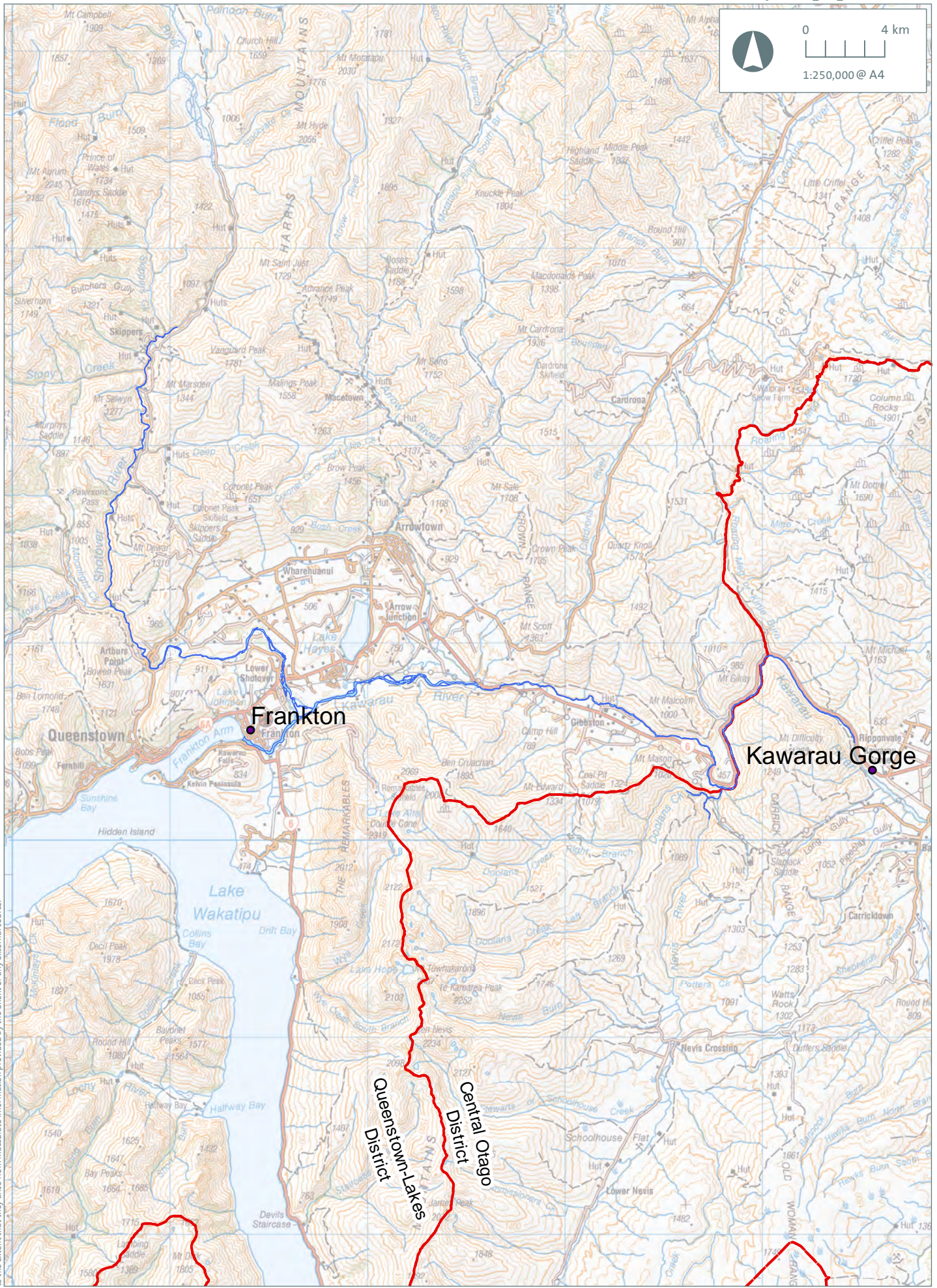


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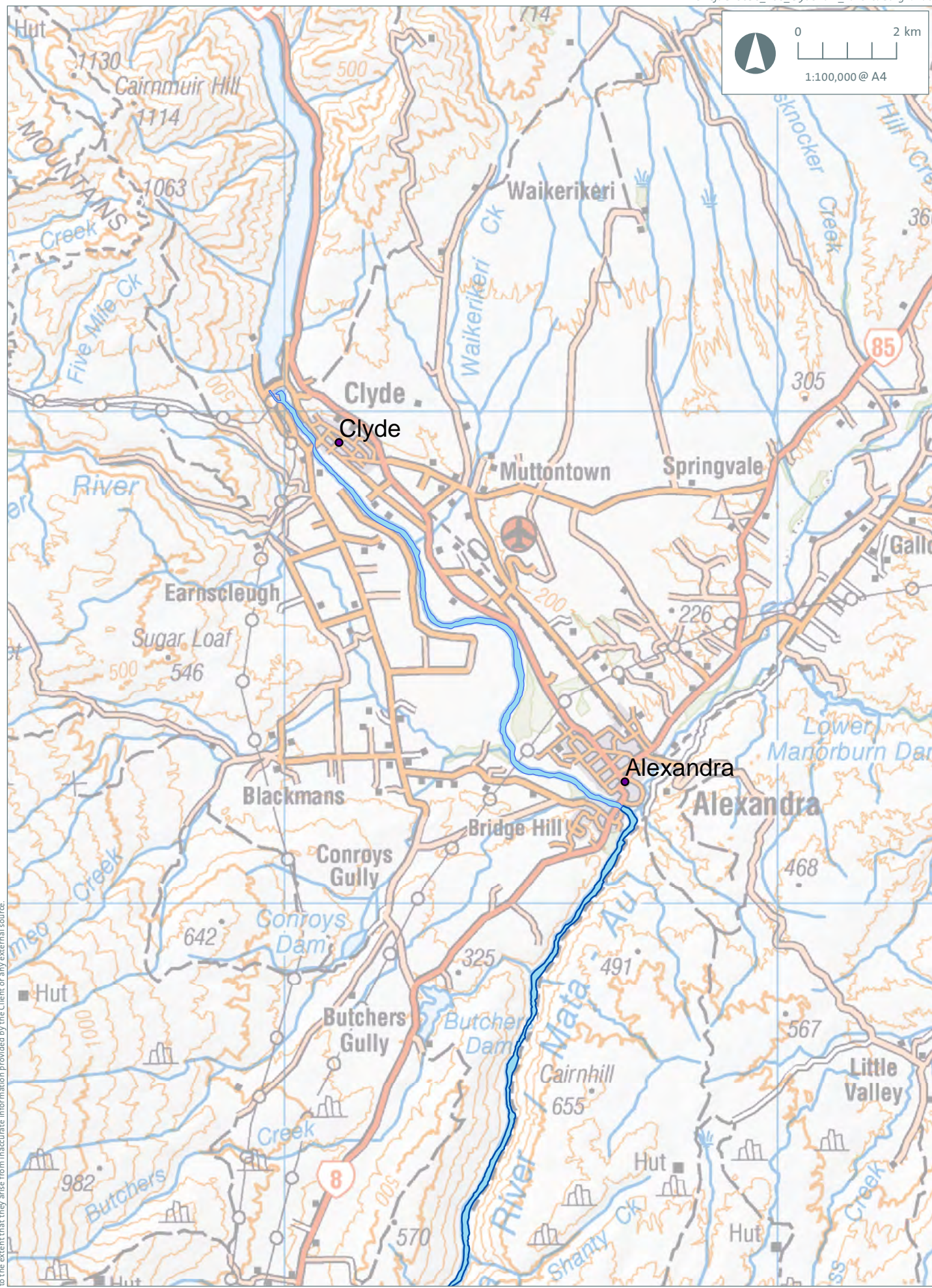
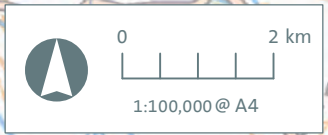


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CLUTHA MATA-AU RIVER STUDY
Kawarau River

Date: 15 October 2018 | Revision: 1

Plan prepared for Otago Regional Council by Boffa Miskell Limited
Project Manager: Yvonne.Pfluger@boffamiskell.co.nz | Drawn: CMU | Checked: BFA



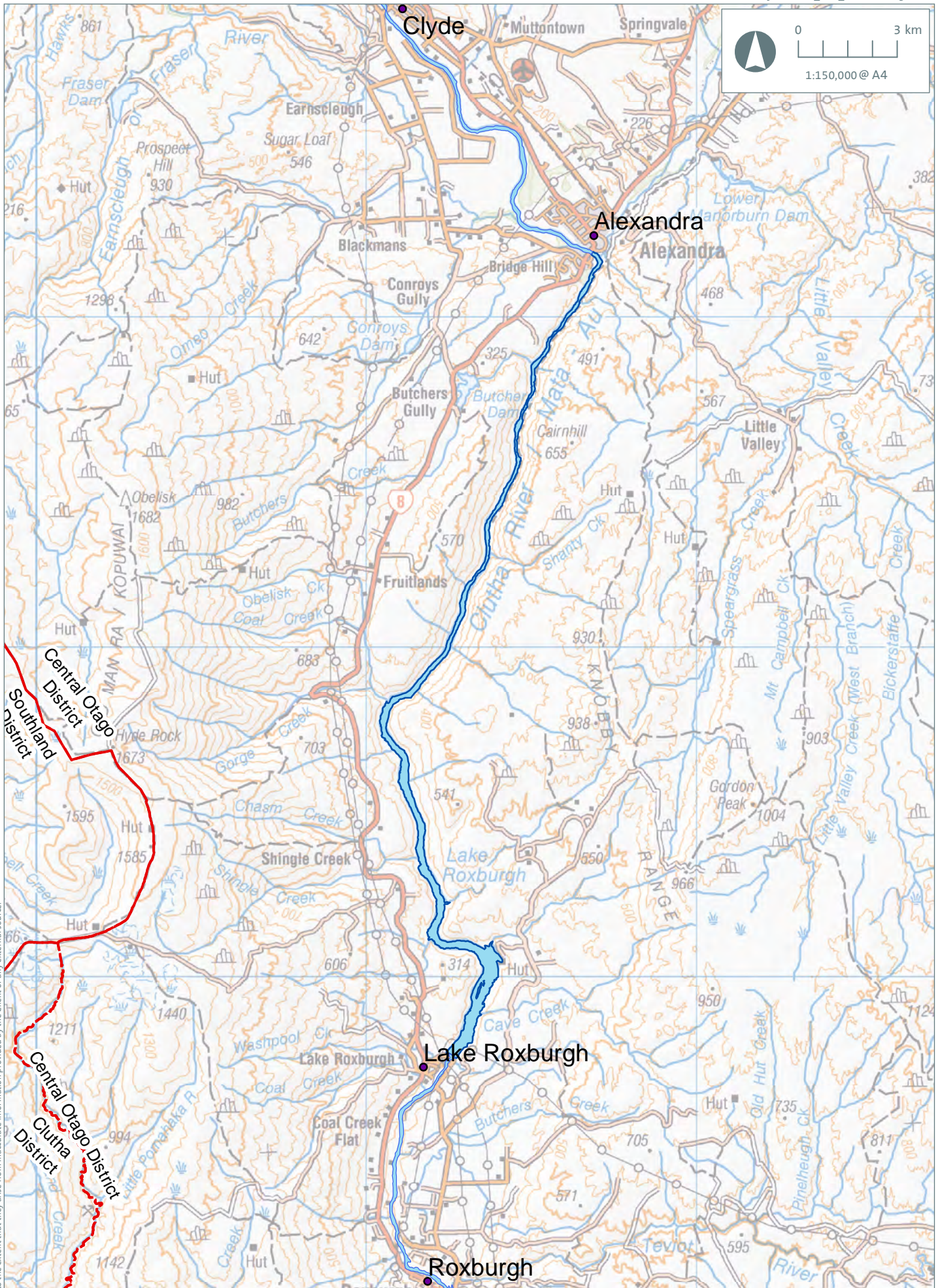
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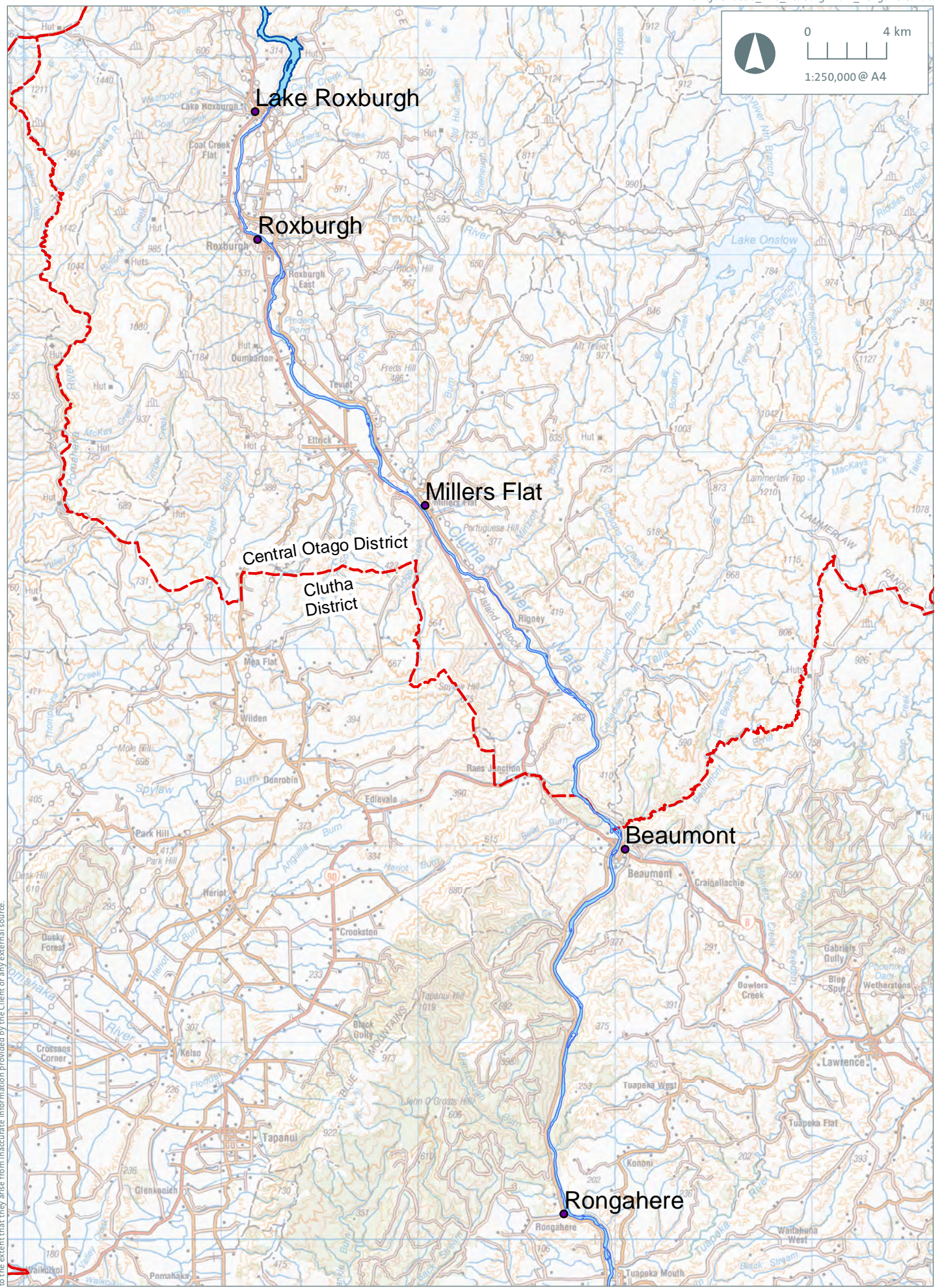
Legend
Territorial Authorities
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CLUTHA MATA-AU RIVER STUDY
Clyde Dam to Roxburgh
Date: 15 October 2018 | Revision: 1

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