

# Tekapo Power Scheme Reconsenting

Natural Character, Landscape and Visual Amenity Effects Assessment  
Prepared for Genesis Energy



## Document Quality Assurance

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# Executive Summary

Genesis Energy Ltd are seeking the necessary core water (regional) consents for the continued operation and management of the Tekapo Power Scheme (TekPS) which expire on 30 April 2025. Genesis Energy does not propose any changes to the current scheme.

The assessment includes the identification and evaluation of the potential effects of the Scheme on the natural character, landscape and views/ visual amenity values of the TekPS, within the statutory context. The assessment was assisted by a site visit, photographic records, a review of technical reports prepared by others and design iterations made to the Scheme.

This assessment considers potential effects of the Scheme and includes assessment of the waterbodies and surrounding landscape associated with the TekPS including Lake Tekapo, the Tekapo River, and Lake Pukaki (in so far as the TekPS affects Lake Pukaki).

In terms of the effects of the continued water-takes for the Scheme on the natural character, landscape and visual amenity values, the continued operation of the scheme will not modify the landscape or change the current water takes into the landscape. A consistent minimum flow would enhance natural character (and landscape and amenity values) of the Tekapo River, in the upper reach between the Lake Tekapo control gates (Gate 16) and Fork Stream. The overall effects of the continued operation of the TekPS would therefore not lead to any additional adverse effects compared to the status quo, and the existing natural character, landscape and amenity values will be maintained.





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# 1.0 Introduction

Boffa Miskell Limited (BML) has been engaged by Genesis Energy Ltd to undertake a landscape, natural character and visual assessment for the proposed re consenting of the regional water and discharge permits (core consents) for the Tekapo Power Scheme (TekPS). This assessment considers the waterbodies and surrounding landscape associated with the TekPS including Lake Tekapo, the Tekapo River, and Lake Pukaki (in so far as the TekPS affects Lake Pukaki).

Genesis Energy are seeking the necessary core consents from Environment Canterbury for the continued operation and management of the TekPS which expire on 30 April 2025. Genesis Energy is not proposing any changes to the current scheme.

This report comprises three interrelated assessments (landscape, natural character and visual amenity) of the potential effects of the Scheme. The scope and methodology of the assessments have been informed by the relevant statutory requirements, the nature and scale of the Scheme, and the existing and potential effects on the environment. This report is consistent with current best practice outlined within Te Tangi a Te Manu Landscape Assessment Guidelines (2022)<sup>1</sup> as well as within The Natural Character Assessment Guidelines for Braided Rivers (2018)<sup>2</sup>.

The assessments address the following:

- Natural character assessment - considers effects on the elements, patterns and processes that influence the natural character of the waterbodies and their margins.
- Landscape assessment - considers effects on the physical landscape resource and character of the catchments in proximity to the Scheme corridor.
- Visual amenity assessment – considers effects on the visual amenity values of the waterbodies and their visual context.

Natural character, landscape and visual effects result from natural or induced change in the components, character or quality of a landscape and waterbodies. Usually these are the result of landform or vegetation modification or the introduction of new structures, activities or facilities into the landscape.

As part of this work, a Site visit was undertaken by James Bentley, Senior Principal Landscape Architect and Julia Wick, Associate Principal Landscape Architect at Boffa Miskell on 24 November 2020. This Site visit included visiting the shores of Lake Tekapo as well as the entire stretch of canals associated with the Scheme extending to the shores of Lake Pukaki. A visit was also undertaken to the banks of the upper reaches of the Tekapo River. The weather was sunny, with high cloud gathering during the afternoon. Lake Tekapo lake level was at 708.00 masl and water was being released through the control structure into the upper Tekapo River at

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<sup>1</sup> Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines, Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022.

<sup>2</sup> Natural Character Assessment Guidelines for Braided Rivers, Report No. R18/35, Environment Canterbury, July 2018.

a rate of a 107.9 m<sup>3</sup>/s (also referred to a cumecs in this report; measured around midday). The lake level of Lake Pukaki was approximately at 526.5masl<sup>3</sup>.

During the Site visit, a number of photographs were taken and these, along with some plans, are included in the accompanying Graphic Supplement to illustrate findings.

## 1.1 The reconsenting application

As outlined, Genesis is not proposing to change or introduce any new structures into the currently consented and operating TekPS as part of this reconsenting application. This application is solely related to the water-takes and associated discharges from the Scheme.

The assessments are based on the existing environment, which for the purposes of this assessment comprises the current state of the environment, including existing environmental processes. The existing structures and associated water takes, uses, diversions, damming and discharges associated with the TekPS form part of that existing environment. Given Genesis Energy does not propose any changes to the TekPS, the environmental effects for the continued operation and management of the scheme are the same as the effects of the scheme on the existing environment.

# 2.0 Existing Environment

## 2.1 Landscape Context

The TekPS is located within the Mackenzie Basin Outstanding Natural Landscape (ONF/L). The area has been identified at both the Regional<sup>4</sup> and Mackenzie District level as being an outstanding natural feature/landscape under RMA section 6(b). Refer to **Figure 3** for the extent of the mapped ONL.

The Mackenzie Basin forms the largest intermontane basin in New Zealand. Biophysical features include extensive glacial terraces, moraines, lakes and kettleholes, as well as broad fluvio-glacial outwash surfaces. The Mackenzie Basin is a homogenous, highly legible landscape which expresses its formative glacial origins in its current geomorphology. The mountain ranges surrounding the Mackenzie Basin include Aoraki/ Mount Cook as part of the Southern Alps to the west, the Two Thumb Range to the north and the Ben Ohau Range to the south. The Basin contains Lakes Ohau, Pukaki and Tekapo, which accentuate the openness and vastness of this landscape.

The lakes are dominant features within the open grassland and mountainous landscape and were formed by the retreating of the glaciers during the waning of the last glaciation era. Subsequently Lakes Pukaki and Tekapo have been substantially raised through the creation of the Waitaki Power Scheme, leading to larger surface areas<sup>5</sup>. To the south of the lakes are

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<sup>3</sup> As estimated on the Meridian website.

<sup>4</sup> 2010. *Canterbury Regional Landscape Study Review*. Prepared for Environment Canterbury by Boffa Miskell Ltd

<sup>5</sup> **Lake Tekapo:** Natural lake level 705.1 – (maximum controlled lake level 710.9) = inundation area of approximately 88.84km<sup>2</sup> to 99.73km<sup>2</sup> which equates to a 10.89 (km<sup>2</sup>) total lake surface area difference during natural lake level operations.

extensive fluvial outwash plains and terraces that, due to the harsh, dry climate and limited growing medium, are characterised by stony ground and tussock grasses. Occasional clusters and shelterbelts of conifers, located within this landscape, assist in accentuating the openness. In some parts of the Basin issues arise relating to the extensive spread of wilding conifers.

Lake Tekapo is the second largest of three lakes within the Mackenzie Basin. It covers an area of 87 square kilometres and is at an altitude of 710 metres above sea level ("masl"). The lake is largely fed at the northern extent by the Godley River, which has its source in the Southern Alps. The township of Tekapo is located at the southern shore of the lake, as illustrated on **Site Photographs A – D**.

The Tekapo Power Scheme development (between the 1930s and 1970s) involved the construction of significant hydro generation structures designed to support and deliver the long-term supply of renewable electricity to the national grid. Significant investment was made during the development of the Tekapo Power Scheme to ensure structures were resilient, reliable and enduring. Photographs illustrating construction of some key structures associated with the Tekapo Power Scheme are provided in **Appendix 3**.

SH8 is the principal highway through the Mackenzie Basin, connecting with Lake Tekapo to the north-east, to Twizel in the south-west and passing the southern shoreline of Lake Pukaki. SH8 intersects the Tekapo Canal some 1.3km east of Irishman Creek.

As highlighted in the Recreation report<sup>6</sup>, Lake Tekapo *'is nationally significant for a wide range of on-water recreation activities, including boating and angling. It has international significance via its scenic values and the contribution these make to the tourism industry. The Tekapo River is regionally significant for kayaking, jet boating and angling. The Tekapo White Water Course on the Tekapo River is nationally significant for kayaking. The Tekapo Canal is nationally significant for angling, with some international use, and is nationally significant for cycling due to the location of the Alps 2 Ocean Trail on its southern bank, and for walking via the Te Araroa Trail'*.

The landscape of the Mackenzie Basin is described further within The Mackenzie Basin Landscape: Character and Capacities report, prepared for Mackenzie District Council by Graham Densem Landscape Architects, dated November 2007. Within this report, a number of Landscape Character Areas are identified, which are illustrated on **Figure 3** of the Graphic Supplement and described further within **Appendix 2** of this report. In terms of the project area, four Landscape Character Areas are relevant: Tekapo, East Basin, Central Basin and Pukaki.

The Tekapo landscape has continued to change over the past few decades, most noticeably in terms of a greater level of farming intensification in some areas of the basin, where pivot irrigators have replaced areas of open grassland. Environment Canterbury also undertake river management of the Tekapo River with areas of planting and contouring occurring.

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For Extreme Minimum control level 702.1 – (natural lake level 705.1) = approximate shoreline exposure due to operations (km<sup>2</sup>) (80.98km<sup>2</sup>) – (88.84km<sup>2</sup>) which equates to a 7.86km<sup>2</sup> total lake surface area difference during extreme minimum lake level operations.

For Minimum control level 704.1 – (natural lake level 705.1) = approximate shoreline exposure due to operations (km<sup>2</sup>) (85.73km<sup>2</sup>) – (88.84km<sup>2</sup>) which equates to a 3.11km<sup>2</sup> total lake surface area difference during minimum lake level operations.

**Lake Pukaki:** Natural lake level 484 – (maximum controlled lake level 532) = inundation area (km<sup>2</sup>) (75.5) – (179.5) = 104 (km<sup>2</sup>)

Minimum control level 518 – (natural lake level 484) = inundation area (km<sup>2</sup>) (154.5km<sup>2</sup>) – (75.5km<sup>2</sup>) = 79km<sup>2</sup> difference in surface area.

<sup>6</sup> Rob Greenaway & Associates; 2023 Genesis Energy Tekapo Hydro Scheme Reconsenting: Recreation Review, page 5.

Also illustrated on **Figure 3** of the Graphic Supplement is the extent of the Mackenzie Basin Regionally Outstanding & Significant Landscape.

## 2.2 Lake Tekapo & Tekapo Power Scheme

Hydro-electricity generation commenced in the Upper Waitaki catchment during the 1950s and has modified the landscape of the Mackenzie Basin. Modification has occurred through the raising of lake levels, the construction of canals and water conveyance infrastructure, the formation of artificial lakes and the control or reduction in river flows.

The TekPS comprises two hydro-electric power stations, referred to as “Tekapo A” (capacity 30 MW) and “Tekapo B” (capacity 160 MW). Water for electricity generation is stored in Lake Tekapo by virtue of the control structure. Water can be diverted through the two power stations via an intake before discharging into Lake Pukaki. Water can also be released through the control structure adjacent to Lake Tekapo into the upper reaches of the Tekapo River. Water that is released into the upper Tekapo River can be diverted back into the Tekapo Canal via Gate 17, or it can be spilt over the Lake George Scott spill weir, down the length of the Tekapo River to the artificial lake of Lake Benmore.

The intake for the TekPS is located on the south-western shores of the lake. The intake draws water through a six-metre diameter, 1.6 kilometre-long tunnel and then travels through a tunnel under the hill to the west of the township, to the Tekapo A power station located part way down the Tekapo River.

Lake Tekapo is dammed by a Control Structure (“Gate 16”) at the head of the Tekapo River. Prior to the TekPS construction, Lake Tekapo had an average level of 705.1 masl and a seasonal lake level range of approximately 2.6 metres. As part of TekPS operations, the lake has a normal operating range of 8.8m (from 702.1 masl to 710.9 masl); however, the minimum and maximum operating levels vary seasonally throughout the year<sup>7</sup>.

The current minimum operating level of Lake Tekapo is as follows:

- 1 April and 30 September – Minimum Level of 702.1 masl; and
- 1 October and 31 March – Minimum Level of 704.1 masl.<sup>8</sup>

The current maximum operating levels for Lake Tekapo are as follows:

- September to February – Maximum Level of 709.7 masl;
- March – Maximum Level of 710.0 masl;
- April and August – Maximum Level of 710.3 masl;
- May – Maximum Level 710.6 masl and
- June and July – Maximum Level of 710.9 masl.

Refer to the Graphic Supplement, Pages 5, 6, 7 & 8 for comparison photography of different lake levels, taken at 705.60, 708 masl and 710 masl.

<sup>7</sup> The maximum levels vary to allow for higher inflows (and therefore to manage flood risk) during certain times of the year. The minimum levels vary to reduce dust effects from exposed shoreline during particularly windy times of the year.

<sup>8</sup> The level of Lake Tekapo may be further reduced to 701.8 masl between 1 October and 31 March if the Electricity Commission determines that reserve generation capacity is required.

## 2.3 Tekapo River

The Tekapo River is approximately 45 kilometres long and is augmented by spring fed flows and tributaries such as Fork Stream (Refer **Site Photograph G**), and the Grays and Maryburn Rivers. The Tekapo River converges with the Pukaki River before discharging into the Haldon Arm of Lake Benmore.

The Tekapo River is the natural outlet of Lake Tekapo but has a highly modified flow regime, due to the control structure dam and a weir two kilometres downstream creating Lake George Scott, refer to **Site Photographs E and F**. Although there are no minimum flows downstream of the control structure, water is released relatively regularly through the control structure to:

- Top up Lake George Scott for operational purposes.
- Provide recreational releases in the upper Tekapo River and the Tekapo Whitewater course.
- Bypass Tekapo A Power Station when it is unavailable for generation.

In all instances water is generally diverted back into the Tekapo Canal so it can be used to generate electricity through Tekapo B Power Station, and three power stations owned and operated by Meridian Energy (Ohau A, B and C Power Stations).

Water is also released from the control structure to manage high lake levels. When this occurs, the water released is spilt over the Lake George Scott Weir and continues down the Tekapo River to Lake Benmore.

Flows from the tributary rivers and streams downstream of the weir at Lake George Scott enable the lower Tekapo River to maintain permanent flow<sup>9</sup>. The principal tributary is Fork Stream, along with Grays River and Mary Burn. Structures and modifications in the riverbed include the weir and the Tekapo Kayaking slalom course.

Hydrological information on the Tekapo River's low, median and mean flows assists in determining the natural character of the river. There is no minimum residual flow required in the Tekapo River below the control structure or the Lake George Scott weir<sup>10</sup>, and aside from some pools, there is no consent requirement for a permanent flow in the Tekapo River for the first 7 km. As stated earlier, beyond Fork Stream, the river does retain a minimum flow, and this increases further southwards as more tributaries connect into the river. Below the Mary Burn tributary, the mean flow is 15.4m<sup>3</sup>/s until it discharges into Lake Benmore.

## 2.4 Tekapo Canal

Outflows from Tekapo A Power Station enter the 25.5 kilometre long Tekapo Canal, which has a maximum capacity of 130 m<sup>3</sup>/s. The Tekapo Canal passes over a number of natural waterways which are accommodated by culverts under the canal, including Forks Stream, Irishman Creek and Maryburn Stream and a number of smaller water courses. The water flows

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<sup>9</sup> For approximately 70% of the time there is no or very little flow in the upper reaches of the Tekapo River between the control gate (Gate 16) and Lake George Scott. Lake George Scott Weir has no flow over the weir to the Tekapo River for approximately 90% of the time. The median flow in the Tekapo River increases from approximately 2.5 m<sup>3</sup>/s at the confluence with Fork Stream to approximately 10 m<sup>3</sup>/s at the ECan Tekapo River recorder site downstream of the Mary Burn. This is predominantly due to flow contributions from tributaries such as the Grays River and Mary Burn. (source: PDP Tekapo Power Scheme – Hydrological and Hydrogeological Analyses, September 2021 executive summary). The reach of the Tekapo River between Lake George Scott and the confluence with Fork Stream appears to have some minor groundwater inflow.

<sup>10</sup> The consents allow Genesis to release water down the river during flood events, but do not *require* a flow.



into a head pond at the end of the Tekapo Canal before entering the penstocks and Tekapo B Power Station. Refer to **Site Photographs I to L**.

## 2.5 Lake Pukaki

Water is discharged into Lake Pukaki via the Tekapo B Power Station. Located within Lake Pukaki, essentially as an island, the Tekapo B Power Station is connected to land via a 74-metre-long bridge. Constructed on concrete raft foundations, Tekapo B is 46 metres high. However, nearly two thirds of the power station is below the waterline.

Lake Pukaki occupies the lower end of a glaciated valley confined by a terminal moraine. Lake Pukaki is a dominant feature of the Mackenzie Basin and contributes to the landscape and amenity values of the environment, albeit being amongst the most modified of the lakes in the area, including having been raised the most<sup>11</sup>. Hydroelectric power development has had a modifying influence in areas including the southern end of Lake Pukaki, however other than Tekapo B Power Station, which is owned and operated by Genesis, all other hydro generation infrastructure associated with Lake Pukaki is owned and operated by Meridian. These include the Pukaki High Dam, Pukaki Canal Intake Dam and the Pukaki Canal Intake Structure. The operating levels of Lake Pukaki are managed by Meridian who use the water to generate electricity through a further six Meridian Energy-owned power stations within the Waitaki Catchment.

Refer to **Site Photographs M and N** which illustrate Lake Pukaki with its lake level at approximately 526.5 masl.

## 3.0 Relevant Statutory Framework Assessment

Full documentation of the statutory framework including objectives, policies and rules is contained in the AEE. Below is a summary of the statutory matters relevant to this Natural Character, Landscape and Visual Amenity Assessment, noting that the activities associated with the TekPS are recognised and provided for in the Regional and District Plans.

### 3.1 Resource Management Act 1991 (RMA)

As relevant to this assessment, the RMA outlines the following matters which must be considered as part of this proposal.

#### *Section 6 – Matters of national Significance*

- (a) *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.*

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<sup>11</sup> Lake Pukaki has been raised 46 metres since 1952 to its current operating level, which substantially increased its size, submerging large areas of original lake shore.

- (b) *The protection of outstanding natural features and landscapes from inappropriate subdivision, use and development.*

#### Section 7 – Other matters

- (c) *The maintenance and enhancement of amenity values;*
- (d) *The maintenance and enhancement of the quality of the environment;*

Section s6 (a) and 6(b) are outlined in further in detail below in Section 4.0 of this assessment.

### 3.2 Canterbury Regional Policy Statement (CRPS)

The RPS sets out regionally significant resource management issues. Of particular relevance to this assessment, Chapter 5 of the RPS sets out the need to protect outstanding natural features and landscapes:

- Objective 5.2.1 – Location and design and function of development is located so it maintains and (where appropriate) enhance the overall quality of the natural environment, including its outstanding natural features and landscapes (Objective 5.2.1.2(a)).

Further guidance is provided in Objectives 7.2.1, 7.3.1 and 7.3.2 which specifically mention the need to ensure natural character values of freshwater are preserved, maintained or enhanced.

- Objective 7.2.1 Sustainable management of freshwater (1) the natural character values of the wetlands, lakes and rivers and their margins are preserved from inappropriate subdivision, use and development.
- Objective 7.3.1 seeks to ensure that adverse effects of activities on the natural character of fresh water, fresh water bodies and their margins is preserved. (2) to maintain natural character values where they have been modified by highly values and (3) to improve natural character values where they have been degraded to unacceptable levels unless modification of the natural character values of a fresh water body is provided for as part of an integrated solution to water management in a catchment in accordance with Policy 7.3.9, which addresses remedying and mitigating adverse effects on the environment and its natural character values.
- Objective 7.3.2 – Natural character of braided rivers and lakes are maintained and enhanced

The Mackenzie Basin has been included as an Outstanding Natural Landscape in the Canterbury Regional Policy Statement and Mackenzie District Plan. This is based on the findings that identified the Basin as an Outstanding Natural Landscape in the Canterbury Regional Landscape Study (Lucas & BML, 1993), Canterbury Regional Landscape Study Review (BML, 2010) and the Mackenzie Landscape Study (Densem, 2007).

It is also noted that there are specific provisions of the RPS that recognise and provide for significant infrastructure such as the TekPS. These provisions are addressed in the AEE.

### 3.3 Canterbury Land and Water Regional Plan

The Canterbury Land and Water Regional Plan aims to provide direction on how land and water are managed in the region. Specific objectives and policies aim to ensure that activities in beds of lakes and rivers preserve the indigenous biodiversity, habitats of indigenous fauna and flora and the natural character of the braided river systems (Objectives 3.19, 4.85A, 4.86).

It is noted that the provisions of the Land and Water Regional Plan, including the objectives and policies referred to above, only relate to the discharges and structures associated with the TekPS. The taking, diverting and damming of water is controlled through the provisions of the Waitaki Catchment Water Allocation Regional Plan.

The plan also acknowledges (Policy 4.51) the national benefits of existing hydro-electricity generation and their associated water takes, use, damming, diverting and discharge of water, which are to be considered as part of the existing environment. On considering an application for a replacement consent for an existing scheme, consideration will be given to the need for, and appropriateness of, improvements in the efficiency of water use and conveyance assessed over the life of the consent and reductions in any adverse effects on the environment.

### 3.4 Waitaki Catchment Water Allocation Regional Plan

There are a number of Objectives and Policies that relate to natural character and landscape matters in the Waitaki Catchment Water Allocation Regional Plan ("WAP"), notably:

Objective 1: To sustain the qualities of the environment of the Waitaki River and associated beds, banks, margins, tributaries, islands, lakes, wetlands and aquifers by:

- (a) recognising the importance of maintaining the integrity of the mauri in meeting the specific spiritual and cultural needs of the tāngata whenua, and by recognising the interconnected nature of the river
- (b) safeguarding the life supporting capacity of the river and its ecosystems
- (c) managing the water bodies in a way that maintains natural landscape and amenity characteristics and qualities that people appreciate and enjoy

Policy 2: By recognising that the following water bodies have a high natural character worthy of a high level of protection, because they are currently either in largely unmodified parts of the catchment; or contain rare or important species and habitat or habitat assemblages:

- (a) tributaries of Lakes Tekapo, Pūkaki and Ōhau;
- (b) mainstems and tributaries of Fork Stream, Irishman Creek and Mary Burn, upstream of the Braemar Road;

Policy 4: By considering the following matters when setting environmental flow and level regimes:

- ....(c) natural character, landscape and visual amenity

Policies 29, 32 and 33 to 35 refer to the water bodies listed in Policy 2, and consider that any consent to take, use, dam or divert water from the High Natural Character Water Bodies do not, create a more than minor effect on ....(d) natural character and landscape.

It is noted that Genesis does not take, dam or divert water from any identified High Natural Character Water Bodies; Lake Tekapo and the Tekapo River are not identified as being High Natural Character Water Bodies.

It is understood from Policy 4 that natural character, landscape and visual amenity were considered in the formulation of the environmental flow and level regimes (which are in Table 3B and Table 4 of the WAP). In that respect, it is understood that Genesis is seeking replacement consents that comply with the environmental flow and lake level requirements for the Tekapo River and Lake Tekapo. For the Tekapo River, there is no environmental flow regime from Lake Tekapo to the Fork Stream confluence with the Tekapo River (which is consistent with how the TekPS is operated). For Lake Tekapo, there are required minimum and maximum lake level requirements which align with the current consent limits, and the limits Genesis is proposing as part of the replacement consents.

As is the case in respect to the provisions of the RPS, there are a number of provisions in the Waitaki Catchment Water Allocation Regional Plan that provide for the continued operation of the TekPS. Notably, the damming, diverting and taking of water for the continued operation of the Scheme in its current form is a Controlled Activity under the provisions of the plan (recognising that the effects of the continued operation of the scheme are largely anticipated).

### 3.5 Mackenzie District Plan

Whilst the reconsenting of the TekPS will be considered under regional statutory documents, it is worth noting that as identified in the Canterbury Regional Policy Statement, within the District Plan (Mackenzie District Council), the entire Mackenzie Basin is also an Outstanding Natural Landscape at a District scale.

The Mackenzie landscape contains areas of exceptional legibility, aesthetic, transient, shared and recognised, very high natural science and high tangata whenua and historic landscape values. It is acknowledged that landscape qualities vary across an area of this size, which contains areas of human modification.

The Plan requires that the landscape values be protected and enhanced, however within the footprint of the TekPS the maintenance and development of structures and works is provided for (including Rural Objective 3B).

Rural Objective 3B – Activities in the Mackenzie Basin's outstanding natural landscape, seeks to protect and enhance the outstanding natural landscapes of the Mackenzie Basin subzone. This objective also seeks to maintain and develop structures and works for the Waitaki Power scheme, within the existing footprints of the infrastructure. Objective 3B states that when undertaking maintenance works within the Tekapo Pukaki canal corridors, Tekapo river, along existing transmission lines and the crown own land containing Lake Tekapo and Lake Pukaki, these activities are subject only (in respect of landscape values) to the provisions of chapter 15 (utilities) of the plan rather than being subject to the landscape provisions of chapter 3.

In the explanations and reasons for policy 3B6 (Lakeside Protection Areas), which provides for the upgrading maintenance and enhancement of the existing elements of the Waitaki Power Scheme, the plan states:

*... The presence of nationally significant electricity generation and transmission infrastructure within the Mackenzie Basin, and particularly within the outstanding natural landscape areas of Pukaki, Tekapo and Ohau must be acknowledged and the benefits derived from the supply of*

*electricity need to be taken into account when assessing landscape values, character and capacity*

### 3.6 Summary of Statutory Documents

In summary, the landscape around, and including, Lake Tekapo, the Canal system and Lake Pukaki are identified as an outstanding natural landscape within the Canterbury Regional Policy Statement. There is also reference to outstanding natural landscapes and protection of natural character values within the Canterbury Land and Water Regional Plan and the Canterbury Regional Policy Statement. Alongside the provisions that require the protection and enhancement of outstanding natural landscapes / natural character values, there are provisions in the various statutory documents that recognise the benefits of hydro-electricity generation and (in the case of the Mackenzie District Plan) recognise that the TekPS is located within an outstanding natural landscape and provides for its ongoing operation and maintenance.

It is not proposed to change or introduce any new structures into the TekPS as part of this reconsenting application. There will be no alterations to the existing infrastructure or changes to the permanent footprint and water intake levels. The existing operating ranges will be maintained. As a consequence, the proposed reconsenting under regional statutory documents would be consistent with those objectives and policies cited above.

## 4.0 Natural Character Assessment

Refer Appendix 1 for an outline of the natural character methodology.

### 4.1 Existing Natural Character

The natural character of many lakes, streams and rivers in the Mackenzie Basin has been modified to varying degrees by human activity, including vegetation modification, farming activity, and damming and diversion for hydro power schemes. The existing natural character of Lake Tekapo, Tekapo River and Lake Pukaki is described below.

#### 4.1.1 Lake Tekapo

Overall, the natural character of Lake Tekapo is considered to be **Moderate**.

The natural levels of Lake Tekapo have been modified by the dam at the outlet. The controlled water level regime contributes to the episodic nature of erosion where both high lake levels and wave energy are required to erode the base of backshore slopes, and to deposit beach sediments to the top and over barrier beach ridges. Low lake levels do not occur very often but can erode sediment from the nearshore shelf and take sediment offshore to deep water and out of the beach system.<sup>12</sup> Structures in the lake include the Tekapo A intake structure, outlet

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<sup>12</sup> Single, M (November 2022) Tekapo Power Scheme re-consenting: Lakeshore geomorphology and processes. Existing environment and future effects.

dam/control gates and SH8 road bridge and, pedestrian bridge near the outlet and boat ramp. Infrastructure, buildings and roads of Tekapo village also encroach into the margin of the lake.

The 8.8m operating range of the lake results in varying extents of the shoreline being exposed/inundated at varying times of the year. The changing lake levels restrict the establishment of vegetation in the lake margin (within the 8.8m level range). When the lake levels are low relatively large unweathered rocky shoreline margins can be exposed.

The aquatic ecology in the lake is generally unmodified with the exception of exotic fish species and some weeds.

Vegetation on the lake margins has been modified through grazing with the introduction of exotic species such as briar rose and willow.

The lake is a dominant natural feature of the basin with its turquoise colouring contrasting with the surrounding hills. Experientially the lake appears to retain high levels of naturalness (with the exception of Tekapo Village and the hydro structures at the southern end).

#### 4.1.2 Tekapo River

Overall, the natural character of the Tekapo River is **Low** between its source and Fork Stream, due principally to its predominantly dewatered state and **Moderate** for the remaining 39km to its mouth at Lake Benmore.

The upper reach of the Tekapo River between the Lake Tekapo control gates (Gate 16) and Lake George Scott is generally dry as almost all the water from Lake Tekapo is diverted through the Tekapo Canal. The reach of the Tekapo River between Lake George Scott and the confluence with Fork Stream appears to have some minor groundwater inflow. This appears to be either leakage from Lake George Scott plus some further minor groundwater inflow further downstream. Visual observations indicate that this results in some ponding and minor surface flow along this reach of the Tekapo River. Releases of water from the control structure are intermittent and these flows are unable to sustain natural river processes<sup>13</sup>.

The modified and minimal flow regime inevitably diminishes the extent and quality of freshwater habitat and water quality. Morphologically without the natural flows and seasonal floods the natural dynamics of the whole river system and movement of sediments is restricted.

For the first 4 km, flow can vary from as little as 0 cumecs to many hundreds of cumecs during periods of flood. Some minor groundwater inflow is recorded between Lake George Scott and Fork Stream (4-7km). During periods of high flows, the water flows through the river without ponding or creating islands. During periods of low flow, the wetted rocky surface area changes significantly and the differences in flow is more detectable on the banks. These changes in managed flow are considered to reduce the natural character of this part of the reach of the Tekapo River.

Below the confluence of Fork Stream, some 7 km south of the river's source with Lake Tekapo, data indicates that the median flow in the Tekapo River increases from approximately 2.5 m<sup>3</sup> /s at the confluence with Fork Stream to approximately 10 m<sup>3</sup> /s at the ECan recorder site downstream of the Mary Burn.<sup>14</sup> As a result, levels of natural character increase beyond Fork

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<sup>13</sup> A minimum flow was discussed as part of the Waitaki Catchment Water Allocation Regional Plan (WAP). In the decision by the board, the Board judged that the costs of requiring water to be released directly from Lake Tekapo into the upper Tekapo River to achieve a continuity of flow from the mountains to the sea outweighed the benefits. Accordingly, the WAP does not require a continuous minimum flow in the Tekapo River upstream of Forks stream.

<sup>14</sup> PDP Tekapo Power Scheme – Hydrological and Hydrogeological Analyses, 2023 page 19.

Stream, to a moderate degree, noting that the flow regime of the lower Tekapo River is still restricted.

#### 4.1.3 Canals

Overall, the natural character of the Tekapo Canals are **Very Low**, being entirely man-made for the purposes of the conveyance of water associated with the operation of the Tekapo Power Scheme.

Whilst a distinctive and recognisable element in the Tekapo landscape that provides a high level of amenity that is associated with fishing and angling, the 25.5km structures are completely man made and create an artificial watercourse.

#### 4.1.4 Lake Pukaki

Overall, the natural character of Lake Pukaki is **Moderate**.

Lake Pukaki is a modified natural lake, due to structures and lake level variability as its use for hydro-electricity storage. It is managed and operated by Meridian Energy. The artificial management of the lake levels for hydro storage mask the natural seasonal level fluctuations. Modifications to the lakebed and margin including the outlet from the Tekapo Canal (Tekapo B) and outflow from the Canal to Meridian's Ohau Power Station.

As with Lake Tekapo, Lake Pukaki is a dominant natural feature of the basin with its bright turquoise colouring contrasting with the surrounding hills. Experientially, the lake retains moderate natural character (with the exception around the hydro structures).

### 4.2 Natural Character Effects Assessment

Natural character comprises the natural elements, patterns and processes of waterbodies and their margins, and how they are perceived and experienced.

Lake Tekapo retains a variety of natural character, from moderate for the lakes to low and moderate-low for the connecting Tekapo River. The areas of highest natural character tend to be in areas furthest from modifications (which is not unexpected). In particular, the braided river deltas of the Tasman and Godley Rivers provide very high natural character at the heads of Lake Tekapo and Pukaki. The extent to which flows/levels are managed generally has a considerable impact on natural character of the shoreline of the lakes, reducing the natural character of the lake margins through this major modification of natural patterns and processes.

Lake level is one factor that is considered to contribute to peoples' experience of lake environments. When the Tekapo lake level is low greater areas of the gravel banks and lakeshore vegetation are visible, that are otherwise typically submerged. (Refer Lake level comparison **Photographs** in graphic supplement). Whilst fluctuations to the lake level would occur naturally, these would typically be more limited, as opposed to the regularity and range in water level experienced through the TekPS. Therefore, low lake levels in Lake Tekapo are typical indicators of the operating ranges which has led to a reduction in natural character. This also affects people's experiential values, as summarised by the Recreation Assessment<sup>15</sup>: *'Lake levels affect the scenic value of Lake Tekapo. For example, for aerial flights, a drop of two to*

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<sup>15</sup> Rob Greenaway & Associates; 2023 Genesis Energy Tekapo Hydro Scheme Reconsenting: Recreation Review, paragraph 5.1.5.



*three metres in the water level means the Lake looks drastically smaller. The operator of Paddle Tekapo considers that fewer people come to his business when the Lake is low, as paddling does not look as attractive’.*

The degree and modification of the flow regime within a river channel is one factor that is considered to contribute to peoples experience of the naturalness of river environments, as well as how this affects other aspects of natural character including its abiotic and biotic attributes. As the Tekapo River often has no / minor groundwater levels of flow for the first 7 km, due to upstream water diversion, this highly modified natural flow regime has resulted in a visible reduction in natural character of the Tekapo River along this stretch of the river. Beyond the Fork Stream confluence to its mouth at Lake Benmore, the Tekapo River maintains a small, but permanent flow<sup>16</sup>, lifting the levels of natural character to a moderate degree, recognising that the TekPS still has an effect on the flow for the whole river.

The natural character of the Tekapo River will remain at its existing level with the key modifications relating to the relative absence of flows at times for the first 7 km and a lower flow for the remaining parts of the river. While this represents a major modification compared to the natural flow regime, there will be no additional adverse effects compared to the highly modified current flow regime.

It is not proposed to change or introduce any new elements into the TekPS as part of this consenting application. There will be no alterations through this process to the existing infrastructure or changes to the permanent footprint and water intake levels. The existing operating ranges will be maintained and therefore the current level of modification to lake shore processes will not be further modified.

Based on this, the proposal will have no adverse natural character effects in comparison to the status quo. A consistent minimum flow would enhance natural character (and landscape and amenity values) of the Tekapo River, most notably in its upper reaches between the Lake Tekapo control gates and Fork Stream. However, such flows have been assessed during the development of planning documents and not required and any such permanent minimum flow would need to be balanced against other factors, in particular the renewable electricity generation potential lost as a result of such a minimum flow.

## 5.0 Landscape Assessment

Landscape character is derived from the distinct and recognisable pattern of elements that occur consistently in a landscape. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement. Landscape effects therefore result from changes in the physical components within an area, which in turn can alter the overall character and potentially the wider landscape. Such effects are typically the result of landform or vegetation modification or the introduction of new structures, facilities or activities necessary to facilitate a

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<sup>16</sup> For approximately 70% of the time there is no or very little flow in the upper reaches of the Tekapo River between the control gate (Gate 16) and Lake George Scott. Lake George Scott Weir has no flow over the weir to the Tekapo River for approximately 90% of the time. The median flow in the Tekapo River increases from approximately 2.5 m<sup>3</sup>/s at the confluence with Fork Stream to approximately 10 m<sup>3</sup>/s at the ECan Tekapo River recorder site downstream of the Mary Burn. This is predominantly due to flow contributions from tributaries such as the Grays River and Mary Burn (source: PDP Tekapo Power Scheme – Hydrological and Hydrogeological Analyses, 2023 executive summary).

project. As already mentioned no such changes are proposed through this reconsenting process.

## 5.1 Existing Landscape Character and Values

The characteristics and values of the wider Mackenzie Basin area are outlined in Objective 3B(1) of the Mackenzie District Plan (MDP) and include; the openness and vastness of the landscape; tussock grasslands; the lack of houses and structures; residential development limited to small areas in clusters; the form of the mountains, hills and moraines encircling and/or located in the Mackenzie Basin and undeveloped lakesides and State Highway 8 roadside.

These characteristics have been influenced over hundreds of years of human modification. Lake Tekapo, Lake Pukaki and the Tekapo Canal, whilst being a man-made feature, are prominent and act as defining, legible and memorable features of the Mackenzie landscape. The natural dynamics of the Tekapo River system are modified by an artificial flow regime, throughout the river's entire length, and noticeably within the first 7km, where no minimum flow is established. However, whilst modified, the lakes and canal system provide moderate aesthetic values, as does the river when flows are available. The canals are also popular for sports such as fishing (salmon and trout), with kayaking occurring in the upper Tekapo River and slalom course at appropriate flows. Furthermore, the lake margins prove popular for recreational activities, with walking and biking tracks along some of the banks.

The hydro schemes were developed with integral landscape design input at the engineering design stage, and significant landform and grassland reinstatement in the construction phase, that have resulted in a high degree of landscape integration now seen. The hydro schemes themselves hold historical association for the local area.

## 5.2 Landscape Effects Assessment

The TekPS and canals are an existing part of the landscape character of Lake Tekapo<sup>17</sup>. Furthermore, the MDP specifically provides for hydro-electricity generation by scheduling, as a permitted activity, works associated with the maintenance, operation, upgrading and refurbishment of the existing electricity generation facilities within the Rural Zone. While the consents being sought relate to the taking, diverting, damming and discharges associated with the TekPS, it is noted that Genesis is not proposing to further modify the landscape (i.e. via changing the operational parameters associated with the Scheme) or introduce any new structures into the landscape as part of this consent application. The scheme will therefore not cause additional effects on the biophysical, perceptual or associative landscape attributes of the associated waterbodies and landscape context. The natural elements, patterns and processes of the river and lakes will not be further modified, other than what the current operation of the power scheme permits.

Based on this, there will be no additional landscape effects of the scheme compared to the status quo.

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<sup>17</sup> Decision No. [2011] NZEnvC387 High Country Rosehips et al v Mackenzie District Council (Plan Change 13), para 99

## 6.0 Visual Amenity Assessment

Amenity values are 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<sup>18</sup>.*

Visual amenity describes the pleasantness and aesthetic coherence of a place and comprises the visual and aesthetic aspects of amenity. The experiential and perceptual components of the landscape and natural character assessment contribute to the overall amenity values of an area.

Matters to be considered in relation to visual amenity are:

- **In river** - flow level, wetted surface / dry channel, substrate / rock material, water clarity, water colour, water movement, light reflection.
- **River / lake margins** - vegetation, levels of human modification, (e.g. structures, buildings), seasonal colour, nature of exposed river / lake margin (e.g. substrate of margin, algal proliferations), sounds and smells associated with the waterbodies.
- **Visibility and viewing audience** - the nature and size of the viewing audience, with some reaches / areas more accessible and visible than others; their sensitivity e.g. recreational / residential audiences have a greater level of sensitivity than passing traffic or workers.

The aspects of the current operation of the TekPS that change the natural processes and have the potential to affect the visual amenity are:

- Noticeable drop in river / lake water level and / or a change in the regular pattern of level fluctuations;
- Any changes to the clarity of the water in the lake or river resulting from operation of the scheme (which may include sedimentation, periphyton or an increase in the extent of a muddy shoreline); and
- Changes to the character of the lake and riverbanks through flooding, erosion or debris.

The Mackenzie Basin as a whole displays very high levels of visual amenity, recreational and perceptual values. This is reflected in the area's predominantly broad natural appearance, expansive views and relative low levels of apparent modification, where modifications (including the hydro scheme and farming practices) contrast with the predominance of natural elements.

Due to the special landscape values, the area is very popular for a wide variety of tourist and recreational activities<sup>19</sup> including touring (by vehicle or bicycle), walking, fishing, hunting, mountain climbing, skiing and aerial activities (including scenic flights and gliding). Kayaking on the Tekapo River is a popular recreational activity. The Tekapo Whitewater Trust constructed a recreational canoe course in 1998 located near Lake George Scott that utilises water released from Lake Tekapo and is taken into the course by diversion from the Tekapo River. The course was constructed with funding from ECNZ. Kayakers also use water released from the Lake

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<sup>18</sup> Resource Management Act Section 7c

<sup>19</sup> Refer to the Rob Greenaway & Associates; 2023 Genesis Energy Tekapo Hydro Scheme Reconsenting: Recreation Review, for further recreational activities.

Tekapo Control Structure (Gate 16) to kayak on the upper Tekapo River between Gate 16 and Lake George Scott.

The Upper Tekapo River is largely dry and has been since the commissioning of the scheme in 1951. Occasional flows do pass through this reach, but they are only of a limited duration. Beyond Fork Stream, permanent flow within the Tekapo River considerably improves the natural amenity values, where open views of the wider river corridor are appreciated.

The wider area is also frequently used as a backdrop for television commercials, documentaries and most recently the motion picture 'Lord of the Rings' trilogy. Art and literature have also been inspired by the high-country environment, where artists have captured the transient qualities of the landscape in numerous rural paintings.

The MDP identifies a series of Scenic Viewing Areas, Lakeside Protection Areas and Scenic Grassland Areas which essentially identify significant areas where views of the surrounding landscape are obtained from major roads and along the lake shores. The majority are identified on **Figure 5** and contained in the Graphic Supplement.

The key landscape and visual amenity values associated with the area include:

- Views of Lake Tekapo, Mount John, the mountains and the glacial lakes.
- The Alps to Ocean walking and cycling track follows alongside the Tekapo Canal and Lake Pukaki, and forms part of the Te Araroa Trail, enabling good views to the river and lakes for recreationalists that can be enjoyed away from busy public roads and viewpoints.
- The relatively open, settled, rural landscape means that views incorporating Lake Tekapo and surroundings are pleasantly scenic; the expansive views provide an experience of openness with an attractive mountain backdrop; and
- Rich transient values associated with the seasons and changes of the lake levels and river flow. The impressive weather and cloud patterns of the Mackenzie sky are renowned together with the distinctive night sky.

## 6.1 Visual Amenity Effects Assessment

This proposal will not change the existing views, landscape amenity values, water clarity or general vistas associated with the area. Based on this, there will be no additional visual effects of the scheme compared to the status quo.

## 6.2 Statutory Effects

There are no additional adverse effects to the existing Natural Character Landscape and Visual Amenity values. The scheme forms part of the existing environment and results in a no change scenario. It is considered that the proposal meets the matters as set out within section 6(a), 6(b), 7(c) and 7 (f) of the RMA and meets the requirements of the Canterbury Regional Policy Statement.

## 7.0 Recommendations for Mitigation Measures

The proposal is essentially retaining the status quo of the TekPS. Therefore, the level of adverse landscape, natural character and visual amenity effects would be comparable to the existing environment, since nothing is changing. The values that contribute to the Mackenzie Basin Outstanding Natural Landscape, includes the TekPS in place. Therefore, the natural character, landscape and amenity characteristics will be maintained.

It is recognised that the upper reaches of the Tekapo River are generally dry with some minor groundwater flow between Lake George Scott and Fork Stream and therefore does not retain a minimum flow and is often in a dewatered state<sup>20</sup>. As a result, the level of natural character in this stretch is currently assessed as low.

The natural character (and landscape and amenity values) of the Tekapo River (as a whole river, but notably for the first 7km) would be enhanced with the addition of a consistent minimum flow. A median flow of 2.5m<sup>3</sup> is currently recorded below Fork Stream, and it is considered that a similar flow for the first 7km of the river would assist in enhancing natural character to levels around 'moderate' natural character. However, such flows have been assessed during the development of planning documents and not required and any such permanent minimum flow would need to be balanced against other factors, in particular the renewable electricity generation potential lost as a result of such a minimum flow.

A consistent minimum flow, coupled with other initiatives, such as weed and pest control in the river may (noting also that Environment Canterbury actively manages the river) enable the natural elements, patterns and processes to be evident, to some degree, enhancing the natural character and amenity values of the river.

## 8.0 Conclusion

Genesis Energy are seeking the necessary core consents from Environment Canterbury for the continued operation and management of the TekPS which expire on 30 April 2025. Genesis Energy does not propose any changes to the current scheme.

In terms of RMA section 6 matters of national importance the majority of the TekPS is located within, and forms part of, a basin-wide Outstanding Natural Landscape. There are general provisions recognising the national significance of the Waitaki Power Scheme. Of particular relevance to the re-consenting of the TekPS are the provisions in the CRPS and Mackenzie District plan recognising the Mackenzie Basin as an Outstanding Natural Landscape.

The Mackenzie landscape contains areas of exceptional legibility, aesthetic, transient, shared and recognised, very high natural science, tangata whenua and historic landscape values. It is acknowledged that landscape qualities vary across an area of this size, which contains areas of significant human modification. The plan requires that the landscape values be protected and enhanced, however within the footprint of the TekPS the maintenance and development of

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<sup>20</sup> Flow can vary from as little as 0 cumecs to many hundreds of cumecs during periods of flood

structures and works is provided for, especially an allocation limit of 0m<sup>3</sup>/s below Lake George Scott<sup>21</sup>.

In terms of the effects of the Scheme on the natural character, landscape and visual amenity values, the continued operation and maintenance of the Scheme will not modify the landscape and the consent application does not contemplate any new structures being introduced into the landscape. Furthermore, Genesis is not proposing to change the nature of the water taken, dammed or diverted or any changes to the operating range of Lake Tekapo. The overall effects of the continued operation of the TekPS would therefore not lead to any additional adverse effects compared to the status quo, and the existing natural character, landscape and amenity values will be maintained.

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<sup>21</sup> Table 3B of the Waitaki Catchment Water Allocation Regional Plan

# Appendix 1: Natural Character Methodology

## Definition and Approach

This assessment of natural character applies to the natural waterbodies and their margins affected by the TekPS. While the RMA does not provide a definition of natural character at a Department of Conservation (DOC) workshop<sup>22</sup> a definition was agreed by participants and has now also been adopted into a NZCPS guidance note<sup>23</sup>.

Natural character comprises the natural elements, patterns and processes of waterbodies and their margins, and how they are perceived and experienced:

*The degree or level of natural character within an environment depends on:*

- 1. The extent to which the natural elements, patterns and processes occur*
- 2. The nature and extent of modification to the ecosystems and landscape / seascape.*

*The degree of natural character is highest where there is least modification*

*The effect of different types of modification upon natural character varies with context and may be perceived differently by different parts of the community.*

Within the Te Tangi a te Manu Aotearoa New Zealand Assessment Guidelines, natural character is interpreted as a type of character—the distinct combination of an area’s natural characteristics and qualities<sup>24</sup>, and that naturalness is one attribute of that natural character:

*Natural character is an area’s distinctive combination of natural characteristics and qualities, including degree of naturalness.*

This assessment interprets natural character as being the degree of naturalness of waterbodies and their margins consistent with the above definitions. When considering braided rivers, the above definitions are also consistent with the Environment Canterbury report<sup>25</sup>.

The process to assess natural character involves an understanding of the many systems and attributes that contribute to a waterbody including biophysical and experiential factors. This assessment draws on field observation and technical information.

Given there are no proposed changes to the TekPS or the waterbodies, as part of the consenting process, this assessment describes and assesses the existing level of natural character of the waterbodies, effectively the same effects for the ongoing operation of the scheme. The attributes and qualities used to describe and assess the level of natural character of the waterbodies are outlined below.

**RMA definition:** river means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse

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<sup>22</sup> Department of Conservation (2011) Natural Character and the NZCPS: National Workshop – Summary and Discussion Outcomes

<sup>23</sup> NZCPS 2010 Guidance note Policy 13: Preservation of natural character

<sup>24</sup> Natural character is an attribute of places and features—it does not exist of itself.

<sup>25</sup> Natural Character Assessment Guidelines for Braided Rivers, Report No. R18/35, Environment Canterbury, July 2018, Chapter 2.



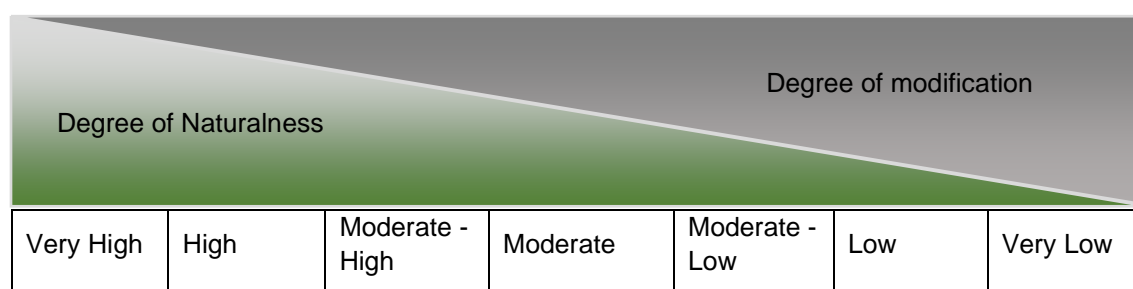
(including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal).

**Table 1: Natural Character Attributes**

<i>Biophysical (Active bed and margins)</i>
<p><b>Active Bed (or braidplain)</b></p> <ul style="list-style-type: none"> <li>• <i>Flow Regime and Lake Levels – how natural / modified are the flows or lake level changes (dams, diversions, altered flow pattern / lake levels).</i></li> <li>• <i>River or lake morphology- active bed shape, including sedimentation, structures and human modifications.</i></li> <li>• <i>Aquatic ecology - Indigenous taxa assemblages, ecosystem functioning, Presence / absence of exotic aquatic flora and fauna, including presence of pest species. Periphyton and Macro invertebrates provide indication of water quality.</i></li> <li>• <i>Water quality (if available).</i></li> </ul>
<p><b>Margins</b></p> <ul style="list-style-type: none"> <li>• <i>Morphology- river bank or lake shore shape, including sedimentation, structures and human modifications.</i></li> <li>• <i>Riparian vegetation and habitat – indigenous vegetation and fauna (birds, lizards), as well as presence of pest species.</i></li> </ul>
<i>Experiential</i>
<ul style="list-style-type: none"> <li>• <i>Human perception of naturalness of waterbody. The expression of the biophysical attributes.</i> <ul style="list-style-type: none"> <li>○ <i>How natural does the area appear (dominance of human activity).</i></li> <li>○ <i>The remote / untamed experience.</i></li> <li>○ <i>Experiential attributes such as sound of water, smells, feel and transient values.</i></li> </ul> </li> </ul>

### Defining the level of natural character

The level of natural character is assessed in relation to a seven-point scale<sup>26</sup>. The diagram below illustrates the relationship between the degree of naturalness and degree of modification. A high level of natural character means the waterbody is less modified and vice versa



<sup>26</sup> It is noted that the Environment Canterbury Natural Character Assessment Guidelines for braided rivers utilises a 5-point scale, however best practice (under Te Tangi a te Manu) is now to use a 7-point scale.

## Appendix 2: Landscape Character Areas

The landscape associated with the project covers four different Landscape Character Areas, as identified within the Densem November 2007 report. A description of the Landscape Character Areas is contained below and illustrated on **Figure 3** in the Graphic Supplement. It is acknowledged that the waters of the TekPS empty into Lake Pukaki, and the Pukaki Landscape Character Area has been included only for contextual purposes.

### **Tekapo Landscape Character Area<sup>27</sup>**

This area comprises the watershed of Lake Tekapo, from its headwaters in the north to the moraines behind Tekapo village in the south, and from the Two Thumb Range summit in the east to the Gammack Range in the West. It also extends to the Fork Stream area near Balmoral Military Camp and the Balmoral Station. Lake Tekapo forms a central and important part of this Landscape Character Area, and acts as a major tourist attraction with its turquoise waters and mountainous setting.

This area contains Lilybank, Mount Gerald, Richmond, Mount Hay, Mount John, Balmoral, Glenmore and Godley Peak stations. Land has recently been freeholded at Richmond, but Glenmore also contains considerable lakeside freehold areas that have existed in an undeveloped state for more than 100 years.

The outwash and moraine surfaces at the foot of the Two Thumb Range, (along the eastern side of Lake Tekapo), at the lake outlet (surrounds of Tekapo village), and south of the Hall and Gammack Ranges (west of Tekapo), are in my opinion generally very vulnerable to change. This is because they comprise sloping, widely visible, continuous land facets which also are in a very unchanged, open, continuous natural state, unbroken by overt development. These surfaces are part of the lake setting.

However incised creeks cross the surfaces east and west of the lake, creating small bands across the slopes which are sunken from sight, and less vulnerable to change. This refers to creeks south of Mount Gerald homestead on the east side of the lake and between Godley Peak, Glenmore and Balmoral homesteads west of the lake.

From Godley Peak to Glenmore homesteads is an area of developed river fan with low vulnerability for change away from the shoreline, that is, inland from the public road. The 'low vulnerability' area has been drawn to exclude several Sites of Natural Significance on this fan.

Shoreline indentations and broken topography around and north of Mount Hay homestead are shown as 'medium vulnerability', with some ability to absorb change. However, the eastern and western shorelines of Lake Tekapo generally are highly vulnerable to change.

Sites of Natural Significance occur in the Round Hill area east of the lake, west of Mount John, and in the Sunday Tarn – Irishman Creek headwaters areas west of the lake.

### **East Basin Landscape Character Area<sup>28</sup>**

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<sup>27</sup> 2007, Densem, p25, paragraphs 3.26-3.31 and 3.34. The MacKenzie Basin Landscape: Character and Capacities, prepared for Mackenzie District Council

<sup>28</sup> 2007, Densem, p25, paragraphs 3.46-3.52. The MacKenzie Basin Landscape: Character and Capacities, prepared for Mackenzie District Council

This area comprises the open land between Tekapo Village in the north and the Grays Hills upland in the south, and from Burke, Mackenzie and Hakataramea Passes and the Rollesby and Dalgety Ranges in the east to the Tekapo River in the west.

This area contains the Sawdon, Holbrook, Glenrock and The Grampians homesteads, and also parts of Rollesby, Mt Dalgety and Grays Hills stations, but not the homesteads (the Rollesby and Mt Dalgety homesteads are outside the Basin).

The bulk of this landscape area comprises an extensive open semi-arid outwash basin which generally is very sensitive to change due to its continuous, flat or steeply uplifted, undeveloped topography with little variation or surface incisions.

The bulk of the area is uniformly open over very wide expanses of 20 – 25 kilometres, giving a vast, magnificent grandeur as foreground to the Main Divide mountains to the west. The fans east of the Haldon Road and raised bulk of the Rollesby/Dalgety Ranges are widely visible over long distances, being elevated to view. The continuous grassland surface, largely devoid of trees, is a component of the areas high vulnerability, because changes are widely visible.

The visibility of this landscape area from State Highway 8 as it enters the high country, is an added factor of its vulnerability. Because of its impact as the first high country seen by travellers on the tourist route to the mountains and southern lakes, and also the first views of the Main Divide mountains, including Aoraki/Mount Cook, this is an iconic area of landscape.

Small areas of low landscape vulnerability occur around the edges of this basin, where the ranges and hills intersect with the basin floor. Here, the indentations of small valleys, spurs and creeks offer opportunities for change that do not affect the wider plains. Developments around the edges of the basin surface would have less widespread effects than those in the centre.

#### **Central Basin Landscape Character Area<sup>29</sup>**

This area comprises the basin between Tekapo in the north and Simons Hill in the south, and between the Mary Range skyline in the west and the Tekapo River in the east. It contains the homesteads of Irishman Creek, The Wolds, Maryburn and Simons Hill stations, as well as portions of Balmoral and Simons Pass land.

As State Highway 8 traverses this area, the visibility of the land from the highway forms an important component in vulnerability ratings. Although in many respects similar to the Eastern Basin, this area is more topographically varied, therefore having less-vulnerable portions. However only small areas are rated as of low vulnerability, where removed from outlook of State Highway 8. The Mary Range, while lower than the hills of the Eastern Basin, nevertheless are mostly of high vulnerability because of their proximity to State Highway 8.

An extensive Site of Natural Significance occurs east of SH 8 on what is believed to be Maryburn land. Another, also mentioned in relation to the Eastern Basin, covers the entire Tekapo River within this landscape area. Scenic Viewing Areas flank most of State Highway 8 from the Tekapo Canal to near the Simons Hill homestead

#### **Pukaki Landscape Character Area**

Lake Pukaki is a natural lake created by receding glaciers. It is the presence of the glacial 'flour' that gives it the blue colour so characteristic of the Mackenzie Basin lakes. The lake forms part of the Upper Waitaki hydroelectric scheme and is managed by Meridian Energy.

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<sup>29</sup> 2007, Densem, p23, paragraphs 3.53-3.56. The MacKenzie Basin Landscape: Character and Capacities, prepared for Mackenzie District Council

The Lake, like Lake Tekapo, is also a major tourist attraction, where, on a clear day, unsurpassed and iconic views of Australasia's highest mountain, Aoraki/Mount Cook, can be obtained. The mountainous backdrop 'encapsulates one part of the beautiful New Zealand image that brings tourists to this country'.<sup>30</sup>

SH8 (the Tekapo -Twizel Road) passes between the southern edge of Lake Pukaki and the Pukaki canal. The turn-off to Aoraki/Mt Cook is approximately 1km west of the canal intake. A large car park, visitor centre and viewing area has been created on the lake margins approximately 400m east of the intake.

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<sup>30</sup> 2007, Densem, p25, paragraph 3.68. The MacKenzie Basin Landscape: Character and Capacities, prepared for Mackenzie District Council.

## Appendix 3: Construction Images of TeKPS

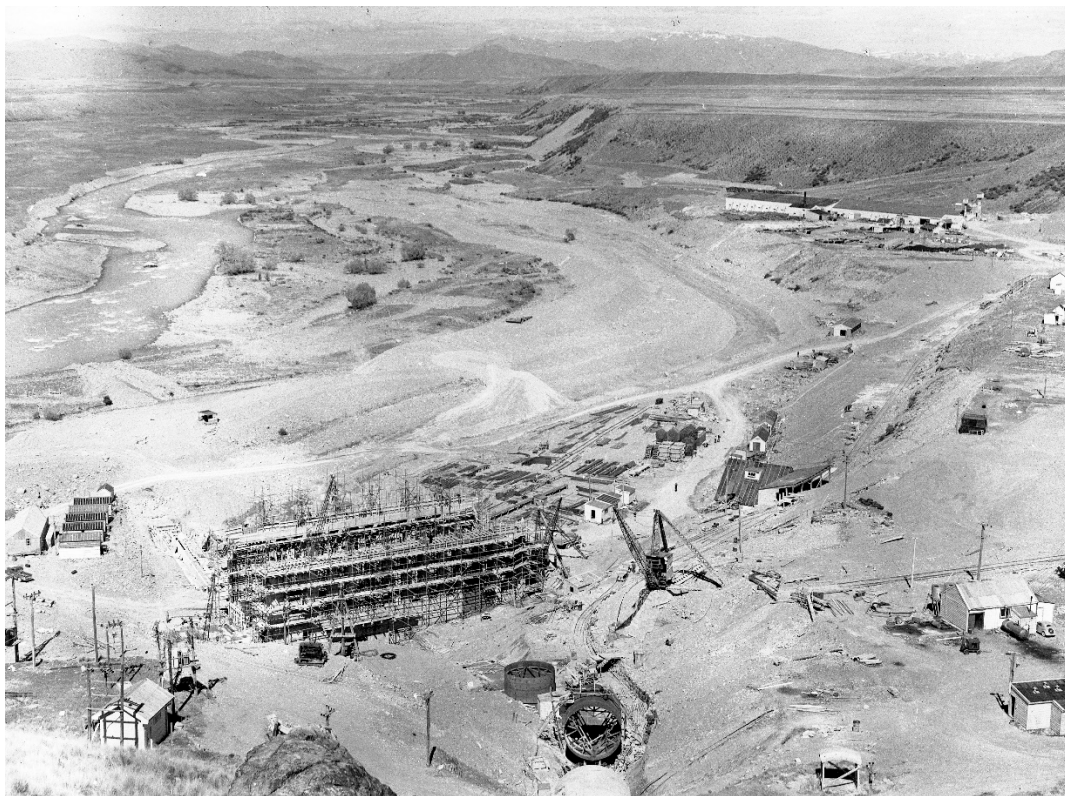


Image Above: Tekapo A Power Station Construction, 1949. *Below:* Intake Structure, 1951.

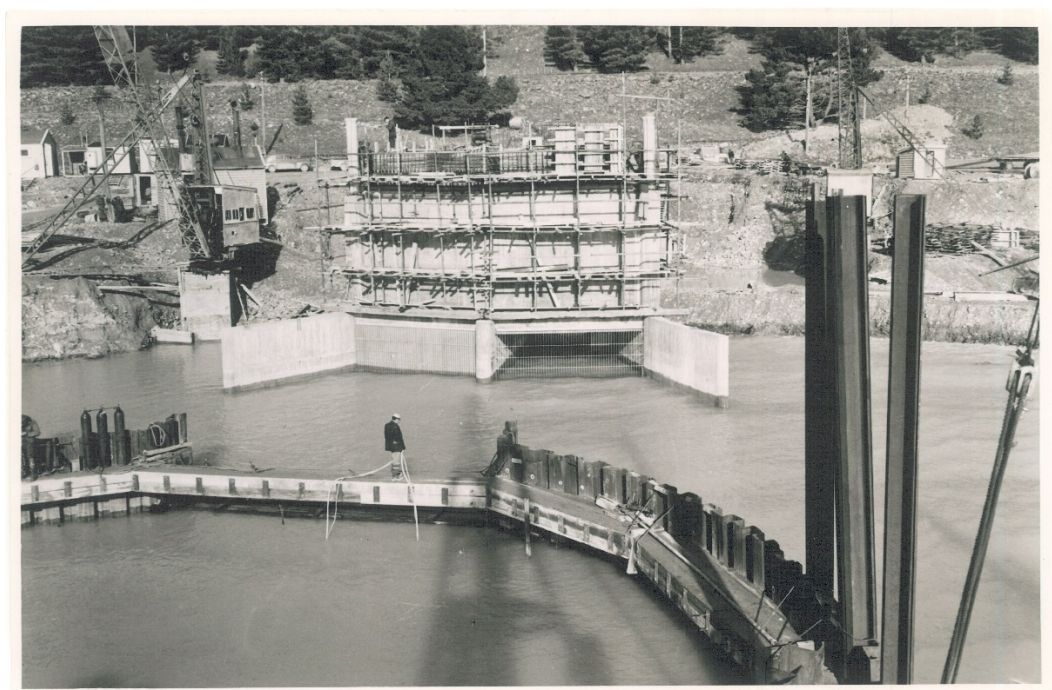






Image Above: Intake structure nearing completion 1952



Image Above: Tekapo B Power Station Construction 1977.

### About Boffa Miskell

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# Lake Tekapo Hydro Reconsenting

LANDSCAPE AND VISUAL AMENITY GRAPHIC SUPPLEMENT

9 February 2023





Document Quality Assurance

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Cover photograph: Lake Tekapo shore looking north, © BML, 2020

Contents photograph: Tekapo Canal, © BML, 2020





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Eagle Technology, LINZ



Data Sources:  
LINZ Data Service

Projection: NZGD 2000 New Zealand Transverse Mercator



LEGEND

⇒ Tekapo Canal

LAKE TEKAPO HYDRO RECONSENTING

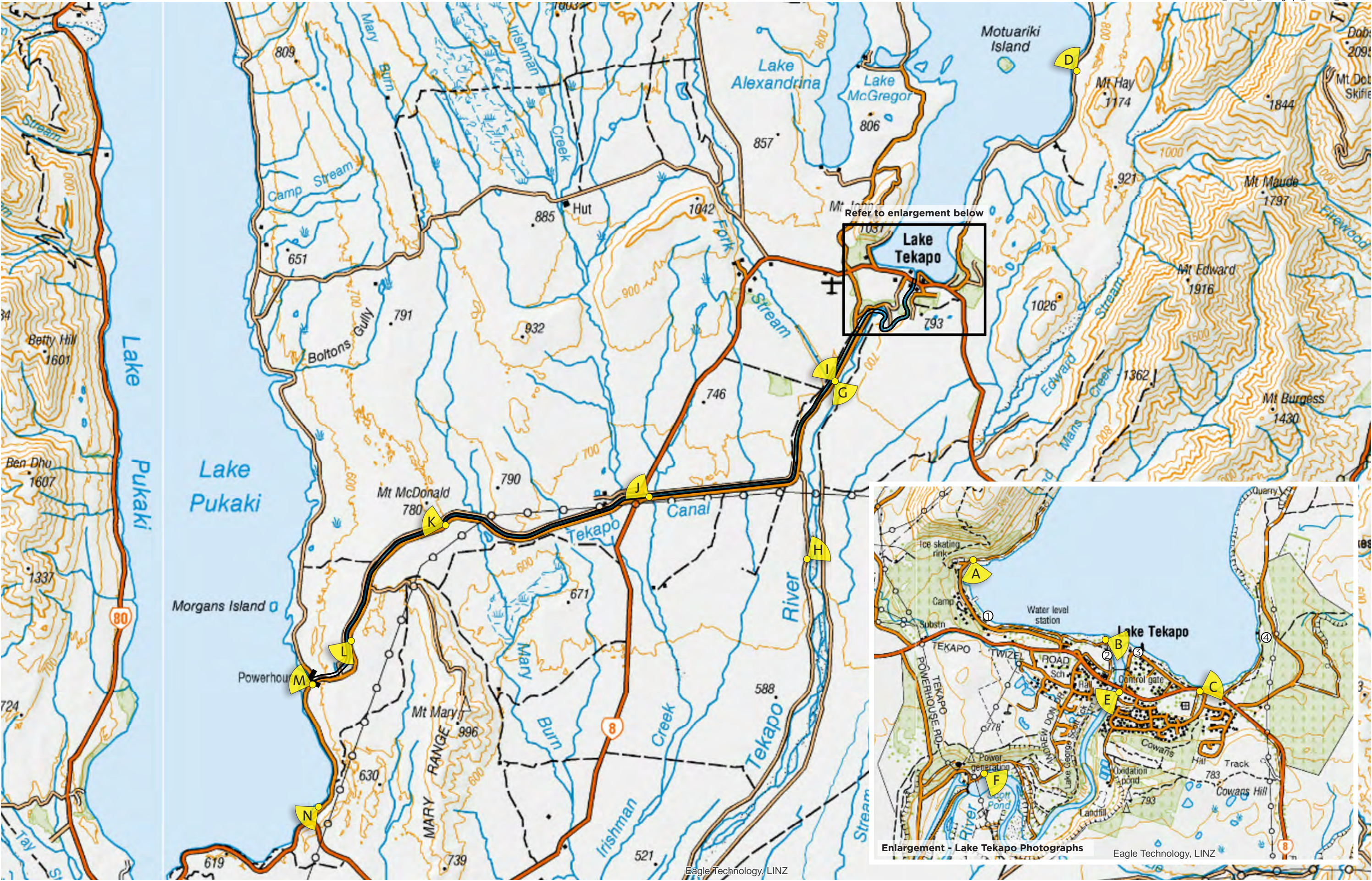
Figure 1: Site Location Plan

Date: 03 December 2020 | Revision: 0

Plan prepared for Genesis Energy by Boffa Miskell Limited

Project Manager: james.bentley@boffamiskell.co.nz | Drawn: HWI | Checked: JBe





Data Sources:  
LINZ Data Service

Projection: NZGD 2000 New Zealand Transverse Mercator

0 4 km

1:120,000 @ A3

LEGEND

- Tekapo Canal
- A Panorama Photograph Locations (A-N)
- ① Lake Level Comparison Photograph Locations (see insert)

LAKE TEKAPO HYDRO RECONSENTING

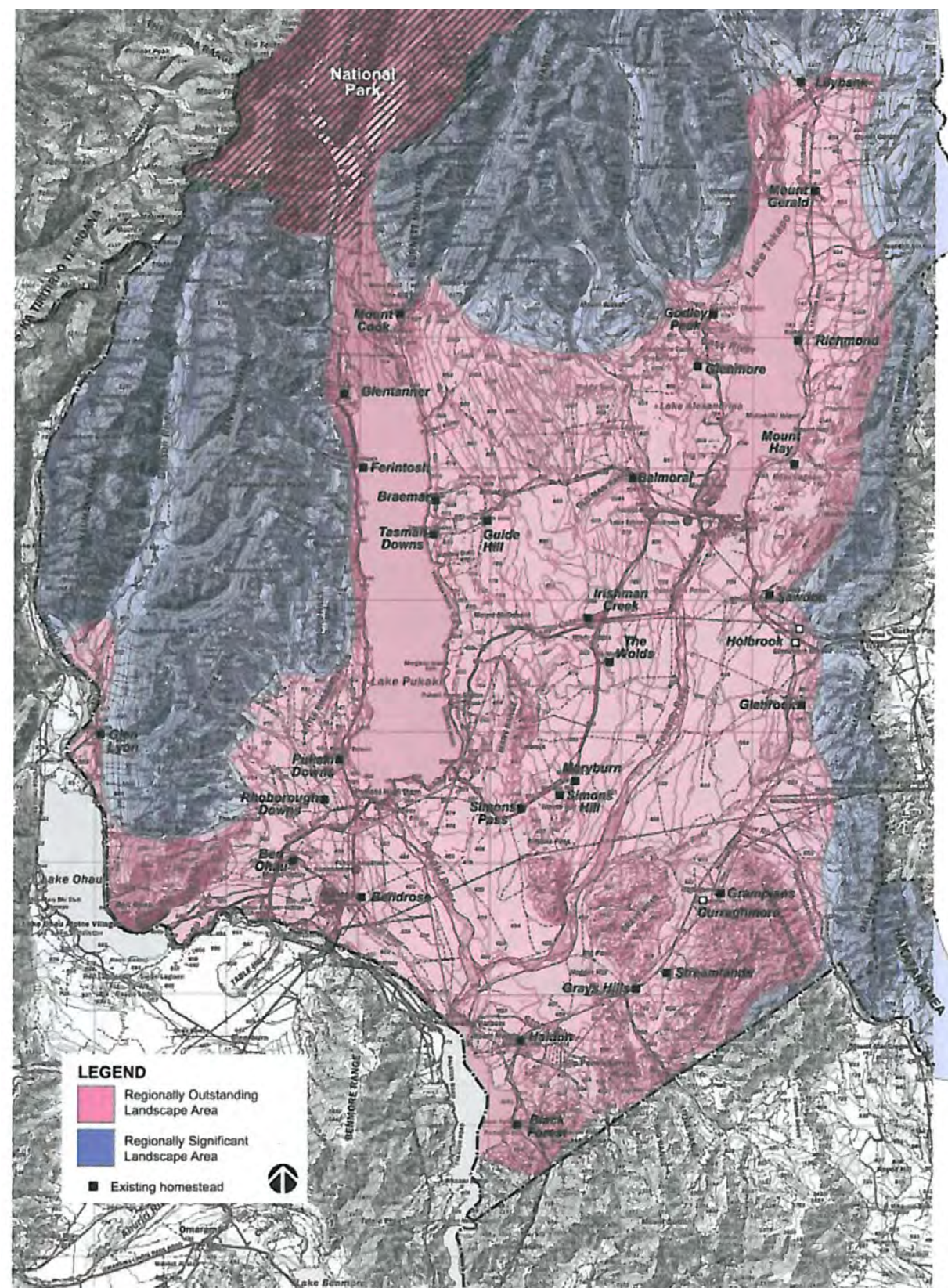
Figure 2: Photograph Location Plan

Date: 03 December 2020 | Revision: 0

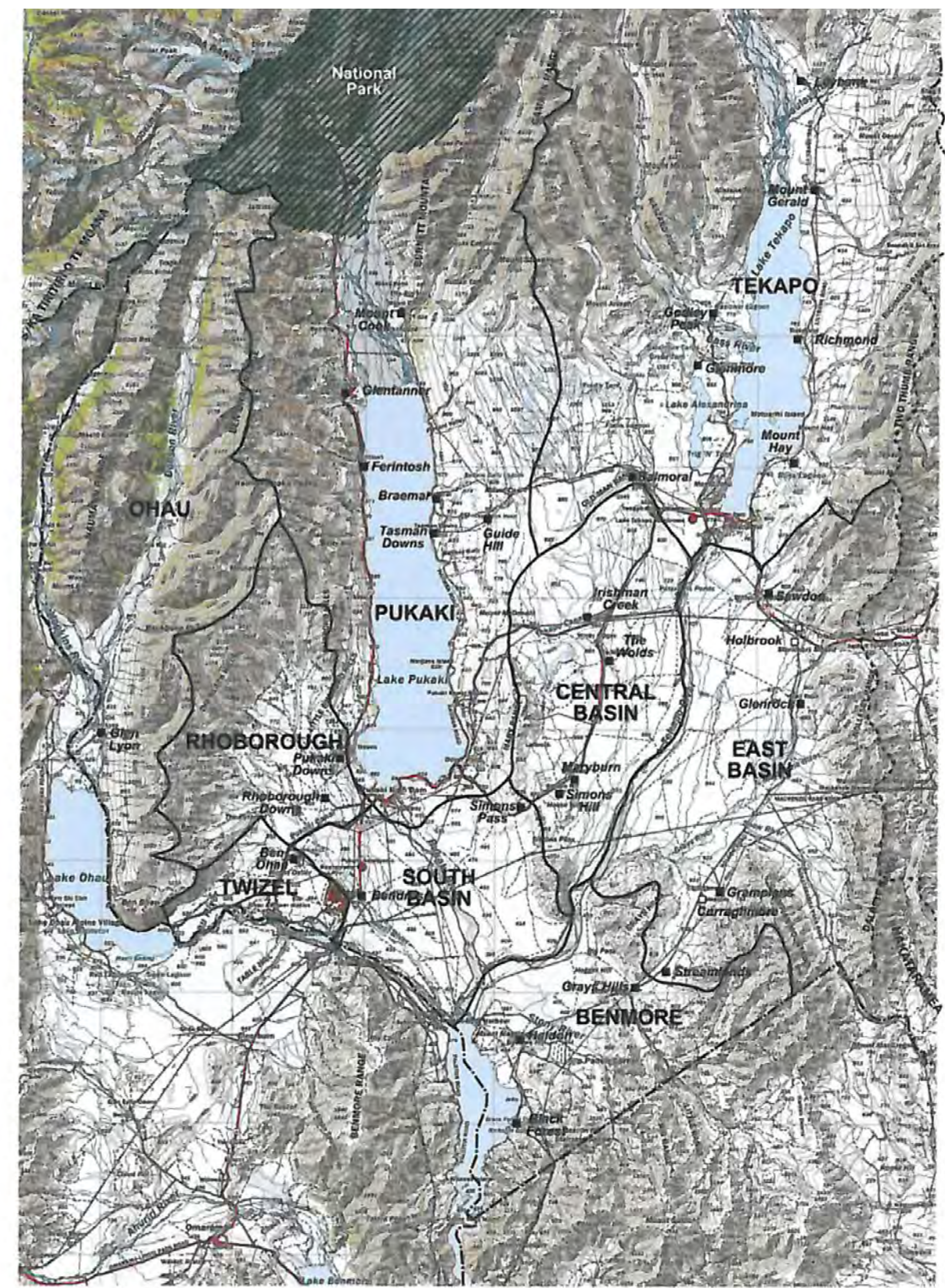
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Page 2



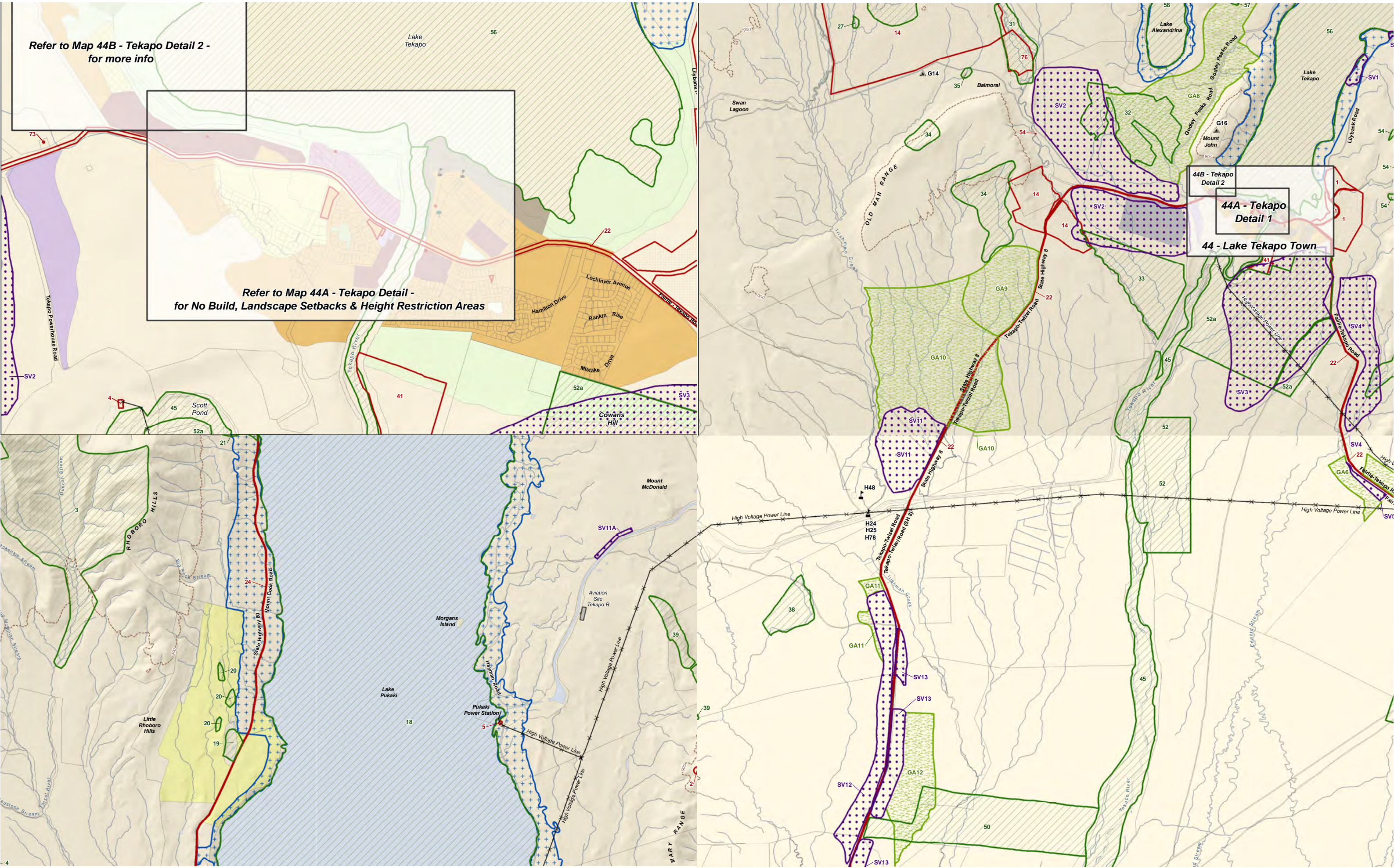


Mackenzie Basin Landscape Map 6  
**REGIONALLY OUTSTANDING & SIGNIFICANT LANDSCAPES**  
(source Environment Canterbury 1993) December 2007



Mackenzie Basin Landscape Map 4  
**LANDSCAPE CHARACTER AREAS**  
December 2007









1: South-western bay of Lake Tekapo: 18th January 2013, Lake Level 710.00 masl



1: South-western bay of Lake Tekapo: 24th November 2020 Lake Level 708.00 masl



1: South-western bay of Lake Tekapo: 09th September 2021. Lake Level 705.60 masl.





2: True left of the Tekapo River source: 18th January 2013, Lake Level 710.00 masl



2: True left of the Tekapo River source: 24th November 2020 lake level 708.00 masl



2: True left of the Tekapo River source: 09th September 2021. Lake Level 705.60 masl.





3: Boat Ramp off Lake near township: 18th January 2013, Lake Level 710.00 masl



3: Boat Ramp off Lake near township: 24th November 2020, Lake Level 708.00 masl



3: Boat Ramp off Lake near township: 09th September 2021. Lake Level 705.60 masl.





4: North of Pines Beach: 18th January 2013 Lake Level 710.00 masl



4: North of Pines Beach: 24th November 2020, Lake Level 708.00 masl



4: North of Pines Beach: 09th September 2021. Lake Level 705.60 masl.





LAKE TEKAPO - Site Photograph A: View looking south towards Tekapo township from the south-western shoreline of the lake. Lake level 708.00 masl.

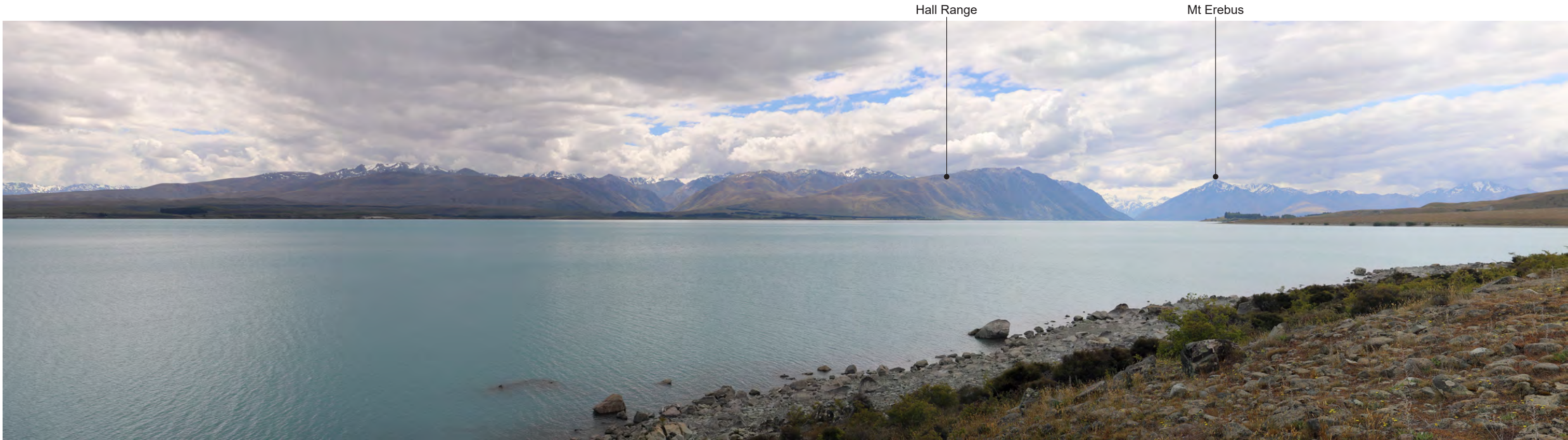


LAKE TEKAPO - Site Photograph B: View looking east towards the source of the Tekapo River. Lake level 708.00 masl.





**LAKE TEKAPO** - Site Photograph C: View looking north-east across the Tekapo Reserve from State Highway 8. Lake level 708.00 masl.



**LAKE TEKAPO** - Site Photograph D: View looking north-west towards the mouth of the Godley River. Lake level 708.00 masl.





**TEKAPO RIVER** - Site Photograph E: View from the Tekapo River control gate looking south near Tekapo township. 107.967 cumecs (24 November 2020 at 12pm)



**TEKAPO RIVER** - Site Photograph F: View looking east towards the mouth of Lake George Scott.



Tekapo River

Fork Stream



**TEKAPO RIVER** - Site Photograph G: View looking south-east at the intersection of the Tekapo Canal and Forks Stream.



**TEKAPO RIVER** - Site Photograph H: View looking north of the Tekapo River some 2.5 kilometres south-east of the Tekapo canal.





**TEKAPO CANAL** - Site Photograph I: View looking north-west up the Forks Stream from the Tekapo Canal.



**TEKAPO CANAL** - Site Photograph J: View from the true left of the Tekapo Canal looking west from the intersection of State Highway 8.



Tekapo Canal  
Road



**TEKAPO CANAL** - Site Photograph K: View from the true left of the Tekapo Canal approximately 4.6 km from the edge of Lake Pukaki.

Tekapo Canal  
Road

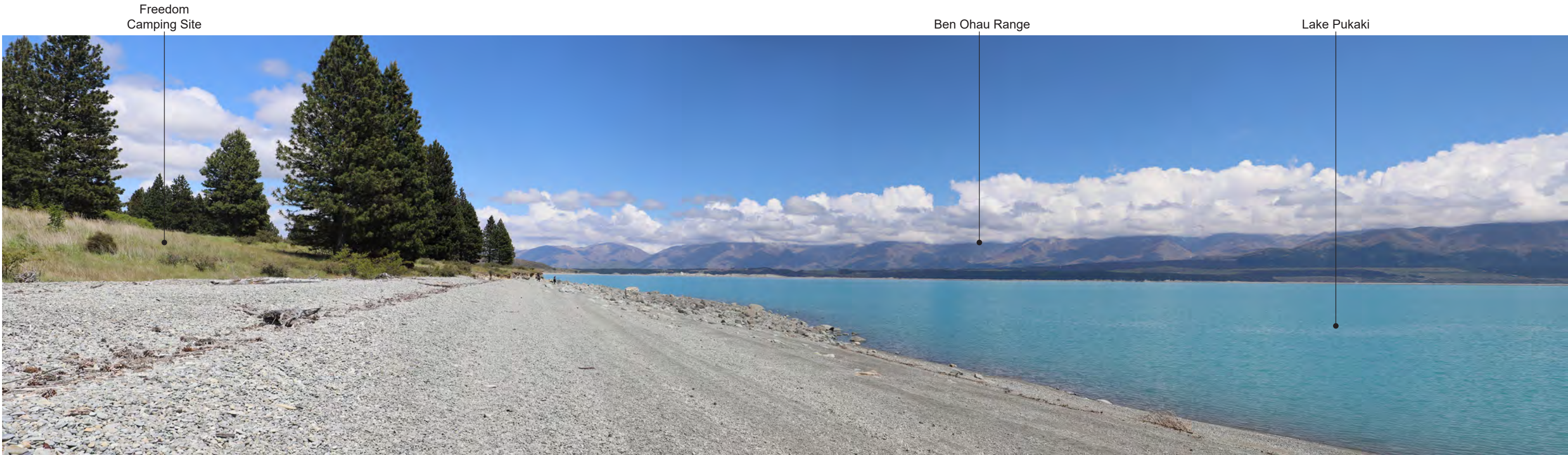


**TEKAPO CANAL** - Site Photograph L: View from the true left of the Tekapo Canal approximately 400 metres from the edge of the stilling basin near Lake Pukaki.





**LAKE PUKAKI** - Site Photograph M: View looking west from the Tekapo B Power Station across Lake Pukaki. Approximate lake level on 24 November 2020: 526.5masl.



**LAKE PUKAKI** - Site Photograph N: View looking south on the shores of Lake Pukaki, from the Freedom Camping site on Hayman Road. Average lake level 527.7masl. Approximate lake level on 24 November 2020: 526.5masl.





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