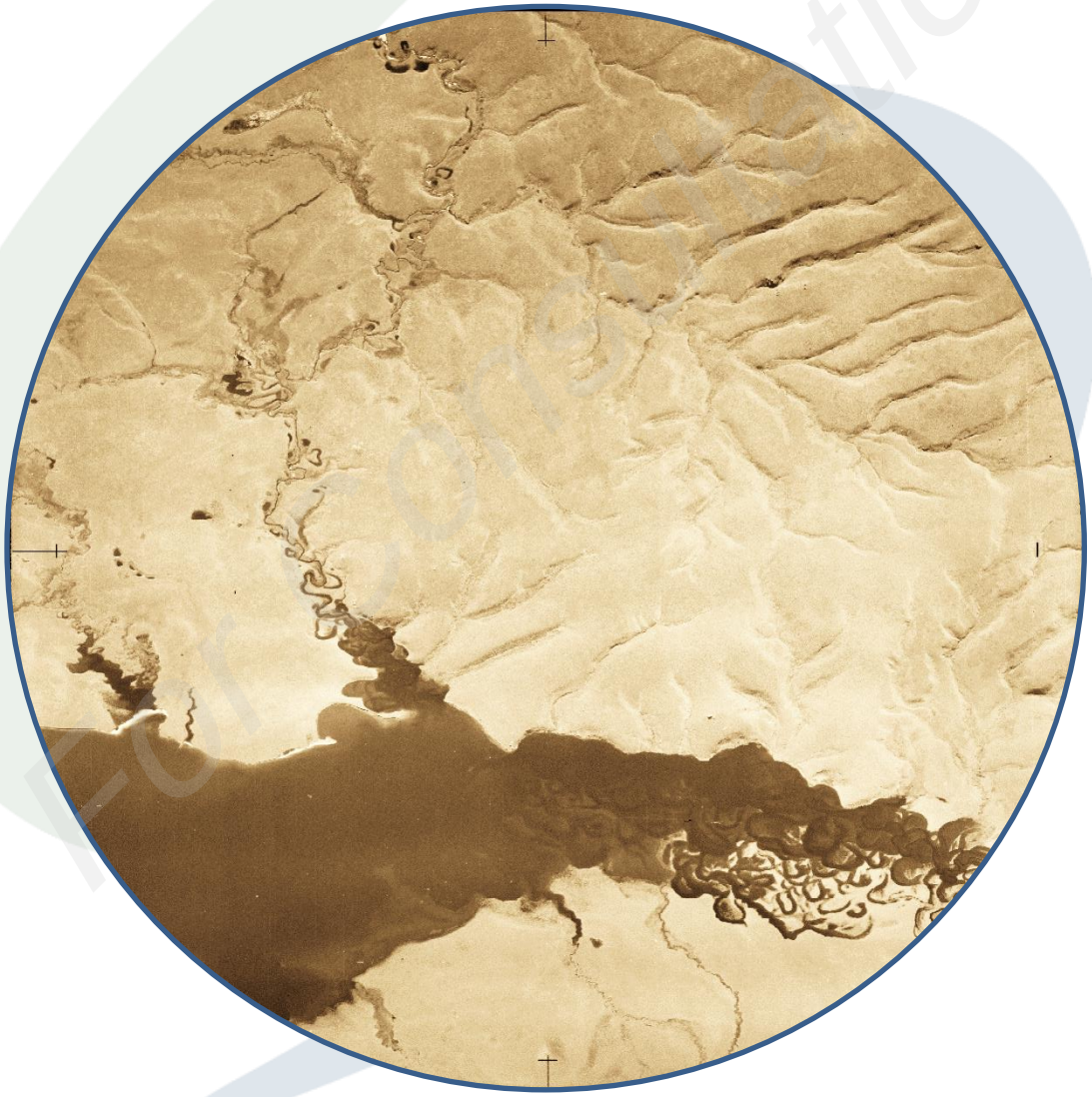
Cultural Values Statement:

The Lake Onslow option for the New Zealand Battery project



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This report has been prepared by Aukaha (1997) Ltd., for the Ministry of Business, Innovation, and Employment on behalf of Te Rūnanga o Ōtākou, Kāti Huirapa Rūnaka ki Puketeraki, and Hokonui Rūnanga.

Cover photo: Central northern section of Lake Onslow, 1945. Source: Retrolens.[1]

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[1] Retrolens, 2021.

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1. He kupu arataki: Introduction

The NZB[2] project has been established under MBIE management to provide comprehensive advice on the technical, environmental, and commercial feasibility of pumped hydro storage and other potential projects as a solution for sustainable dry-year energy production.

The NZB project aims to support efforts to achieve Carbon Zero 2050, which will require a move from fossil fuels to renewable sources for power generation. More than four-fifths (81%) of energy production in Aotearoa comes from renewable generation methods, primarily hydropower; however, hydro generation is impacted by low levels of lake storage and inflows at certain times of year.[3] Consequently, we still rely on coal- and gas-fired power stations to provide on-demand energy generation for Aotearoa.

The challenge is to find an alternative source that can store energy sufficient to provide back-fill for an entire year of less than average rainfall. The increasing move towards solar and wind-powered energy production means "we could face a more complex 'dry, calm, and cloudy problem' in the future."[4] It is predicted that climate change will contribute to these conditions.[5]

MBIE are considering other possible solutions based around the following technologies and processes:

- Biomass, biogas, and biofuels
- Geothermal energy
- Green hydrogen or green ammonia
- Compressed or liquid air; and
- Flow batteries.[6]

Pumped hydro energy storage is becoming an increasingly popular option overseas, as countries try to meet carbon emission targets amid the consequences of climate change. Fossil fuels have been the mainstay of global energy production for the last century, but this has come at a terrible cost for the environment, people, and economies across the world.[7]

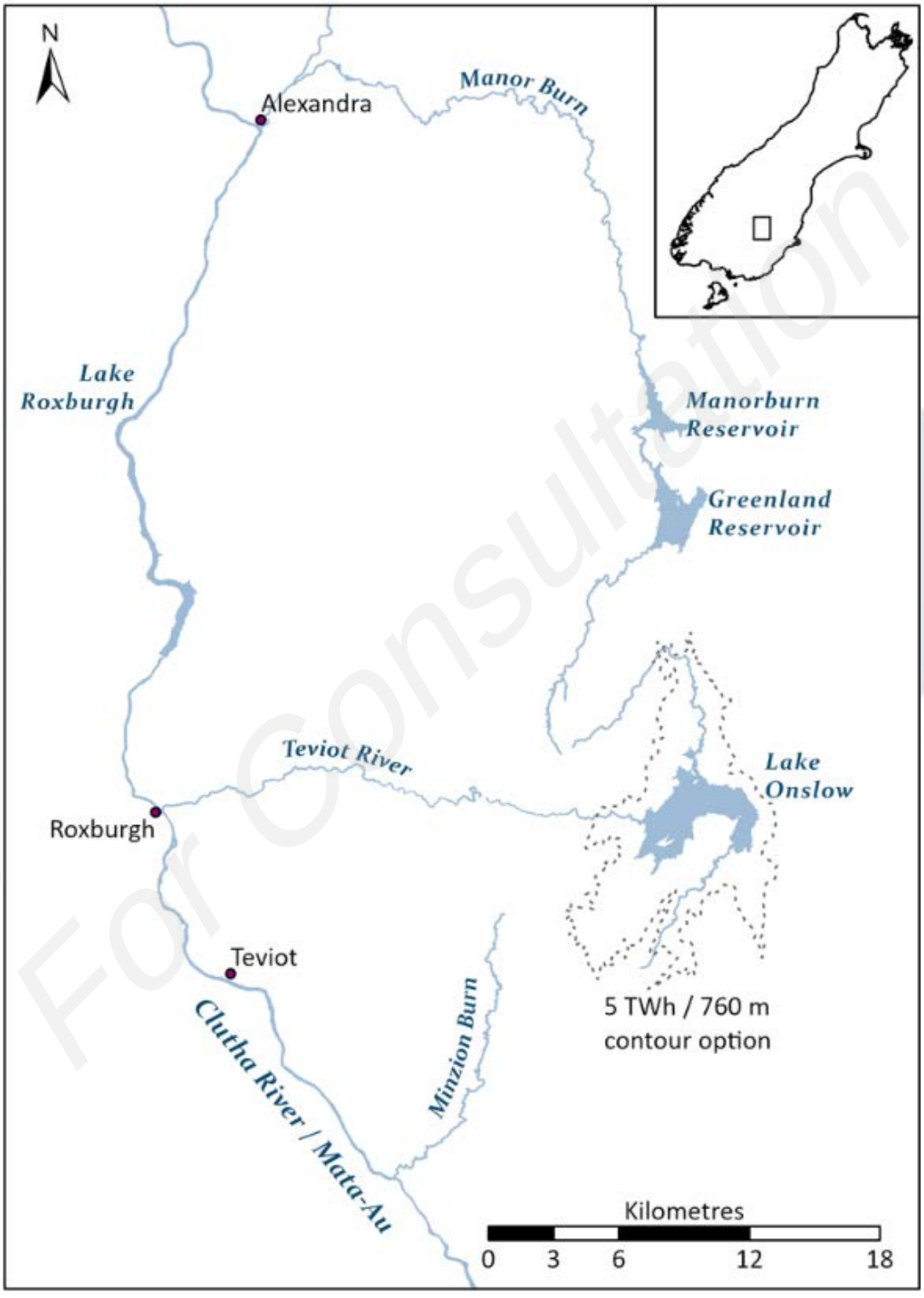
Climate change is caused by the accumulation of GHGs in the atmosphere. Human activities that produce GHG emissions, such as transportation, industry, and agriculture, all contribute to our carbon footprint. Significant GHGs include carbon dioxide and methane, which make up 88% of GHG emissions in Aotearoa. These gases absorb heat from Earth's surface, warming the atmosphere and increasing global temperatures which has huge knock-on effects for every ecosystem across the globe.[8]

'Zero Carbon' is New Zealand's commitment to reducing net GHG emissions to net zero by 2050. This will be achieved by ensuring that any human-produced carbon dioxide is removed from the atmosphere, and instituting policies to combat climate change.[9] Reducing global carbon emissions is the only way to avoid the catastrophic consequences of further global warming.[10] It is expected that Māori will be disproportionately affected by the impacts of climate change in Aotearoa.[11]

[2] A list of abbrevitations in provided in Appendix 2.
[3] MBIE, 2021a.
[4] MBIE, 2021a, p. 23.
[5] By 2090, it is predicted that climate change will contribute to Aotearoa experiencing a range of impacts that will contribute to the incidence of dry-year conditions, including higher average temperatures (increase of +0.7 to +3.0°), more extreme hot days (increases of 40-300%), more dry days per year (~5% increase), and increased incidence and intensity of drought. The interior of Te Wai Pounamu at higher elevations is identified in relation to increased incidences of dry days per year, and droughts. MfE, 2018.
[6] MBIE, 2021d.
[7] IHA, 2020.
[8] Statistics New Zealand, 2020b.
[9] MfE, 2021.
[10] World Economic Forum, 2020.
[11] Awatere, King, Reid, Williams, Masters-Awatere, Harris, Tassell-Matamua, Jones, Eastwood, Pirker, and Jackson, 2021.

The following cultural values statement identifies the mana whenua values associated with Lake Onslow, including the significance of wai māori,[12] and connections and associations to the site, and to the surrounding cultural landscape. The Kāi Tahu history of loss since the advent of colonisation is also explored, including an examination of the ways this has influenced the contemporary mana whenua relationship with the site.

Whakaahua 1: Lake Onslow, Central Otago[13]



[12] A glossary of Māori terms is provided in Appendix 1.
[13] MBIE, 2021b.

2. Ko te kāhui mauka: Description of proposed activities

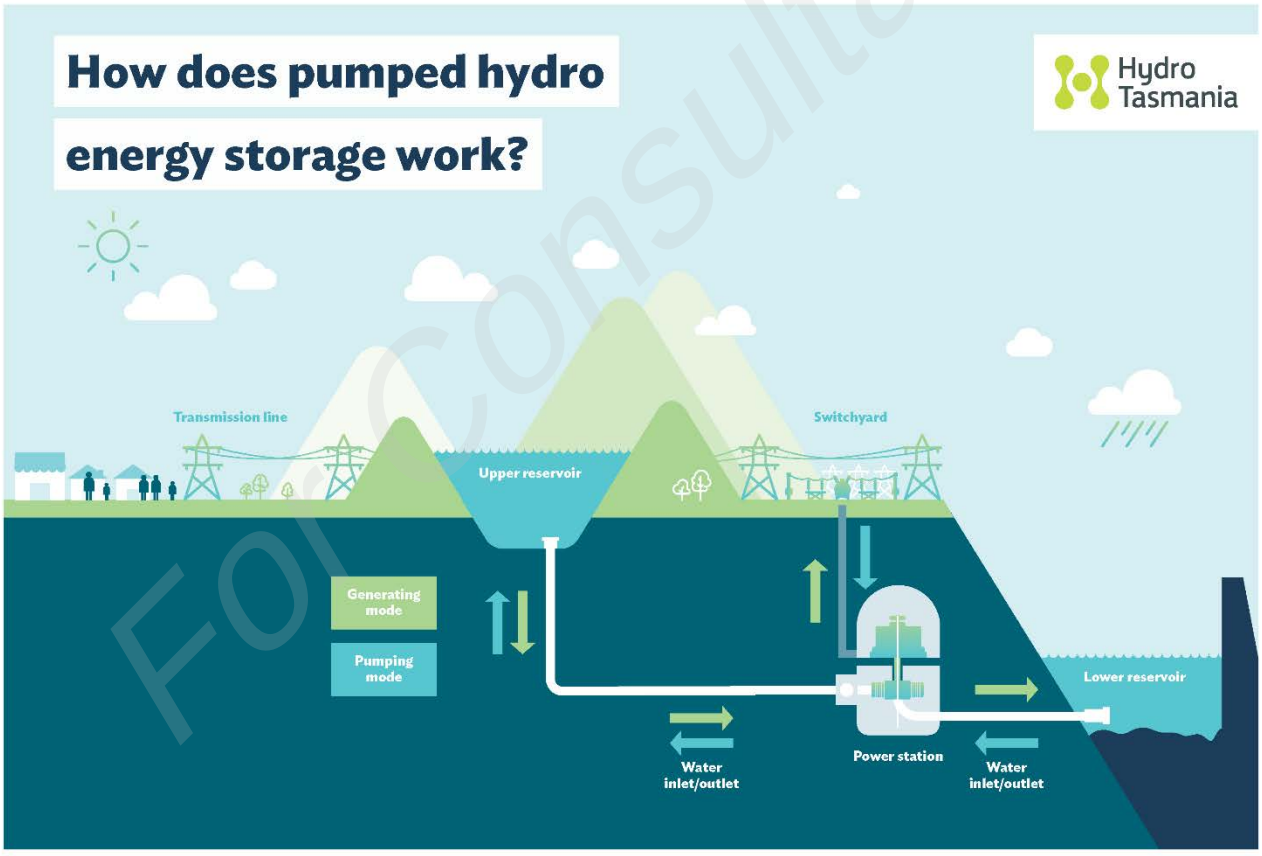
Pumped hydro storage provides a ready supply of stored power production that can respond quickly to meet power consumption demands. The model consists of two reservoirs, one at a higher elevation than the other. When the power supply is not required, volumes of water are pumped into the upper reservoir and stored for later use. When power demands are high, water from the upper reservoir is dropped down through power station turbines to the lower reservoir, with the resulting energy converted into power and fed into the national grid.

Construction of a pumped hydro-storage facility would turn Lake Onslow into a stored energy source, much like a battery, and provide a sustainable solution for the dry-year problem.

The Lake Onslow option proposes using the lake as the upper reservoir, with the Mata-au acting as the lower reservoir. The exact configuration and design of the infrastructure has not yet been finalised; however, Commercial Information

In order to support the expansion of the lake, a larger dam wall is proposed directly to the west of the current dam, potentially constructed from local geological materials like clay and rock. A subterranean tunnel and powerhouse would be constructed as the means of power generation for the scheme.[14]

Whakaahua 2: How does pumped hydro energy storage work?[15]



It is anticipated that Lake Onslow will have capacity to generate, or store the equivalent of, at least 5TWh annually,[16] around 13% of current annual consumption of 38.8TWh.[17] Construction would take four to five years, with commissioning and filling of the expanded lake requiring a further two years to complete. At

[14] Ibid.
[15] AHEC, 2021.
[16] MBIE, 2021b.
[17] Electricity Authority, 2018.

peak construction, up to 4,500 skilled and semi-skilled jobs would be available. The project is estimated to cost around $4 billion dollars, with funding of the project yet to be determined.[18]

In 2021, TRM was appointed to investigate engineering, environmental planning, and geotechnical feasibility investigations. TRM is a consortium led by engineering consultancy Mott MacDonald New Zealand, with engineering consultancy GHD, and environmental planning and design consultancy Boffa Miskell. TRM is undertaking an assessment of feasibility and cost for an in-principle Ministerial decision in May 2022.

The feasibility study being undertaken by TRM includes the following aspects:

- Identification of design options
- Estimation of costs
- Identification of environmental effects
- Identification and delivery of the geotechnical fieldwork programme

Fieldwork will aim to better understand regional geology, rock properties, and fault lines, to identify the best locations and designs. Investigations will include bore hole drilling and digging test pits. This is anticipated to take place between December 2021 and March 2022. Findings will inform the best route for the tunnel and powerhouse.[19]

Resource consenting is required for the geotechnical fieldwork, with pre-application engagement with Aukaha currently underway.

[18] MBIE, 2021b.
[19] MBIE, 2021c.

3. Toitū te mana, toitū te whenua: Kā Papatipu Rūnaka

There are three papatipu rūnaka located in Otago that hold shared authority and mana whenua status in the area surrounding Lake Onslow, including the Mata-au. These are:

- Te Rūnanga o Ōtākou
- Kāti Huirapa ki Puketeraki
- Hokonui Rūnaka

In this report, the three papatipu rūnaka are alternatively referred to as Kā Rūnaka, or as mana whenua.

Te Rūnanga o Ōtākou

The coastal of takiwā of Te Rūnanga o Ōtākou centres on Ōtākou on Otago Peninsula, and extends from Purehurehu to Te Mata-au. The inland reaches of the takiwā include shared interests in the lands and mountains to the western coast with kā rūnaka to the north and south.

Kāti Huirapa ki Puketeraki

The takiwā of Kāti Huirapa ki Puketeraki centres on Karitāne and extends from the Waihemo to Purehurehu. The takiwā extends inland to the Main Divide, sharing interests in the lakes and mountains to Whakatipu-waitai.

Hokonui Rūnanga

The takiwā of Hokonui Rūnanga centres on the Hokonui region, and includes shared interests in the lakes and mountains between Whakatipu-waitai and Tawhititarere with other Murihiku rūnaka, and those located from the Waihemo south.

Kā Rūnaka are represented by Aukaha (1997) Ltd., a regional environmental entity established and owned by the papatipu rūnaka with shared authority in the Otago region. Aukaha works on behalf of Kāi Tahu, to support rūnaka aspirations in the natural, rural, and built environments.

The RMA 1991 places obligations on local and central government to engage with mana whenua as a Treaty partner.[20] Aukaha staff provide best-practice planning advice to rūnaka to support their mahi in this area.

[20] RMA 1991.

4. He tikaka rakahau: Project methodology

Aukaha has been contracted by MBIE to prepare an assessment of cultural, archaeological and heritage values related to the the proposal for pumped hydro storage at Lake Onslow. The key elements of the project methodology is set out below.

4.1 Review of literature

A desktop review of the project area was undertaken, focusing on detailed documentary research, to inform the drafting of a cultural values statement related to the proposed activities. Reference material has been derived from the following key sources:

a. The Kāi Tahu ki Otago NRMP[21]
b. Ngāi Tahu cultural maps[22]
c. District wāhi tūpuna mapping
d. Recorded archaeological sites via ArchSite,[23] and
e. Available ecological and environmental monitoring data and reports.

Other relevant policies, plans, government and industry literature and reports, and academic research publications were identified as further source material during the review of literature.

4.2 Cultural values assessment

A cultural values assessment identifies key mana whenua values affected by the proposed activity, referencing the core values of mana, tapu, whakapapa, and mauri.

The cultural values statement provided below was drafted by Aukaha staff members, and presented to mana whenua representatives for review, comment, and amendment. All material released by Aukaha has been assessed and approved by mana whenua, to ensure that the final statement accurately reflects the position of Kā Rūnaka.

4.3 Desktop assessment of archaeology and heritage

A desktop study of heritage and archaeological sites has been produced by NZHP under subcontract to Aukaha (1997) Ltd. The desktop study provides an initial assessment of archaeology and heritage resources within the project area based on historical research, documented archaeological and heritage sites, and a survey of digital elevation data (LiDAR) supplied by MBIE.

Further details of methodologies employed in the production of the desktop assessment of archaeology and heritage for Lake Onslow can be found in the report appended.[24]

[21] KTKO, 2005.
[22] TRONT, 2021.
[23] NZAA, 2021.
[24] Davies, Cropper, & Hurford, 2021.

5. Kā puna-karikari-a-Rākaihautū: The significance of water to Kā Rūnaka

Wai is a central element in Kāi Tahu creation traditions and is placed at the core of the whakapapa of the world:

Nā Te Pō, ko Te Ao	*From the night comes the day*
Nā Te Ao, ko Te Aomarama	*From the day comes the bright day,*
Nā Te Aomarama, ko Te Ao Tūroa	*The longstanding day*
Nā Te Ao Tūroa, ko Te Koretewhiwhia	*From the longstanding day comes to unattainable void*
Nā Te Koretewhiwhia, ko te Rawea	*The intangible void*
Nā te Rawea, Ko Te Koretetamaua	*The unstable void*
Nā Te Koretetamaua, ko Te Korematua	*The parentless ones*
E moe ana Maku i Mahoranuiātea	*Maku the Damp, coupled with Mahoranuiatea*
Ka puta ko Raki	*and Raki the Sky was born.*
Tuatahi e moe ana Raki ki Pokoharua-i-te-Pō	*First, Raki coupled with Pokoharua-i-te-Pō*
Tuarua e moe ana Papatūānuku.[25]	*Second, he coupled with Papatūānuku.*

In the above account from Tīramōrehu, darkness gives rise to the light, and through an abyss of nothingness, moisture materialises as the first iteration of wai. The whakapapa continues down to Rakinui and his wives, Pokoharua-i-te-Pō and Papatūānuku.

The children of Rakinui and his wives created elements of te taiao, including mountains, rivers, forests, and seas, and all living things. These atua are the spiritual source of wai and whenua, connected to mana whenua through whakapapa. Wai is a central unifying feature in this whakapapa, as it is in our landscape, connecting the coast to the hinterland, and as a source of life.[26]

Wai is an early ancestor in the whakapapa of the Kāi Tahu world, enhancing its mana and placing great obligation on mana whenua to protect it. The duty of kaitiakitaka is not merely about guarding or caretaking, but involves acting as an agent for environmental protection and decision-making, on behalf of tūpuna and mokopuna. As expressed in the whakataukī, Mō tātou, ā, mō kā uri a muri ake nei, the focus of kaitiakitaka is to ensure environmental sustainability for future generations.

Mauri is a concept central to the action of kaitiakitaka. It is the mauri that binds the spiritual and physical aspects of our world together, generating and upholding all life. All elements possess a life force, from living things, to inanimate objects, natural and made. Mauri flows from our living world and down through whakapapa, linking all aspects of our world.[27] The mauri of water represents the essence that binds all things, acting as a life-giving force, and connecting the environment, from the mountains to the sea. Thus, mauri is a critical element in the relationship of Kā Rūnaka with all waterways, including the Mata-au, Te Awa Makarara, and Lake Onslow.

The whakapapa of mana whenua and wai are integrally connected through kinship and ancestral connections. The naming of waterways is linked to their creation. Rakaihautū, an ancestor of Waitaha, is credited with digging dug the lakes of Te Waipounamu with his kō, Tūwhakarōria, as well as their naming.[28]

[25] KTKO, 2005, p. 57.
[26] Potiki & Potiki, 2019-2021.
[27] Ibid.
[28] Anderson, 1942.

Beyond the important links of wai to atua, tūpuna, and te taiao, water was, and is, used extensively by mana whenua for spiritual and common uses. Wai is used to remove tapu, and in ceremonies. Waterways like the Mata-au were important pathways, whether traversed by waka or mōkihi, or followed on foot, and they are often still recognised as ara tawhito. The ecosystems provided by wai, in lakes, rivers, wetlands, estuaries, and at the coast, offer lifegiving habitats for native species, which are also considered whanauka. Moreover, wai māori is fundamentally important for human health and well-being, as a safe source of hydration and healthy kai. Consequently, the relationship between mana whenua and wai is significant and enduring, stretching from the past and into the future, as a central component of Kāi Tahu identity.

To Kāi Tahu, wai is a taoka under their mana and rakatirataka. Whanaukataka is at the heart of this relationship, rather than an economic model of ownership. Thus, when the health of a waterway is degraded, the impacts are far-reaching, for the waterway, for the ecosystems, habitats, and species it supports, and for the people.

When the mauri of wai is degraded, there are multiple impacts. Physical effects may be noticeable in the environment, through changes in the āhua of the water, such as appearance, smell, colour, or taste. Changes in chemical composition or flow of water may also be present. These physical changes are likely to affect animal and plant species that live in surrounding ecosystems. Impacts might include the decline of species, usually natives, and over-population of other species, often those that are introduced. In turn, this alters the connection of mana whenua with a waterway, as mahika kai uses may become unsustainable if the mauri continues to degrade. From here, a loss of knowledge can occur, as the opportunities to share the stories, practices, and histories associated with a waterway diminish due to the lack of connection.

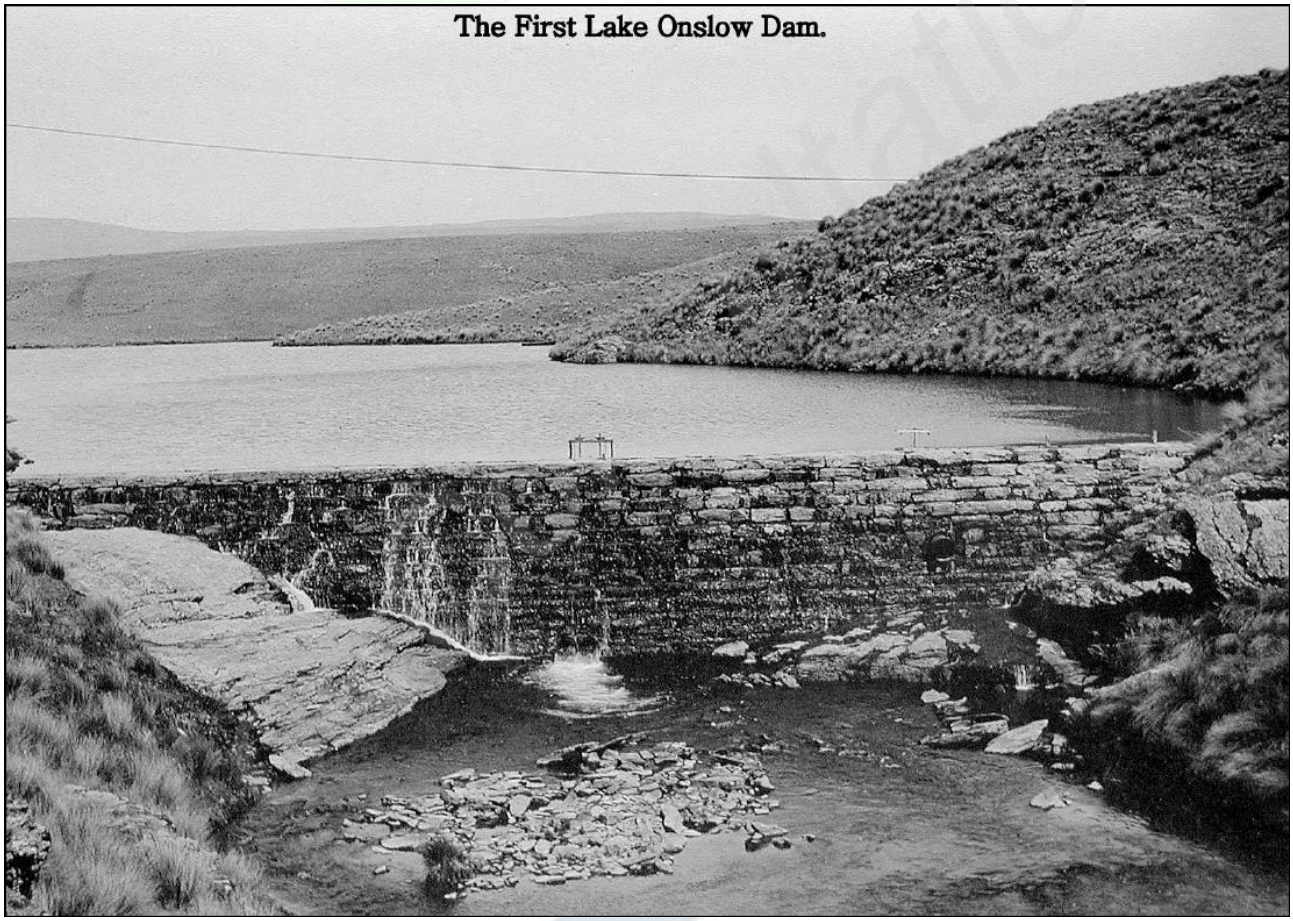
Kā Rūnaka have seen this pattern take place over and over throughout the history of European settlement in Te Waipounamu, with many behaviours and actions that undermine and degrade the mana and the mauri of our waterways still in evidence today. For Lake Onslow, this history is tied to the modification of the waterway over the settlement period from a wetland and wāhi mahika kai, to the artificial reservoir as it is today.

6. Kua kaheko te tuna: From Wāhi Tūpuna, to Dismal Swamp, to Lake Onslow

The place that is now known as Lake Onslow is located in Central Otago, at 700m above sea-level in an area of Otago tussock landscape, about 22km to the east of Roxburgh. Te Awa Makarara runs due west from the lake, running down to meet with the Mata-au at modern-day Roxburgh. Historically, the Lake Onslow site housed an extensive wetland, but the site changed significantly over time due to damming, mining activities, and modification of the surrounding environment. The place was named 'Dismal Swamp' by early settlers, with one story referencing an uncomfortable night's sleep under a large snow tussock in the late 1850s.[29]

Modification of the waterway, and the use of wai as a limitless resource are key themes in the treatment of Dismal Swamp and Te Awa Makarara. When gold was discovered in the river in 1862, the Makarara was dammed for the first time. Dammed water was used for sluicing and hydraulic elevation. Running water from a higher elevation through water races increased water pressure at a time when mechanical means were not available.[30]

Whakaahua 3: Lake Onslow rock dam after 1894[31]



Mining continued in the Teviot, with water as a key component of the processes used to extract it. In 1888, a license to dam Te Awa Makarara at Dismal Swamp was obtained, and designs for a 5.5m high stone course dam were commissioned. A further 1.52m was added to the dam in 1894. Water races were

[29] Mount Ida Chronicle, 1911.
[30] Hamilton, 2009.
[31] Davies, Cropper, & Hurford, 2021.

constructed from Te Awa Makarara to support mining activities, including a 2km-long pipeline called the Ewings Race, located at a 200m elevation above the Mata-au.[32]

As the gold mining opportunities in the Teviot Valley became less profitable, infrastructure from mining was used to irrigate orchards that were springing up around Roxburgh.[33] When electrical generation became available, the water demands of the community increased. Proposals to use Te Awa Makarara as a source of water for irrigation and power generation were first promulgated in the early 1920s, and the idea quickly gained traction. The Ministry of Works started construction on the George Power Station in 1923, and the scheme came online the following year. By November 1924, 321 users were connected to the scheme.[34]

Over the next 40 years, the scheme was extended, including extension of electrical services to Millers Flat (1927-1929), and twice raising the dam height (in 1934 and 1937-1938). When a flood event damaged the dam in 1968, the dam wall was reinstated to the same height, but amidst pressure to raise the dam height again.[35]

Whakaahua 4: Lake Onslow from the east[36]

The most recent infrastructure work at Lake Onslow took place with the building of a new dam, completed in 1982. The original dam was submerged by the resulting inundation, and the land area of the lake

[32] Hamilton, 2009.
[33] McKinnon, 2015.
[34] Hamilton, 2009.
[35] Ibid.
[36] Otago Taphophile, 2019.

increased by more than double to 834ha. Additional generation stations were built at the same time, and again in 1999 and 2010. These are now operated by Pioneer Energy, with the irrigation systems being managed by the Teviot Irrigation Company.[37] Pioneer Energy operates a number of other small dams along the length of Te Awa Makarara, with associated power stations, holding a number of other associated resource consents for damming, taking, and discharging of water.[38]

Whakaahua 5: Lake Onslow dam, 1982[39]

Pioneer is currently seeking variations to two water permits, one for damming and one for a water take, proposing an increase in the seven-day draw down rate from 0.2m to 0.4m.

Further influences on Lake Onslow and the surrounding waterways have been instigated by the incursion of introduced species, particularly the release of trout, which are well-established in the lake and river, as well as the Mata-au mainstem.

Poetic references to the lack of trout in Otago waters featured regularly in newspaper articles in the 1850s and '60s. The sentiment of the settler population can perhaps be summed up by the following statement, which appeared in the *Otago Witness* in 1864:

> *One of the grand features of New Zealand is its immense and beautiful rivers… It is a most serious lapse on the part of old Dame Nature that these rivers should be destitute of fish of any importance…*[40]

[37] Hamilton, 2009.
[38] ORC, 2021; Pioneer Energy, 2021.
[39] Otago Taphophile, 2019.
[40] Otago Witness, 1864.

Established in 1863, the Otago Acclimatisation Society aimed to introduce European fish and game species to the province. Their activities included establishment of ponds for breeding purposes, importation of ova, and the release of trout in waterways across Otago. By 1869, the first stories of sighting and catching trout in Otago waterways were being reported.[41] These efforts were almost universally undertaken by settlers: "Māori were, to a large extent, observers, rather than agents, in the introduction of trout to New Zealand."[42]

Tūtohi 1: Scheduled wetlands in the Lake Onslow catchment[43]

Wetland name and description	Status and values
Middle Swamp (no. 104) A 66.4ha bog ecosystem on the southern margin of Lake Onslow.	**Regionally Significant Wetland** High degree of wetland naturalness
Boundary Creek Fen (no.15) A 93.9ha fen located to the south and east of Lake Onslow.	**Regionally Significant Wetland** High degree of wetland naturalness
Fortification Creek Wetland Management Area (no.45) An extensive 525.9ha wetland area covering the slow-moving lower reaches of Fortification Stream and Te Awa Makarara. Also includes swamps at the inlets of Lake Onslow.	**Regionally Significant Wetland** Habitat for rare or threatened species or communities High degree of wetland naturalness Scarce wetland type Regionally significant wetland habitat for waterfowl

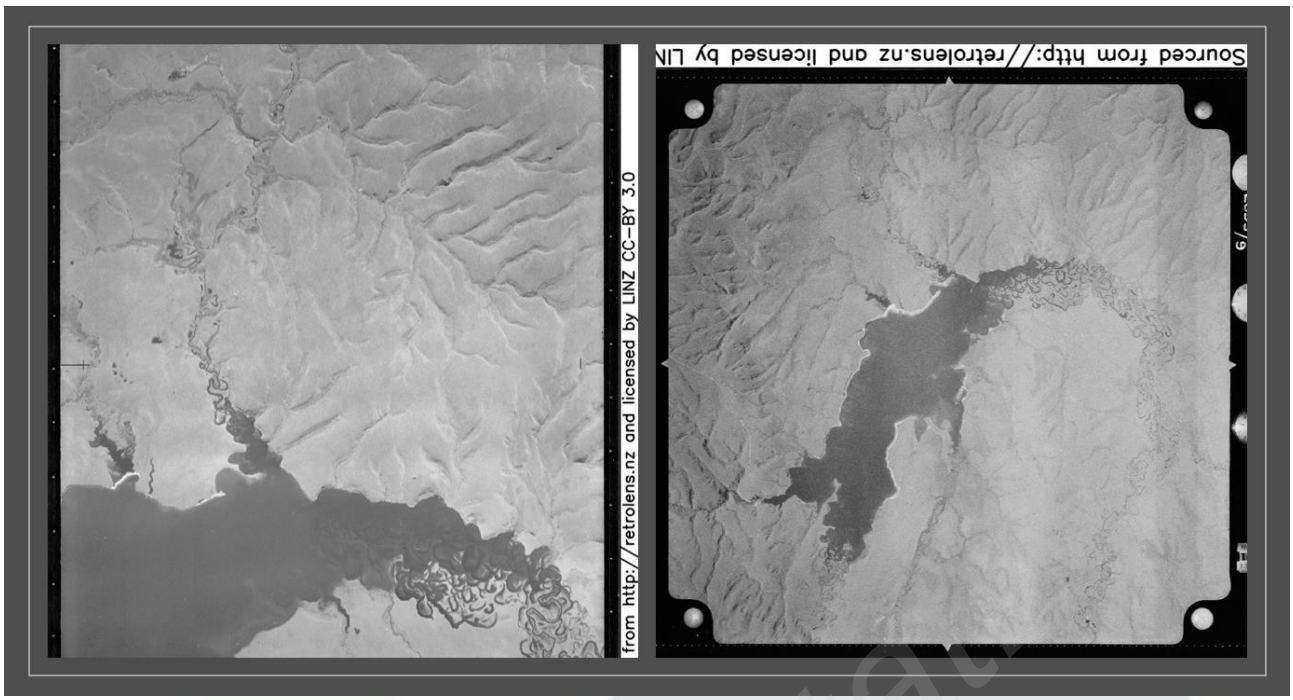
Today, trout are well established in many Otago waterways, including Lake Onslow, Te Awa Makarara, and the Mata-au. Trout have responded well to the modification of waterways through damming, as these sites create a ponding effect that trout find beneficial. Whereas native fish tend to be adapted for natural flow conditions, exotic fish species like trout respond well to modification due to broad environmental tolerances and their ability to out-compete native fish species.[44]

The further damming of Te Awa Makarara in 1982 substantially increased food supply for trout in Lake Onslow, evidenced by noted increases in fish size.[45] Today, wild trout are abundant in the waterway, averaging 1-1.5kg, but with specimens of up to 3kg not uncommon.[46] The population is self-sustaining due to the excellent spawning habitats available in tributaries, and the lake has been described as "one of Otago's best lake fisheries for brown trout."[47]

Water quality at Lake Onslow is tested at the dam wall, with further testing data collected downstream in the Mata-au at Bengerburn on SH8, and at Millers Flat. SOE testing results released by ORC in 2018 draw on testing data for the past five years when the flow site was at or below median flow. The results show elevated turbidity at the Lake Onslow flow site, and elevated levels of NNN, DRP, and bacteria (E. coli) at Bengerburn.[48]

[41] Kós, 2017.
[42] Ibid, p. 198.
[43] ORC, 2020c; ORC, 2020b; ORC, 2020a.
[44] Jellyman & Harding, 2012.
[45] Jellyman, 1984.
[46] Fish and Game New Zealand, 2021.
[47] New Zealand Fishing, n.d.
[48] ORC, 2018.

Whakaahua 6-7: Lake Onslow 1945 (left), and 1959



Whakaahua 8-9: Lake Onslow 1975 (left), and 1984[49]

Water quality data for Lake Onslow indicates that the levels of total phosphorous and total nitrogen in the lake are likely to be degrading.[50] Recent land activities have seen an increase in the introduction of exotic grass species around the lake margins, with an associated drop in the instance of native tussocks and grasses in the area.[51]

[49] Retrolens, 2021.
[50] LAWA, 2021b.
[51] LAWA, 2021a.

High levels of nitrogen and phosphorous in waterways contribute to the growth of nuisance plants and algae, which negatively affect freshwater biodiversity, and are potentially toxic to fish.[52] High turbidity also affects stream ecosystems, particularly when a high instance of suspended solids is present, as this will alter the benthic structure of the river, supressing native freshwater plants and invertebrates.[53] There are now three scheduled wetland areas on the southern margins of Lake Onslow, and to the south of Te Awa Makarara (see Tūtohi 1 above). These wetland are the vestigial remnants of the historic wetlands that were lost when the first dam was built at Dismal Swamp. Species associated with these wetlands include two listed as nationally critically endangered: pārera, a type of duck, and panapana, a plant species. A number of other species currently found in these locations are experiencing similar, although less severe, levels of endangerment.[54]

Whakaahua 10-11: Fortification Creek Wetland 1975 (left), and 2021[55]

Over the past 170 years, the accumulated influence of human activity has changed the appearance, attributes, and ecology of Lake Onslow and associated waterways, affecting the mana whenua values associated with the area. Historical aerial maps over almost four decades show some of the more recent modifications to the Lake Onslow site, from 1945 to 1984 (see images above). Most striking in these images is the significant loss of the wetland habitats from around the lake margins as the dam wall was raised higher and higher between 1888 and 1939, particularly that of what is now the Fortification Creek Wetland (see images above).

[52] ORC, 2018.
[53] Haddadchi & Hicks, 2019.
[54] See Tūtohi 4 on page 21 for more information about species associated with Lake Onslow.
[55] Retrolens, 2021 (detail); Google, 2021 (detail).

7. He taura whiri kotahi: Mana whenua associations with the Lake Onslow area

Rather than being seen as a "dismal swamp," wetlands like the one that proceeded the formation of Lake Onslow were prized sites for mana whenua, with many in Otago associated with seasonal heke and mahika kai practices. Kāika and nohoaka were often located near wetlands, as they provided a readily available source of food and resources, much like a convenient local supermarket.

Much of the knowledge of Māori connections to Lake Onslow have been lost, but clues still remain that indicate its value to mana whenua. Other wetlands in the wider area around Lake Onslow can provide evidence of the importance of wetland environments to mana whenua, and also offer a point of comparison for the Lake Onslow site. Significantly, the site bears many of the same hallmarks that can be seen at Te Paruparu-a-Te-Kaunia, a wāhi tūpuna strongly associated with mahika kai activities related to the gathering of pūtakitaki, pārera, kukupako, pāteke, whio, and totokipio.[56]

Tūtohi 2: Comparison of archaeological sites at Lake Onslow and Te Paruparu-a-Te-Kaunia[57]

Archaeological evidence	Examples identified at Lake Onslow	Examples identified at Te Paruparu-a-Te-Kaunia
Rock shelters	G43/193 Cave/rock shelter G43/194 Cave/rock shelter; moa bone fragments	H43/32 Rock shelter in schist outcrop; fragments of charcoal H43/41 Rock shelter with small charcoal granules H43/42 Rock shelter with streaky traces of charcoal
Work areas	G43/39 Stone flakes; working area/flaking floor	H43/38 Finds of silcrete and shattered moa bone; possibly a moa butchering site
Other	G43/9 Intact oven G43/192 Umu tī G43/47 Food source	H43/3 Wooden club

The identification of archaeological sites with similarities to those seen at Lake Onslow provides an indication of the importance of these wetlands to mana whenua as a site where food and resources were collected (see Tūtohi 2 above). Both sites show signs of seasonal habitation, with the identification of rock shelters, a common source of shelter for Māori engaged in heke, and both reference work areas and associated stone tools, one referencing flaking, and the other as a possible butchering site. Signs of habitation at Te Paruparu-a-Te-Kaunia may be more recent, given the identification of charcoal traces in rock shelters.[58]

One particular archaeological record holds some valuable information that hints at the attributes that brought tūpuna to the site, refers to the area beneath the lake's surface as "a source of large freshwater crayfish … [and] its tributaries used to be a source of freshwater mussels."[59]

Other archaeological sites reference moa as a possible food source in the area. Wetlands like the historic site at Lake Onslow were preferred habitats for a number of moa species.[60]

[56] TRONT, 2021.
[57] NZAA, 2021.
[58] Ibid.
[59] Croad, 1978.
[60] Worthy, 1990.

Lake Onslow, Te Awa Makarara, and the Mata-au have all been mapped as wāhi tūpuna as part of the Ngāi Tahu mapping project, Kā Huru Manu.[61] While the Māori name for Lake Onslow is not known, there are a range of placenames identified in the surrounding area, demonstrating mana whenua connections (see Tūtohi 3 below).

The Mata-au itself was a significant ara tawhito, an ancestral pathway that allowed generations of tūpuna to travel from the coast to the mountains and back again. Ara tawhito provided access to valued sites for mahika kai. Wāhi mahika kai, nohoaka, and kāika are dotted all along its length, including three along or near the nearby stretch of the Mata-au: Omairiu; O Puriri; and Te Tihi o Kaitarau. [62]

Mahika kai sources referenced in the wider area include kanakana, īnaka, tuna, weka, kāuru, and pōhata. Many of these are at a much lower elevation, so it is possible that the species associated with Te Paruparu-a-Te-Kaunia provide a better indication of the species present.[63]

Tūtohi 3: Wāhi tūpuna in the landscape surrounding Lake Onslow[64]

Ikoa Māori	Ikoa Pākehā	Description
Te Awa Makarara	Teviot River	Recorded Māori name.
	Oven Hill	Named for the Māori ovens found there.
Omaiuru		A wāhi mahika kai located near Ettrick, where is recorded that tuna and pōhata were gathered.
O Puriri		A wāhi mahika kai near the Mata-au where kanakana, īnaka, and pōhata were gathered.
Te Tihi o Kaitarau		An inland kāika mahika kai located east of the Mata-au where weka and kāuru were gathered.
Te Papanui	Lammermoor Range	Recorded Māori name.
Ōkura	Beaumont River[65]	Recorded Māori name, with the word 'kura' referencing red rocks or cliffs along the river.

Mahika kai practices extended beyond the gathering of animals and plants for food to include resource gathering for technological applications. Plant species, geological resources, and animal by-products, like feathers and bones, were all valuable resources for tūpuna. Wāhi tūpuna like the wetland previously located at Lake Onslow give indications of how these practices were undertaken. The gathering of food may well have been the driver to bring tūpuna to the site, but other resources that were in the vicinity were also gathered, making the most of the significant journey taken to get there. Geological resources were

[61] TRONT, 2021.
[62] Ibid.
[63] Ibid; NZAA, 2021.
[64] TRONT, 2021.
[65] Although some of these locations sit well outside the proposed Lake Onslow inundation zone, they have been included as they are located along the proposed pipelines associated with the operation of the scheme.

accessed, and umu were constructed to process kāuru for later consumption. Rock shelters in geological formations on the wetlands' margins were used as temporary campsites.

Just as modern humans will pop into a shop while they are 'in the neighbourhood,' this was also the practice for mana whenua in the past, who would use the opportunity of being in the location to access other resources that were also plentiful elsewhere. This phenomenon is identifiable across the archaeological record between Lake Onslow and the Mata-au, with a significant number of umu, middens, and rock shelters identified.[66]

Tūtohi 4: Species likely to have been present at the Lake Onslow historic wetland[67]

Ikoa Māori	Ikoa Pākehā	Conservation status
mānia	tussock (Carex)	Not threatened
mokomoko	McCanns skink	Not threatened
pātītī	red tussock	Not threatened
pūtakitaki	paradise duck	Not threatened
tī kouka	cabbage tree	Not threatened
kukupako	black teal	At risk: recovering
pāteke	brown teal	At risk: recovering
totokipio	New Zealand dabchick	At risk: recovering
weka	woodhen	At risk: recovering
īnaka	whitebait	At risk: declining
kōura	freshwater crayfish	At risk: declining
mokomoko	Southern grass skink	At risk: declining
mokomoko	Korero gecko	At risk: declining
tuna	eel	At risk: declining
kākahi	freshwater mussel	Threatened: nationally vulnerable
kanakana	lamprey	Threatened: nationally vulnerable
korikori	mountain buttercup	Threatened: nationally vulnerable
tūturiwhatu	Banded dotterel	Threatened: nationally vulnerable
whio	blue duck	Threatened: nationally vulnerable
pārera	grey duck	Threatened: nationally critical
Panapana	New Zealand bitter cress	Threatened: nationally critical
pekapeka	New Zealand bat	Threatened: nationally critical
	Teviot flathead galaxias	Threatened: nationally critical

Native species and resources were not just a source of food; practices associated with mahika kai were drivers for the intergenerational transmission of knowledge, in the form of mātauraka, maumaharataka, tikaka, and kawa. Seasonal migrations to places like the wetlands located at the site of modern-day Lake Onslow provided an opportunity to pass on important stories, memories, practices, and knowledge as

[66] TRONT, 2021.

[67] Species selected were referenced in relation to wāhi tūpuna in the area, including Te Paruparu-a-Te-Kaunia, and based on DOC's assessment of the site; ibid.

taoka tuku iho, treasures passed down from the ancestors. Seasonal heke did not only enable physical sustainability through the accessing of food and resources, but also facilitated cultural transfer to take place, sustaining the culture and the practices of the people through time.

For hundreds of years, mana whenua were able to practice, hone, and develop their skills, practices, and knowledge of the natural environment, enabling them to flourish. But life never stays the same for long, and the arrival of people from Europe brought about changes that are still manifested in the lives of mana whenua today, under the long shadow of the Kāi Tahu history of loss.

8. E rite ana ki te karo o te moa: The Kāi Tahu history of loss

Te Tiriti o Waitangi was signed by representatives of Kā Rūnaka in late May and early June of 1840.[68] Subsequently, in 1844 and 1864, Kāi Tahu agreed a series of land sales with the Crown. Rather than acting in good faith, the Crown reneged on key elements of the agreements, resulting in widespread land alienation and economic deprivation for mana whenua.[69]

The 1848 Kemp's Deed was the largest of the Crown land purchases, comprising 13,551,400 acres for which £2,000 was paid. Although the deeds promised a tenth of the land would be retained as reserves for Kāi Tahu, less than 6,500 acres were allocated within the footprint of the deed.[70]

The loss of connection to whenua that took place as a result of the Deeds, coupled with the visible deterioration and degradation of lakes, rivers, and waterways since that time, is a source of great mamae for mana whenua. This is particularly true given the obligations of mana whenua to fulfil their roles as kaitiaki whenua in their takiwā, mō tātou, ā, mō kā uri a muri ake nei.

Barriers to following kā ara tawhito made visiting wāhi tūpuna and wāhi mahika kai as was done in the past more and more difficult. Over time, the ancestral lands were surveyed, sold, and settled. Wetlands like Dismal Swamp and Te Paruparu-a-Te-Kaunia were dammed, and other waterways were modified and drained. Changes in the landscape led to changes for the people, contributing to the displacement of whānau, loss of knowledge and identity, and the suffering of economic hardship.

When gold was struck in Otago in 1862, thousands flocked to Te Waipounamu to find their fortunes. A number of Kāi Tahu people saw the benefits to be had from joining the gold rush, as well as engaging in other paid work like shearing and labouring. In 1862, Māori gold miners were recording catching weka and whekau.[71] Nevertheless, the influx of people, and the wealth that the gold rush produced, pushed a further wedge between Kā Rūnaka and the hinterland.

Gold mining had a myriad of impacts for mana whenua, with every aspect of the relationship and connection with the landscape coming under attack. Physical barriers to accessing Central Otago and the Upper Lakes became increasingly apparent. When a group of mana whenua from the coast undertook a heke inland in an attempt to retain access to their traditional land and resources, they were unable to progress past Ōmārama. They stayed there until 1879, when they were forcibly ejected. From that point onwards, the primary economic activity available to mana whenua in the Upper Lakes region was as labourers.[72]

The development of key infrastructure like roads, towns, and services, caused physical changes to landscape, some impacting significant landmarks and wāhi tūpuna. Events like the mining of Pukemakamaka, the channelling of the Ōwheo, and the draining of the inland salt-lakes of the lower Taiari, all sites now mapped as a significant wāhi tūpuna for Ōtākou, but without regard for their values, is indicative of the manner in which the settlement of Aotearoa occurred.

The impact of goldmining on mana whenua associations is evident in the archaeological record surrounding Lake Onslow and Te Awa Makarara, which shows a significant number of sites linked to mining and settlement, notably water races and huts. The landscape was extensively modified at Roxburgh during this period, following the discovery of gold in the Makarara in 1862.[73] Nevertheless, the prominence of heritage archaeology associated with the activities of this time are matched fairly evenly with those indicating the Māori history of settlement, providing invaluable knowledge of how tūpuna lived in the past. Of the fifteen

[68] Waitangi Tribunal, 1991, s4.2.
[69] Ibid.
[70] TRONT, 1997.
[71] Beattie, 1945.
[72] Kleinlangevelsloo & Clucas, 2017.
[73] Hamilton, 2009.

known archaeological sites in the area surrounding Lake Onslow, seven relate to Māori settlement (see Tūtohi 5 below).[74]

The damming of Dismal Swamp adversely affected mana whenua values associated with the place. Ancestral sites and mahika kai places were obliterated by the inundation. The landscape changed irrevocably, drowned under the trout-laden waters of the reservoir above. With the loss of these values, the impetus for mana whenua to retain their connections was degraded, and with significant challenges being faced closer to home at the coast, mana whenua grew further and further removed from their places, and the knowledge with which they were associated. Over time, this led to a significant loss of cultural knowledge, as stories, knowledge, history, and learning that had previously been shared during heke, were no longer being shared, no longer being remembered.

Tūtohi 5: Māori and heritage archaeological sites in the vicinity of Lake Onslow[75]

Māori archaeological sites	Heritage sites
G43/39 Moa bones and small flakes of porcellanite	G43/40 Chimney
G43/43 Rock shelter	G43/42 Gold workings
G43/47 Food source	G43/126 Trig station
G43/9 Ovens	G43/196 Remnant fenced enclosure or holding pen
G43/192 Umu tī	G43/198 Tow hut sites, gold sluicing, and a water race
G43/193 Rock shelter	G43/202 Hut site, hydraulic elevating, and water race
G43/194 Rock shelter	H43/118 Hut site
	H43/121 Stacked schist hut site

The trout themselves had further impacts, pushing highly endangered species like the Teviot flathead, a non-migratory galaxiid species, to the brink of extinction. Teviot flatheads are now restricted to a habitat of less than a hectare in remote tributaries whose hydromorphology allows them to remain untouched by the predation of trout. Recognised as having a nationally critical level of endangerment, the highest conservation rating available, the survival of this taoka species is finely balanced, with severe risks should the population be exposed to predation.[76]

The introduction of rabbits to Te Waipounamu for meat and hunting in the 1830s saw the explosion of their population. From the 1870s, rabbit plagues became a concern, leading to major impacts for farming. Weka and kāhu were their only natural predators, but they were unable to keep up with the spread of rabbit numbers.[77]

Farmers used a variety of methods of control rabbits, with poisons and toxins being employed from the 1880s. Native species like weka became significant victims of poisoning, and rabbit populations continued to soar. In the same decade, stoats, and other mustelids were released as a further rabbit control measure, but immediately began to prey on native species.[78] The impact of these introduced species on native species has been profound, and continues to hamper their survival today due to habitat loss and predation.

Native plant species, like mānia, pātītī, and tī kōuka, which previously grew in abundance around the margins of the historic wetland complex and along the banks of Te Awa Makarara, are being increasingly replaced with exotic grasses and pastureland, which has been linked to the increases in phosphorous and nitrogen levels in the lake.[79] The modification of the land and environment continues. For mana whenua,

[74] NZAA, 2021. Not all of these sites are within the inundation zone, but rather are in a tight radius around the lake.
[75] Ibid.
[76] DOC, 2021.
[77] Peden, 2008.
[78] Ibid; Brockie, 2007.
[79] LAWA, 2021a.

this is a history that replays over and over, with echoes of the losses of the past reverberating through to the future.

The deprivation suffered by Kāi Tahu over this time encompassed not only the material loss of land as an asset base and seasonal hunting grounds, but the loss of a spiritual connection to te taiao, of their ability to exercise rakatirataka, a fundamental building block of Kāi Tahu life and identity, and the transmission of mātauraka.[80] The legacy of this period continues today, through the continuing commitment and duty to advocate for, and protect, te taiao, mō tātou, ā, mō kā uri a muri ake nei.

[80] Waitangi Tribunal, 1991.

9. Mauri tū, mauri ora: Mana whenua values in the Lake Onslow area

9.1 Wāhi Tūpuna and Ara Tawhito

Lake Onslow, Te Awa Makarara, and the Mata-au are all mapped as wāhi tūpuna (see image below), referencing the significance of these sites to Kā Rūnaka as mana whenua in the Otago takiwā. The Mata-au is further identified as a significant ara tawhito, linking many wāhi tūpuna along its route.

Lake Onslow is listed in Schedule 1D of the ORPW as having cultural values as a wāhi taoka, and a wāhi mahika kai. Te Awa Makarara is also recognised as a wāhi mahika kai. The history of loss has seen mana whenua lose many aspects of the mahi and mātauraka that were shared in the past. One of the visions identified for the Mata-au FMU under the PORPS 2021 is that water bodies will support thriving mahika kai, and that Kāi Tahu whānui will have access to their mahika kai. The restoration of these mahika kai and taoka values are a significant priority for Kā Rūnaka.

Although the Makarara and the Mata-au both technically sit outside the inundation zone, there can be no doubt that the proposed activities at Lake Onslow would have an impact on them. Furthermore, for Rūnaka the whole environment is connected, from the mountains to the sea; one site is intrinsically connected to the other sites around it. This is well illustrated by the image above, showing a detail of the Fortification Creek Wetland Management Area located directed south of Lake Onslow. The location of these three archaeological sites, two rock shelters and an umu, along the side of this scroll wetland are almost certainly linked, perhaps indicating a campsite, where food was gathered, prepared, and possibly preserved. Each individual site provides context for the wider landscape.

[81] TRONT, 2016.

Intrinsic to the status of wāhi tūpuna is a history of connection, and a relationship that was experienced and shared across generations. In the case of many of these sites, including Lake Onslow, that connection has been alienated or degraded through the history of loss. Thus, at the core of mana whenua values for the wāhi tūpuna and ara tawhito in this area is to rekindle that connection, and to reignite the fires of ahikāroa. These links are strongly bedded in the core Māori values of whakapapa, mana, and tapu.

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9.2 Wai māori values

Wai māori is a taoka of extreme significance for mana whenua. The waters that feed major rivers like the Mata-au contribute to the whakapapa of the awa as it travels from the mountains to the sea. Different waterbodies were seen for their intrinsic values by tūpuna, each having its own mana and mauri, and providing a source of well-being. The ecological services provided by wetlands were well recognised by tūpuna, and was valued as a taoka. Fresh water was known to be found at the downstream discharge from a wetland. In some parts of Aotearoa important artefacts have been found interred in wetlands, taking advantage of the ability of wetlands to preserve wood. Moreover, wetlands were well recognised as a reliable source of food sources and plant species.

The NPSFM 2020 identifies Te Mana o te Wai as the fundamental concept in the management of freshwater in Aotearoa.[83] The first priority is identified as the health and well-being of the waterway and freshwater ecosystems, with human health, and social, economic, and cultural well-being prioritised second and third respectively.[84] The key role of mana whenua in defining Te Mana o te Wai is recognised, including in the identification of freshwater values.[85]

[82] TRONT, 2021.
[83] NPSFM 2020, s1.3(1).
[84] NPSFM 2020, s1.3(5).
[85] NPSFM 2020, s2.2(2).

Given the level of modification and abstraction in the environment surrounding Lake Onslow and Te Awa Makarara, there is no doubt that the mana and mauri of these waterways have been degraded. Any indigenous biodiversity in the catchment has been heavily influenced by introduced species, with some species no longer being present. In order to meet the requirements of the NPSFM 2020, it is vital that the proposed activities are undertaken in such a way as to uphold and promote the mana of these waterways.

Retention and restoration of indigenous freshwater ecosystems is a crucial element of upholding Te Mana o te Wai. The presence of three scheduled wetlands in the vicinity of the lake provides a focus for these activities, as does the conservation status of the indigenous species identified in the area. The loss of wetlands in the Otago takiwā is a significant concern for mana whenua, as it is becoming for our wider community. It is estimated that around 90% of our wetland habitats have already been lost, and many more are under threat. The NPSFM 2020 provides specific guidance about the protection of wetland environments, stating "There is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted."[86]

The protection of these wetland complexes and the indigenous biodiversity they support is a priority of great significance for Kā Rūnaka.

9.3 Ecological values

The habitats and ecology of indigenous freshwater and terrestrial species in the inundation zone has already suffered from many impacts due to landscape modification and the introduction of exotic species. Trout have excelled in the new environment, but, as their numbers have grown, native freshwater species have become more at risk. Earlier this year, it was identified that 76% of indigenous freshwater fish species (39 of 51) have a conservation status of threatened with, or at risk of being threatened with, extinction. This includes a number of native species known to be found in Lake Onslow and surrounding area, such as the kākahi, the kanakana, and the kōura.[87]

Casting the net wider, we can see that similar threats are identifiable for other freshwater species, like invertebrates. While only around 26% are currently considered threatened or at risk, a further 26.5% of native freshwater invertebrate species are listed as 'data deficient.' Moreover, statistics over the period from 2013-2018 show that there has been an actual decline in the conservation status of native freshwater invertebrates.[88] As the species at the bottom of the food chain, a strong biodiversity of invertebrate species not only supports the conservation of our other native species, but also acts as an overall indicator of the well-being of the environment.

Sadly, the picture for native terrestrial species is looking no less bleak. In 2021, 79% of the native land species assessment were classified as either threatened with, or at risk of, extinction. This includes a range of land-based creatures including plant species, bats, frogs, reptiles, terrestrial birds, and terrestrial invertebrates.[89]

Indigenous plants species are also at risk, particularly vascular plants, such as ferns, conifers, and flowering plants, of which almost half are either threatened with, or at risk of, extinction. Of considerable concern with regard to native plant species is the lack of data that is affecting our ability assess a species' endangerment level. Like invertebrates, plant diversity provides an indication of ecosystem health. Native animals and plants evolved side by side in the context of the natural environment of Aotearoa. It is no

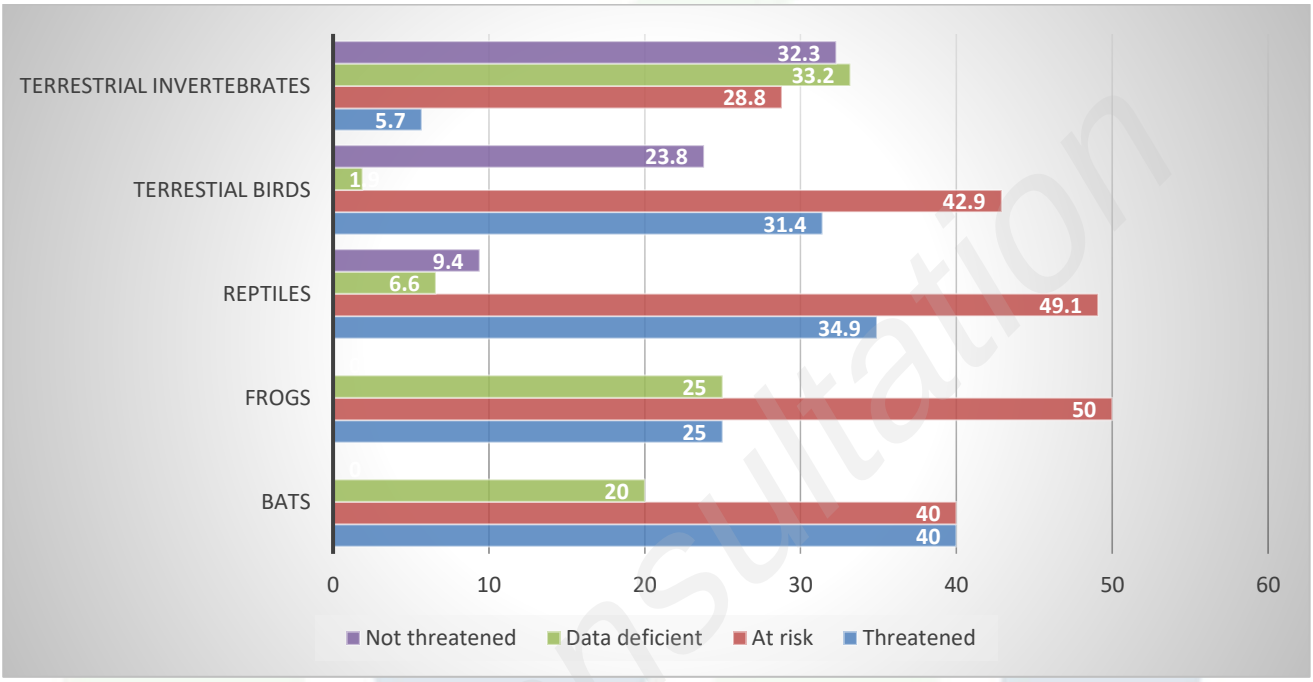
[86] NPSFM 2020, s2.2(6).
[87] Statistics New Zealand, 2021.
[88] Statistics New Zealand, 2020a.
[89] Statistics New Zealand, 2019.

surprise that the very best habitats and ecosystems for our native species are filled with a range and diversity of indigenous plants species.[90]

A number of at-risk native animals are known or suspected to be living in the environment surrounding Lake Onslow, including bird, fish, and lizard species, with the possibility that pekapeka may also be present.

Kā Rūnaka place great weight on efforts to protect native, taoka, and mahika kai species, not just as valued resources utilised by tūpuna in the past, but also as whanauka, connected to mana whenua by whakapapa to the times and the stories of the atua.

Tūtohi 6: Conservation status of native terrestrial species[91]



Central to the status of mana whenua and the exercise of rakatirataka over one's takiwā are the roles and responsibilities of Kā Rūnaka to protect and care for te taiao. The health and well-being of the environment is considered a strong indicator of the mana of the people. That the environment and waterways in their takiwā have become so degraded over the passing years is a source of great mamae for mana whenua.

Kā Rūnaka strongly assert that the activities proposed at Lake Onslow be undertaken in such a way as to protect these species, and to restore and retain their native habitats should the project proceed. Significant opportunities to improve the natural environment at Lake Onslow for our native species are available if there is only the willingness and foresight to do so.

Of particular concern is the impact of the proposed activities for the Teviot flathead galaxias, which is currently protected from predation by trout, in the tiny streams and tributaries around Lake Onslow. Without mitigation, the proposed inundation would likely lead to the extinction of this species, by flooding the tributaries and thus providing access to trout. It is vital that their survival is prioritised should the project proceed.

> *To ensure the survival of galaxiids, trout-free source populations must be maintained, and new sources created.*[92]

[90] Ibid.
[91] Ibid.
[92] Woodford & McIntosh, 2013, p. 18.

Within the impetus for Carbon Zero 2050 is not just our own survival as a species, but the survival of the indigenous species that surround us, and that live around Lake Onslow. In doing so, we will be able to work together to uphold the core values of mana and mauri in relation to te taiao.

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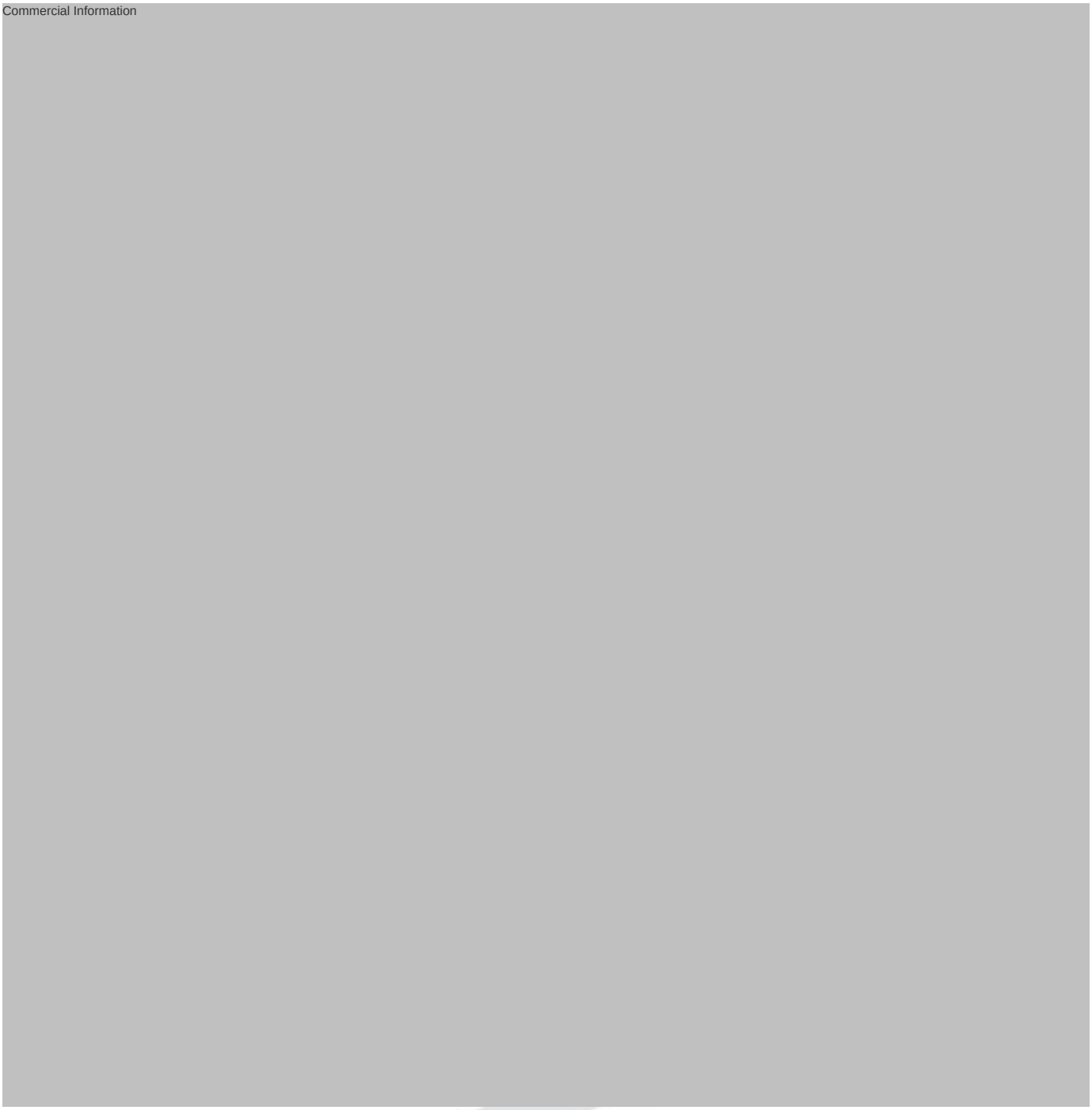

9.3 Archaeological values

Māori archaeological evidence in the proposed Lake Onslow inundation zone will be completely lost if not recovered prior to the proposed inundation. Moreover, given the abundance of known Māori archaeological sites in the immediate area, it is likely that more evidence is yet to be found.

Significant tracts of land appeared to have been meticulously assessed, particularly to the south of Te Awa Makarara, and west of Lake Onslow. North of the Makarara, very few sites have been identified, except for

[93] TRONT, 2021.

one, a silcrete blade found in 1978, about 18km west of the Lake Onslow Dam, further 'empty' tracts of land visible on all side of the lake itself (see Whakaahua 14 above).

Mana whenua are acutely aware that these are only the sites that have been found, while there are likely to be more sites yet to be discovered. Archaeological evidence provides further information about tūpuna and their daily lives, building the knowledge of mana whenua for the tasks and feats undertaken by their ancestors. The lessons of the original flooding of Dismal Swamp can still be seen in the archaeological record for this site, recorded in 1978, ninety years after the building of the first dam. At this stage, of course, there was no site left visible to examine.[94]

Kā Rūnaka strongly advocate that every measure available be taken to assess the inundation zone and surrounding affected areas, to identify archaeological evidence and sites, so this can continue to build our knowledge of the lives of tūpuna in the past. Given the remote location, and the likelihood that further archaeology will be present, Kā Rūnaka contend that an archaeologist be present for earthworks in all areas that are identified as high value by the archaeological and heritage assessment.[95] The preservation of the histories of tūpuna through archaeological evidence strongly support the core mana whenua values of whakapapa, mana, and tapu.

9.4 Equity values

Throughout the history of loss, a significant feature of the social and political landscape was the lack of equity in outcomes. For Māori, the history of inequity has been overwhelming, particularly in that these inequalities are still clearly identifiable today, through the health, welfare, education, and criminal justice statistics for Māori that we often see reported in the news. Opportunities for progress and success are usually handed down through families and communities, meaning that people who are not part of these communities often miss out.

Given the potential wide-ranging benefits available should the project proceed, it is vital that these are distributed equitably across the whole community, not just in employment, but through active engagement in all levels of the activity, including governance.

Since the gold rush days, many whanauka have taken advantage of employment opportunities in the hinterland of Te Waipounamu. Today, Kā Rūnaka want to see those opportunities elevated, providing a platform for the development and growth of their people through the acquisition of valued skills and experiences, and through to the action of mana and rakatirataka within their takiwā as mana whenua.

[94] Croad, 1978.
[95] Davies, Cropper, & Hurford, 2021.

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Appendix 1: Glossary of Māori terms

āhua	Nature, appearance
ahikāroa	title to land through longstanding occupation; literally 'the long-burning fires'
ara tawhito	ancestral trails
atua	deity, early ancestor
awa	river
heke	migration, movement
īnaka	whitebait
kāika	settlement(s)
kāika mahika kai	food gathering settlement(s)
kākahi	freshwater mussel
kāuru	edible parts of the cabbage tree
kai	food
kaitiaki whenua	caretakers of the land
kaitiakitaka	the exercise of guardianship by the mana whenua of an area in accordance with tikaka Māori in relation to natural and physical resources, and including the ethic of stewardship
kanakana	lamprey
kawa	accepted protocols
kō	digging stick
kōura	freshwater crayfish
korikori	hairy alpine buttercup, mountain buttercup
kukupako	black teal
mānia	Carex tussock
mātauraka	knowledge, wisdom, understanding
mahi	work, activities
mahika kai	practices, knowledge, and activities related to food gathering
mamae	pain, distress
mana	status, prestige, honour
mana whenua	customary authority exercised by an iwi or hapū in an identified area, and the people mandated to exercise it on their behalf
Mata-au	Clutha River
maumaharataka	the accumulated memories of whānau
mauri	life force, life essence
mokopuna	grandchildren, descendants

mōkihi	reed raft
nohoaka	temporary campsites
Ōkura	Beaumont River
Ōwheo	Leith River
pārera	grey duck
pāteke	brown teal
pātītī	red tussock
panapana	New Zealand bitter cress
papatipu rūnaka	entities mandated to uphold mana in their takiwā
pekapeka	New Zealand bat
pōhata	turnip
Pukemakamaka	Saddle Hill
Purehurehu	Hayward Point
pūtakitaki	paradise duck
rakatirataka	chiefly authority
rūnaka	council, board
takiwā	territory
taoka	treasure
taoka tuku iho	treasures handed down (by the ancestors)
tapu	spiritual restrictions
tautiakitaka	the act of protecting
Te Awa Makarara, Makarara	Teviot River
Te Papanui	Lammermoor Range
Te Paruparu-a-Te-Kaunia	Great Moss Swamp
te taiao	the natural environment
tikaka	correct procedure, correct method
tī kōuka	cabbage tree
totokipio	New Zealand dabchick
tuna	eel
tūpuna	ancestors
tūtohi	table (of data)
tūturiwhatu	banded dotterel
umu	oven
umu tī	oven used to preserve kāuru
wāhi mahika kai	food gathering sites

wāhi tūpuna	ancestral landscapes of significance to iwi
wai	water
Waihemo	Shag River
wai māori	freshwater
waka	canoe
weka	woodhen
whānau	extended family
whakaahua	image
whakapapa	genealogy
whakataukī	proverb
whakawhanaukataka	the process of building relationships
Whakatipu-waitai	Lake McKerrow
whanauka	relative, relatives
whanaukataka	a sense of family connection
whekau	laughing owl, now extinct
whenua	land
whio	blue duck

Appendix 2: List of Abbreviations

AHEC	Australian Hydro-Electric Corporation
DRP	dissolved reactive phosphorous
FME	Freshwater Management Unit
GHG	greenhouse gases
IHA	International Hydropower Association
LAWA	Land Air Water Aotearoa
MBIE	Ministry of Business, Innovation, and Employment
MfE	Ministry for the Environment
NZAA	New Zealand Archaeological Association
NZB	New Zealand Battery
NZHP	New Zealand Heritage Properties Ltd.
NNN	nitrite-nitrate nitrogen
NPSFM 202	National Policy Statement for Freshwater Management 2020
ORPW	Otago Regional Plan for Water
PORPS 2021	Proposed Otago Regional Policy Statement 2021
RMA 1991	Resource Management Act 1991
TRM	Te Rōpū Matatau
TRONT	Te Rūnanga o Ngāi Tahu