REPORT

Tonkin+Taylor

Proposed Manapōuri Lake Control Improvement Project

Resource Consent Applications and Assessment of Effects on the Environment

Prepared for
Meridian Energy Limited
Prepared by
Tonkin & Taylor Ltd
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Glossary of Key Terms Used in this Report

Abbreviation	Meaning
AEE	Assessment of Effects on the Environment (this report)
DFS	Deposited fine sediment
ES	Environment Southland
ESCP	Erosion and Sediment Control Plan
FNU	Formazin Nephelometric Unit; a measure of turbidity
LWR	Lower Waiau River
Meridian	Meridian Energy Limited (the applicant for resource consents)
MLC	Manapōuri Lake Control Structure
MPS	Manapōuri Power Scheme
MTAD	Manapōuri Tailrace Amended Discharge
MTADA	Manapōuri Te Anau Development Act 1963
NES-F	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NTFPS	Ngāi Tahu Freshwater Policy Statement
NTU	Nephelometric Turbidity Unit; a measure of turbidity
NPS-FM	National Policy Statement for Freshwater Management
NPS-REG	National Policy Statement for Renewable Electricity Generation
PSWLP	Proposed Southland Water and Land Plan
Project	Manapōuri Lake Control Improvement Project (MLCIP); the proposal subject to these resource consent applications
Protocol	Protocol for the Controlled Releases of Voluntary Supplementary Flows from the Manapouri Lake Control Structure (MLC) to the Lower Waiau River, Final 9 April 2013
RAP	Southland Regional Air Plan
RL m	Reduced Level metres – elevation relative to Deep Cove 1960 mean sea level datum
RMA	Resource Management Act 1991
RPS	Southland Regional Policy Statement
RWP	Southland Regional Water Plan
NTCSA	Ngāi Tahu Claims Settlement Act 1998
SSC	Suspended sediment concentration
VC	Visual clarity

Executive Summary

Background, and purpose of the Project

This Assessment of Effects on the Environment (AEE) has been prepared to support resource consent applications by Meridian Energy Limited (Meridian), under the Resource Management Act 1991 (RMA), for the Manapōuri Lake Control Improvement Project (MLCIP / the Project).

Meridian owns and operates the Manapōuri Power Scheme (MPS), the largest hydroelectric power station in New Zealand. The Manapōuri Lake Control (MLC) structure is located southeast of Lake Manapōuri, at the confluence of the Waiau and Mararoa Rivers, forming the downstream control of the outlet of Lake Manapōuri. The MLC is a key component of the MPS and is essential to the operation and management of the scheme.

Meridian releases flows through the MLC to the Lower Waiau River (LWR) in accordance with existing resource consent conditions, and a protocol for the controlled release of supplementary flows. Flows released into the LWR by Meridian are characterised by volume and purpose, and include flood flows, recreational flows, and flushing flows. Each flow release has some benefits for river health.

The current channel depth and alignment, and accumulated bed material and gravel in the Waiau Arm, immediately upstream of the MLC, have been identified as a physical constraint detrimentally affecting the conveyance and reliability of providing flows, particularly flushing flows.

The Project seeks to improve flow conveyance and reliability through the MLC for the benefit of freshwater values in the LWR. The proposal is predicted to increase flushing flow reliability to approximately 70% from the existing 30% reliability.

Project description

The proposal involves the construction of a new channel which is parallel to, and outside the permanently active bed of, the current main channel in the Waiau Arm. Approximately 225,000 m^3 of gravel and bed material, over a length of approximately 1 km, will be excavated and disposed of on Meridian-owned land near the new channel.

The “parallel channel” option has been selected following a robust assessment of alternatives and advice from multiple technical specialists. It has been selected as it achieves the Project purpose while minimising the duration of works within the wetted channel of the Waiau Arm. As such, it has been assessed as the least effects option. That is, this option will minimise the release of suspended sediment to the LWR during the excavation works, while appropriately managing all other environmental effects.

Subject to obtaining resource consents, and to hydrological conditions, Meridian proposes to undertake the works within a 10-month window of January to October 2025. Works will be deferred to a subsequent year in the same period if conditions are unsuitable or resource consents are not obtained in time to meet the 2025 window.

The overall construction period within the January to October window is envisaged to be approximately 4 – 5 months. Within the normal operating range of the lake, the up and downstream cuts to connect the parallel channel to the current permanent bed and channel are the only excavation works which require activities in water. These are anticipated to take approximately 5 weeks if undertaken simultaneously. Out of channel excavation works are anticipated to take approximately 10 weeks. The remainder of the construction window is required for establishment, disestablishment, and rehabilitation activities. Works are proposed on a 7-days per week and up to 24 hours per day basis.

The channel excavation works are targeted to the time of year when hydrological conditions are likely most favourable for safe and efficient delivery of the work. The construction window has also been identified to limit disruption to Meridian's monitoring requirements under existing resource consent conditions.

Once constructed, periodic maintenance of the new parallel channel and the Waiau Arm channels above and around MLC will be required (however, this is expected to be infrequent).

Resource consents sought

Meridian seeks resource consents from Environment Southland for the construction, operation, and maintenance of the Project, namely:

- A water permit under Section 14 of the RMA to:
  - Temporarily take, divert, and use water for the purposes of facilitating construction and maintenance activities, including within and in proximity to wetlands and for dewatering, dust suppression, and erosion and sediment control activities, and
  - Permanently divert surface water into the parallel channel.
- A discharge permit under Section 15 of the RMA to:
  - Temporarily discharge water and suspended sediment to land and water (the Waiau Arm and Lower Waiau River) for the purposes of facilitating construction and maintenance activities, including within and in proximity to wetlands and for dewatering, dust suppression, and erosion and sediment control activities.

Overall, the proposal has been assessed to be a non-complying activity under the Proposed Southland Water and Land Plan (PSWLP).

The Project involves a number of land use activities, including within the bed of a lake (the Waiau Arm), which would ordinarily be subject to Sections 9 and 13 of the RMA. However, under Section 4 of the Manapōuri Te Anau Development Act 1963 (MTADA), Meridian is authorised to undertake certain activities which are necessary or requisite to the operation of the MPS or ancillary works. Under that authority Meridian is not seeking land use resource consents for the Project, however, the environmental effects associated with these activities have been robustly assessed in this AEE and will be appropriately managed.

Assessment of effects and mitigation measures

The Project will achieve positive effects and beneficial river health outcomes for the LWR by improving the conveyance and reliability of flows, including flushing flows and recreational flows. Any adverse effects of the proposed activities have been assessed as being no more than minor, subject to recommended measures to avoid, remedy or mitigate those effects. A suite of volunteered conditions has been prepared which addresses those measures.

The table overleaf provides a summary of the key adverse effects and mitigations proposed.

Summary of key environmental adverse effects and mitigations proposed

Potential Effect	Description	Mitigation Proposed
Cultural	• Potential effects on values identified in Te Tangi a Tauira – The Cry of the People, including effects on water quality and ecology, due to temporary discharge of suspended sediment.	• Proposed mitigation measures for other effects associated with the Project (in particular those addressing hydrology and water quality) will support the mitigation of potential adverse cultural effects; and • Ongoing engagement with TAMI throughout the Project to understand and appropriately monitor potential effects.
Hydrology and water quality	• Temporary suspended sediment discharges during construction activities.	• Parallel channel methodology limits duration of activities in flowing water; and • Adherence to thresholds for suspended sediment and deposited fine sediment during construction.
Geology and hydrogeology	• Temporary effects from the take of water for dewatering and dust suppression activities.	• Take is temporary and largely non-consumptive; and • Negligible effect on neighbouring water supplies and adjacent wetlands.
Terrestrial vegetation	• Removal of exotic grassland and crack willow tree land.	• Rehabilitation of disturbed areas at completion.
Wetlands	• Works in proximity to wetlands; and • Permanent loss of one low-value palustrine wetland (122 m^2) and partial areas of lacustrine wetland.	• Maintaining 10 m setbacks for wetlands (with the exception of the identified areas to be lost); and • Robust erosion and sediment management controls to prevent sediment discharges to the wetlands.
Freshwater ecology (plant communities, macrophytes, fish, phytoplankton, birds)	• Temporary suspended sediment discharges during construction activities; • Stranding of fish in lacustrine channel or outside of Project area; • Following construction, water volume reduction in the existing channels of the Waiau Arm during low lake levels may increase risk of phytoplankton blooms; and • Disturbance of nesting birds.	• Measures as per "Hydrology and water quality" above; • Implement a Freshwater Fauna Management Plan to apply during the construction phase including methods to avoid and minimise effects; • Maintaining flows (including flushing flows) down the Waiau Arm during construction, improved flushing flows after construction, and maintaining monitoring programmes under existing resource consents; and • Avoiding work in or near bird nesting areas during nesting season.
Landscape and visual values	• Temporary visual effects during construction works; and • Changes to the natural character and landscape of the site.	• Topsoil stripped and stockpiled; to be used for rehabilitation at the conclusion of Project; replanting in pasture grass at next growing season; • Landforms and structures to be shaped and contoured to be sympathetic to surrounding environment; and
Recreation	• Provision of recreational flows.	• Meridian will maintain existing recreational flows on the fourth Sunday of the month, October – April.
Amenity	• Temporary construction effects including noise, vibration, lighting, and dust.	• Implement a Construction Noise Management Plan; • Dust suppression if required; and • Compliance with the relevant vibration and lighting standards.

Consultation and engagement

Meridian has undertaken engagement regarding the Project, including a number of in-person meetings and written communications with stakeholders throughout 2022 and 2023. Stakeholders engaged with include Te Ao Mārama Incorporated, Southland Fish and Game Council, Waiau Working Party, Waiau Rivercare Group Inc, Guardians of Lakes Manapōuri, Monowai and Te Anau, Department of Conservation, RealNZ Limited, Jet Boating New Zealand (JBNZ) Southland Branch, and adjacent landowners.

Most groups engaged with were generally supportive of the Project's aims and raised questions regarding the methodology and design. Where possible these issues have been addressed through the Project design and in this AEE. Some issues raised by stakeholders fell outside of the scope of the Project and are more appropriately addressed through other resource management processes, such as Environment Southland's Plan Change Tuatahi.

Meridian requests full public notification of the resource consent applications. Stakeholders and any interested parties will therefore have the opportunity to provide feedback for formal consideration.

Statutory assessment and overall conclusion

This Project is necessary and requisite to the operation of the MPS or ancillary works, and so certain aspects are authorised under MTADA rather than the RMA. Pursuant to the RMA, the works are consistent with the purpose and principles of the RMA and not contrary to the relevant objectives and policies of the regional planning documents. The adverse effects of the Project have, subject to the volunteered consent conditions, been assessed as no more than minor. The Project achieves positive effects through improved flow delivery and river health outcomes for the LWR.

The Project therefore meets both "gateway" tests, under section 104D(1) of the RMA, for the granting of resource consents as a non-complying activity (noting that only one arm of this test needs to be met in order for the gateway to be passed through).

Schedule 4 Requirements

Schedule 4 of the RMA sets out the information required in an application for a resource consent. All relevant matters required to be included have been addressed in the assessments and descriptions in this AEE. The following table provides a summary of the information required in Schedule 4 and a quick reference to its location in this report.

Schedule 4 Item	Location within report
A description of the activity	Section 5
A description of the site at which the activity is to occur	Section 4
The full name and address of each owner or occupier of the site	Application Forms (Appendix A)
A description of any other activities that are part of the proposal to which the application relates	Section 5
A description of any other resource consents required for the proposal to which the application relates	Section 6
An assessment of the activity against the matters set out in Part 2	Section 9
An assessment of the activity against any relevant provisions of a document referred to in section 104(1)(b). This must include: • Any relevant objectives, policies, or rules in a document • Any relevant requirements, conditions, or permissions in any rules in a document • Any other relevant requirements in a document (for example, in a national environmental standard or other regulations)	Section 9
An assessment of the activity's effects on the environment that includes the following information:	
• If it is likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity.	Although the adverse effects are not considered significant, alternatives are addressed in Section 3
• An assessment of the actual or potential effect on the environment of the activity.	Section 7
• If the activity includes the use of hazardous installations, an assessment of any risks to the environment that are likely to arise from such use.	Section 5
• If the activity includes the discharge of any contaminant, a description of— – The nature of the discharge and the sensitivity of the receiving environment to adverse effects; and – Any possible alternative methods of discharge, including discharge into any other receiving environment.	Sections 3, 4 and 7
• A description of the mitigation measures (including safeguards and contingency plans where relevant) to be undertaken to help prevent or reduce the actual or potential effect.	Sections 7 and 8
• Identification of the persons affected by the activity, any consultation undertaken, and any response to the views of any person consulted.	Section 10

Schedule 4 Item	Location within report
• If the scale and significance of the activity's effects are such that monitoring is required, a description of how and by whom the effects will be monitored if the activity is approved. • If the activity will, or is likely to, have adverse effects that are more than minor on the exercise of a protected customary right, a description of possible alternative locations or methods for the exercise of the activity (unless written approval for the activity is given by the protected customary rights group).	Section 8 n/a
An assessment of the activity's effects on the environment that addresses the following matters: • Any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects. • Any physical effect on the locality, including any landscape and visual effects. • Any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity. • Any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations. • Any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants. • Any risk to the neighbourhood, the wider community, or the environment through natural hazards or hazardous installations.	Section 7
For applications involving permitted activities	
If any permitted activity is part of the proposal to which the application relates, a description of the permitted activity that demonstrates that it complies with the requirements, conditions, and permissions for the permitted activity (so that a resource consent is not required for that activity under section 87A(1)).	Section 6 (refer Section 2.2 and 6.2 for application of the Manapōuri Te Anau Development Act 1963)

1 Introduction

1.1 Purpose of this report

This Assessment of Effects on the Environment (AEE) report has been prepared on behalf of Meridian Energy Limited (Meridian) to support resource consent applications to authorise the Manapōuri Lake Control Improvement Project (MLCIP or the Project). The AEE has been prepared in fulfilment of section 88 of the Resource Management Act 1991 (RMA).

1.2 Meridian Energy Limited (the applicant)

Meridian is a mixed ownership model company. It is approximately 51% owned by the Crown, and is dual listed on the New Zealand Stock Exchange (NZX) and the Australian Securities Exchange (ASX).

Meridian generates electricity exclusively from renewable sources, using its hydro and wind assets. The company owns and operates seven hydro power stations and one wind farm in the South Island, and a further four wind farms in the North Island. Meridian is currently constructing an additional windfarm in Hawkes Bay and a grid connected Battery Energy Storage System in Northland. Meridian sells electricity to the industrial, business, agricultural and residential markets through multiple channels, including its Meridian Retail brand and Powershop (a wholly owned subsidiary of Meridian).

Meridian owns and operates the Manapōuri Power Scheme (MPS), the largest hydroelectric station in New Zealand. The catchment area for the scheme includes Lakes Manapōuri and Te Anau, and the Mararoa River catchment. The MPS utilises rainfall and a relatively small amount of snow melt that falls in the Te Anau and Manapōuri lake catchments, and water that is diverted into Lake Manapōuri from the Mararoa River catchment at the Manapōuri Lake Control Structure (MLC). Water stored in Lake Manapōuri is used to generate electricity at the underground station at West Arm, which discharges into Deep Cove in Doubtful Sound.

1.3 Purpose of the Project

Meridian releases flows through the MLC to the Lower Waiau River (LWR) in accordance with existing resource consent conditions, and a protocol for the controlled release of supplementary flows. Flows released into the LWR by Meridian are characterised by volume and purpose, and include flood flows, recreational flows and flushing flows to assist in the management of periphyton in the LWR.

The current channel depth and alignment, and the accumulation of bed material and gravel in the Waiau Arm, immediately upstream of the MLC, have been identified as the primary physical constraints affecting the conveyance and reliability of providing flows, particularly flushing flows to the LWR.

The Project will achieve better outcomes for river health in the LWR by improving flow conveyance and reliability through the MLC. This will be accomplished by constructing a new and deeper channel adjacent and parallel to the Waiau Arm upstream of the MLC. Once constructed, periodic maintenance of the new parallel channel and the Waiau Arm channels above and around MLC will be required (however, this is expected to be infrequent).

1.4 Overview of the proposed activities

The Project will involve the construction of a new channel which is parallel to the current main channel in the Waiau Arm. This channel will largely be outside the current permanent active bed and channel of the Waiau Arm. Approximately 225,000 m^3 of gravel and bed material will be excavated and disposed of on Meridian-owned land near the new channel. Figure 1.1 overleaf provides an overview of the Project and key site features.

The "parallel channel" option has been selected following a robust assessment of alternatives and advice from multiple technical specialists. It has been selected as it achieves the Project purpose while minimising the duration of works within the wetted channel of the Waiau Arm. As such, it has been assessed as the least effects option. That is, this option will minimise the release of suspended sediment to the LWR during the excavation works, while appropriately managing all other environmental effects.

Subject to obtaining resource consents, and to hydrological conditions, Meridian proposes to undertake the works within a 10-month window of January to October 2025. Works will be deferred to the same period in a subsequent year if conditions are unsuitable or resource consents are not obtained in time to meet the 2025 window.

The overall construction period within the January to October window is envisaged to be approximately 4 – 5 months. Within the normal operating range of the lake, the up and downstream cuts to connect the parallel channel to the current permanent bed and channel are the only excavation works which require activities in water. These are anticipated to take approximately 5 weeks if undertaken simultaneously. Out of channel excavation works are anticipated to take approximately 10 weeks. The remainder of the construction window is required for establishment, disestablishment, and rehabilitation activities. Works are proposed on a 7-days per week and up to 24 hours per day basis.

The channel excavation works are targeted to the time of year when hydrological conditions are likely most favourable for safe and efficient delivery of the work. The construction window has also been identified to limit disruption to Meridian's monitoring requirements under existing resource consent conditions.

A full description of the proposed activities is set out in Section 5 of this report.

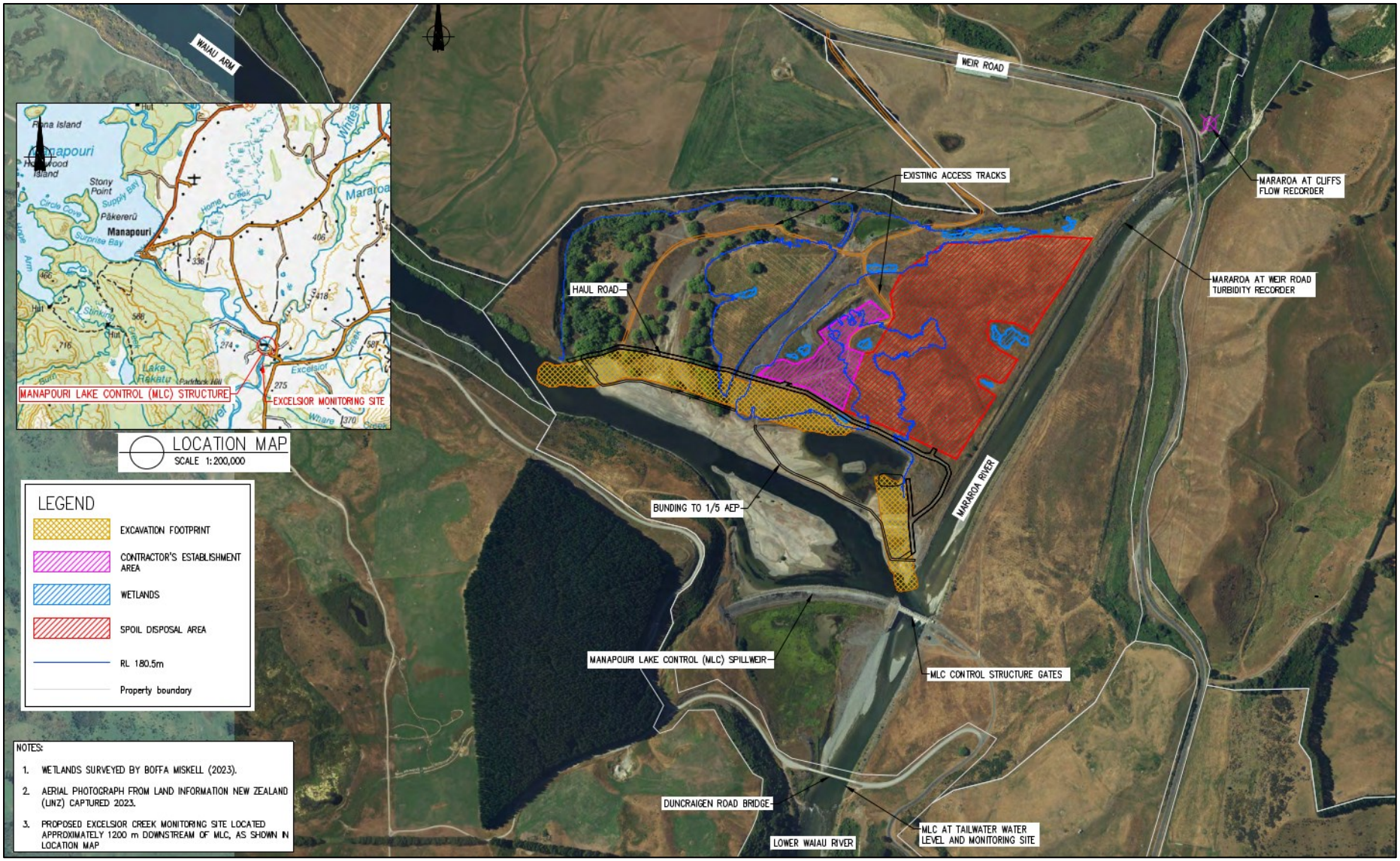

Figure 1.1: Project Overview.

1.5 Overview of resource consent requirements

Meridian seeks resource consents from Environment Southland for the construction, operation, and maintenance of the Project, namely:

- A water permit under Section 14 of the RMA to:
  - Temporarily take, divert, and use water for the purposes of facilitating construction and maintenance activities, including within and in proximity to wetlands and for dewatering, dust suppression, and erosion and sediment control activities; and
  - permanently divert surface water into the parallel channel.
- A discharge permit under Section 15 of the RMA to:
  - Temporarily discharge water and suspended sediment to land and water (the Waiau Arm and Lower Waiau River) for the purposes of facilitating construction and maintenance activities, including within and in proximity to wetlands and for dewatering, dust suppression, and erosion and sediment control activities.

The Project involves a number of land use activities, including within the bed of a lake (the Waiau Arm), which would ordinarily be subject to Sections 9 and 13 of the RMA. However, under Section 4 of the Manapōuri Te Anau Development Act 1963 (MTADA), Meridian is authorised to undertake certain activities which are necessary or requisite to the operation of the MPS or ancillary works. Under that authority Meridian is not seeking land use resource consents for the Project. However, the environmental effects associated with these activities have been robustly assessed in this AEE and will be appropriately managed.

Further details of MTADA are contained in Section 2.2 of this report. A full description of the resource consent requirements of the Project, including how MTADA applies to certain activities, is contained in Section 6. Resource consent application forms are included in **Appendix A**.

1.6 Consent duration and lapse

Although the construction period is expected to take approximately 10 months, the resource consents are sought for a 35-year term. This will provide for any ongoing maintenance activities associated with the parallel channel and the Waiau Arm channels above and around MLC. The 35-year term also allows for the permanent partial diversion of water into the parallel channel.

The default lapse period of 5 years is sought for both resource consents.

1.7 Content of this AEE

The remainder of this report:

- Describes the background to the MPS, MLC and Project (Section 2);
- Explains the option selection process (Section 3);
- Describes the site and existing environment (Section 4);
- Describes the proposed activities associated with the Project (Section 5);
- Outlines the resource consent requirements, including how MTADA applies (Section 6);
- Assesses the actual or potential effects on the environment (Section 7);
- Provides volunteered consent conditions (Section 8);
- Assesses the Project against the relevant statutory documents (Section 9);
- Describes the consultation and engagement undertaken (Section 10); and
- Provides an overall conclusion (Section 11).

Table 1.1 identifies the information which is appended to and forms part of this AEE and is subsequently referred to throughout this report.

Table 1.1: Information appended to this AEE

Appendix	Description	Author
A – Application Forms	The completed application forms for the resource consents sought	n/a
B – Record of title	Record of title for the MLC site	n/a
C – Construction Methodology	Detailed construction methodology for the proposed activities subject to this AEE	Damwatch Engineering Limited
D – Freshwater Assessment	Effects on hydrology and water quality, plant communities, macroinvertebrates, fish, and birds	NIWA
E – Phytoplankton Risk Assessment	Assessment of risk of phytoplankton blooms in the Waiau Arm immediately upstream of the MLC following excavation of a new parallel channel	NIWA
F – Terrestrial Vegetation, Wetland Assessment & Freshwater Advice on Construction Effects	Effects on terrestrial vegetation and wetlands in and within the vicinity of the Project area including freshwater advice on managing construction effects	Boffa Miskell Limited
G – Groundwater Assessment	Effects on the hydrogeological environment, particularly regarding potential dewatering activity	Land Water People
H – Landscape Assessment	Effects on natural character, rural character, and landscape and visual values	Boffa Miskell Limited
I – Construction Noise Assessment	Effects of construction noise on sensitive receptors	Marshall Day Acoustics Limited
J – Objectives and Policies assessment	Assessment of the Project against the relevant objectives and policies of relevant statutory documents	Tonkin + Taylor

2 Background

2.1 Manapōuri Power Scheme (MPS)

The MPS draws on water in Lakes Manapōuri and Te Anau, and the Mararoa River. The scheme utilises rainfall and a relatively small amount of snow melt that falls in the Te Anau and Manapōuri lake catchments, and water that is diverted into Lake Manapōuri from the Mararoa River catchment at the MLC. Water in Lake Manapōuri is used to generate electricity at the underground station at West Arm, which discharges into Deep Cove in Doubtful Sound.

The physical infrastructure central to the MPS consists of the Manapōuri Power Station located at West Arm, the Te Anau Lake Control structure located at the southern end of Lake Te Anau at the outlet to the Upper Waiau River, and the MLC located at the confluence of the Waiau and Mararoa Rivers. Together these enable the levels of Lake Te Anau and Lake Manapōuri to be managed to enable generation of power through the hydro scheme while complying with regulations associated with the operation of the MPS. Construction of the MPS began in 1964, with the first power generated through the station in 1969. It became fully operational in 1972. Construction of the MLC was completed in 1976.

The MPS is operated in accordance with the Operating Guidelines for Lakes Manapōuri and Te Anau (the Guidelines) which were set in place under Section 4A of MTADA and were gazetted on 21 November 2002. Under Clause (1) of Section 4A, the Guidelines are for "*…the levels of those lakes aimed to protect the existing patterns, ecological stability,* and *recreational values of their vulnerable shorelines* and to *optimise the energy output of the Manapouri power station".*

Meridian holds a suite of resource consents for water takes, diversions, and discharges associated with the MPS infrastructure. The MPS is required to operate in accordance with the operational resource consents granted in 1996 and in 2010 for the Manapōuri Tailrace Amended Discharge (MTAD). The resource consents set flow requirements to the LWR for a range of purposes already identified. Further details on these consents are contained in Section 6.

2.2 Manapōuri Te Anau Development Act 1963 (MTADA)

As indicated above, the MPS is also operated and regulated in accordance with the Guidelines promulgated pursuant to section 4A of the MTADA.

The key MTADA authorisation is contained in Sections 4 and 4A of MTADA. Section 4 authorises the operator of the MPS (Meridian) to "*…erect, construct, provide, use, and operate all works, appliances, and conveniences which may be necessary or requisite…"* to the operation of the MPS or ancillary works.

Meridian is therefore not required to seek resource consents for certain activities which would otherwise be regulated through the RMA[1]. An assessment of the activities associated with this Project which are authorised under MTADA rather than under the RMA is set out in Section 6 of this AEE.

Notwithstanding that land use consents are not being sought, the potential effects resulting from these activities have still been assessed and described in this AEE and will be managed appropriately.

[1] Activities regulated under sections 9, 12, 13, 15(1)(c) and (d), and 15(2A).

2.3 Manapōuri Lake Control structure (MLC)

The MLC is located south-east of Lake Manapōuri, at the confluence of the Waiau and Mararoa Rivers, forming the downstream control of the outlet of Lake Manapōuri. The MLC is essential to the operation and management of the MPS as it assists with managing the level of Lake Manapōuri, diverts water from the Mararoa River into Lake Manapōuri for hydro-electric generation, and releases water to the LWR, in accordance with MPS resource consents. The MLC is also necessary to enable the meeting of and providing for the release of flows including for minimum flows, recreational flows, and flushing flows. The land for the MLC is held in fee simple title and owned by Meridian.

In the early years after the MLC's construction in 1976, the diversion of turbid sediment-laden flood flows from the Mararoa River to Lake Manapōuri caused adverse effects and operational problems including sediment deposition within the Waiau Arm immediately upstream of the MLC. To address this, in 1987 a new outlet for the Mararoa River was excavated to its present-day course, discharging the river directly through the MLC gates. Figure 2.1 identifies the former and present day Mararoa River alignment upstream of MLC.

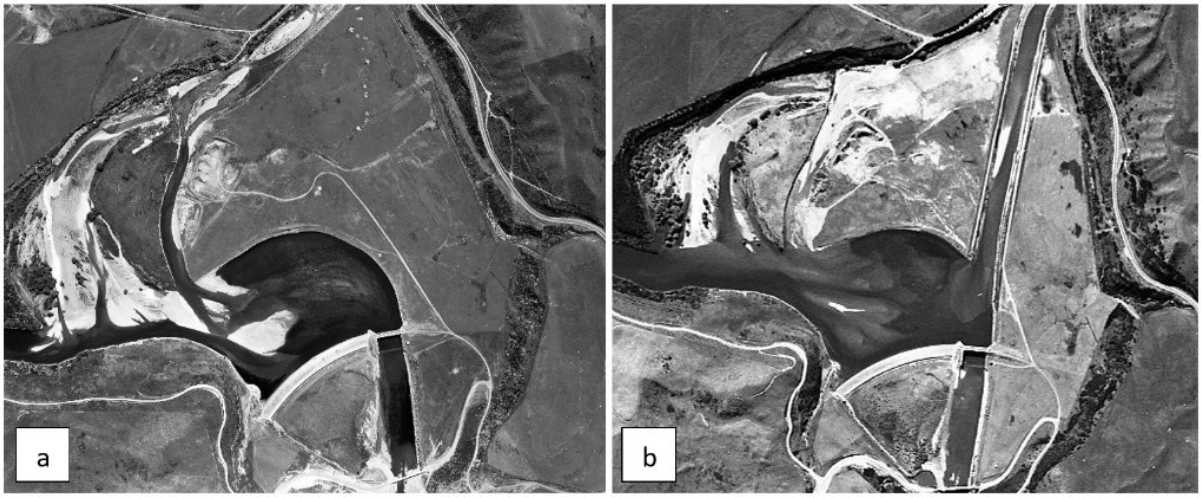

Figure 2.1: Historical aerial photographs - (a) 1986, showing Waiau-Mararoa confluence upstream of MLC, (b) 1989, showing realigned Mararoa outlet directly above the control gates (Source: Appendix C).

The MLC structure consists of four large radial control gates which can be lowered or raised depending on the requirements at the time. A fish pass is located on the true-left bank of the MLC structure within the large radial control gate. A weir adjacent to the MLC structure helps pass flood flows from Lake Manapōuri via the Waiau Arm over the structure.

Meridian holds resource consents from ES for the purpose of carrying out various maintenance activities at the MLC (Consent No. 204160). These consents expired on 11 December 2021, but an application lodged within 6 months of expiry has allowed maintenance activities to continue while the application is being processed. Draft conditions for the replacement consents are currently under review. The existing consents have 18 conditions which manage the environmental effects of the maintenance works. This includes mitigation measures for works within the waterway and water quality standards (among others). The Project falls outside the scope of the existing consent 204160 and the replacement consent which has been sought.

2.4 Supplementary flow constraints analysis

A supplementary flow (or a 'flushing flow') is a deliberate flow which is released from Lake Manapōuri through the MLC, for discharge into the LWR to help mitigate the effects of nuisance periphyton in the LWR. This is achieved under a Protocol[2], in place since 2013, for managing flushing flows which forms part of its operating consents[3]. The Protocol provides for the release of up to five flushing flows during the summer months (between November and May), in response to "red status", where instream surveys identify high periphyton biomass.

An effective flushing flow has a peak discharge above 160 m^3/s and a 24-hour average discharge of at least 120 m^3/s. Operating experience indicates that Lake Manapōuri must be at or above RL 177.69 m to pass a flow of ~160 m^3/s via the MLC with the control structure gates fully open and not controlling the discharge.

The ability to provide between four and five flushing flows each summer, as anticipated by the Protocol, has been constrained by a low level of reliability of flow release. This in part has been a result of the flows in response to red status during warmer summer months coinciding with low lake levels, and due to the inability to pass sufficiently large volumes of water down the Waiau Arm channel and through the MLC structure in accordance with the Protocol.

A computational hydraulic model of the Waiau Arm channel (using the bathymetry as surveyed in 2020) was developed to investigate the flow and conveyance capacity through the Mararoa delta area. The modelling showed that the Waiau Arm and MLC system does not have the conveyance capacity to pass the desired flushing flow volumes at low Lake Manapōuri levels. A key reason for this is the headloss in the shallower 1000 m long reach of the Waiau Arm through the historical Mararoa delta area upstream of MLC.

Figure 2.2 shows the 2020 bathymetric survey data of the Waiau Arm channel above the MLC, which indicates there are significantly raised bed levels in the Waiau Arm channel closer to the MLC compared to the channel upstream.

Identifying this, Damwatch modelled different scenarios exploring a channel excavated through the Maraora delta area. Modelling showed that excavation of a channel, with a base width of 16 m at RL 172.0 m, would allow 160 m^3/s to be released at a Lake Manapōuri level of approximately RL 177.28 m. A channel excavated to this depth has been modelled to improve flushing flow reliability to approximately 70% from the existing 30% reliability, based on the record of 'red status' in the LWR from 2015 to 2021 and coincident lake levels.

Further background can be found in Damwatch's report in **Appendix C** of this AEE.

[2] *Protocol for the Controlled Releases of Voluntary Supplementary Flows from the Manapouri Lake Control Structure (MLC) to the Lower Waiau River*, Final 9 April 2013.

[3] The Protocol is required under Condition 7 of ES Consent 206156-V4.

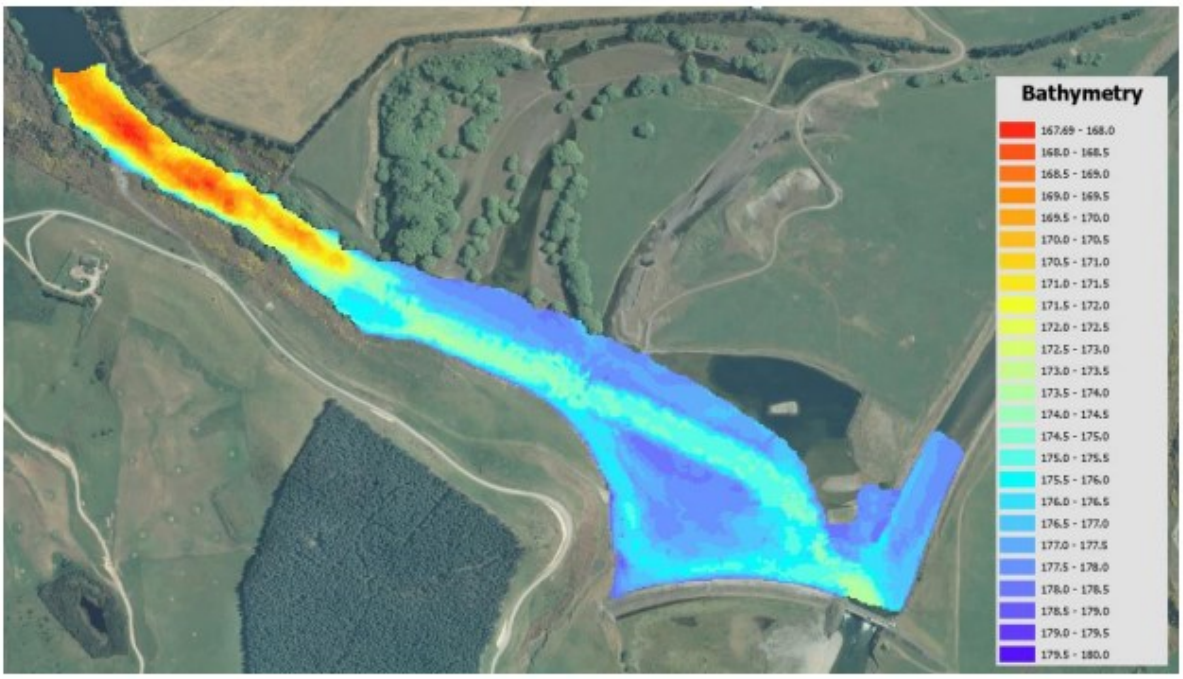

Figure 2.2: 2020 Bathymetric survey data of Waiau Arm channel through the Mararoa Delta area illustrating buildup of gravel in the Waiau Arm above the MLC (source: Appendix C).

2.5 Trial investigations

Deepening the existing channel, as indicated by the flushing flows constraints analysis, would require removal of bed material from the Waiau Arm, including potentially in areas which are frequently under water. To better understand the bed material, the potential effects of sediment generation, and to further assist with the development of the construction methodology, Meridian undertook trial investigations. These investigations fell within the scope of the existing MLC maintenance consents. In particular, Consent 204160 (from ES) allows for routine maintenance activities to the MLC structure and in the surrounding river beds.

The trial investigations were undertaken in February 2023. The purpose of the trials was to:

a Assess the ability to excavate the bed material from a bund platform to target the proposed channel excavation depths;

b Investigate the possible volume and composition of fine sediment in the parallel channel; and

c Better understand the nature and characterisation of channel substrate material within the proposed excavation footprint.

The trial involved the construction of bunds and the excavation of bed material at three locations along an approximately 900 m stretch of the Waiau Arm.

To assist with understanding the effects of sediment, Meridian engaged NIWA to quantify the suspended sediment generated from the trial works as measured at Duncraigen Bridge, approximately 375 m downstream of the MLC gates. Monitoring comprised:

- Periodic observations of visual clarity (VC) and suspended sediment concentration (SSC) in the LWR at Duncraigen Bridge;
- Continuous recording of turbidity using a bank-attached turbidity sensor located approximately 50 m downstream of Duncraigen Bridge, and

- Visual estimates of net changes in deposited fine sediment (DFS) at six locations between the MLC and the turbidity recorder.

The SSC and VC observations were used to establish relationships with turbidity. This was used to generate a continuous record of SSC and VC for the period of the trial.

In summary, the trials concluded:

a The bed material is sufficient to support the excavator machinery proposed for the Project;

b Bund construction and removal, and excavation of bed material, causes rapid increases in SSC and decreases in VC (there appeared to be little increase in DFS, but the results were inconclusive); and

c River substrate was highly variable across the site, ranging from sandy gravels to silts and clays.

The trials led to Meridian further investigating the construction options available to reduce the generation of sediment. These options are discussed in the following section.

3 Preferred Option Selection

3.1 Overview

Meridian has carried out a robust assessment of alternative options for completing the Project, before arriving at the form of the Project as described in this AEE. This chapter summarises the process followed in considering alternatives.

As a permit for the discharge of sediment is being sought, Section 105 of the RMA requires a description of the possible alternative methods of discharge, including discharge into any other receiving environment, and for a consent authority to have regard to these factors when making a decision.[4] Detailed consideration has been given to methods for addressing any potential adverse effects of these discharges, and appropriate methods have been adopted (including through design and construction methods and conditions of consent) to ensure effects are appropriately managed.

Schedule 4 of the RMA requires that alternative locations or methods of undertaking an activity be described, where the proposed activity is likely to have any significant adverse effects on the environment. The potential adverse effects of this Project have been assessed as no more than minor overall (refer Section 7). Although it follows that a description of the possible alternative locations or methods for undertaking the activity is not legally required, Meridian has undertaken an alternatives assessment as part of optioneering and scoping of the Project, and as part of the alternative discharge method analysis.[5]

We note that, given the nature and purpose of the Project, any new channel by necessity needs to be located within the Waiau Arm. The analysis of alternatives has therefore focussed on where a channel should be within this area, and the construction methodology which gives the lowest and least potential for discharges of suspended sediment.

The report by Damwatch in **Appendix C** contains more detailed information and background to the option selection process.

3.2 Options workshops

A high-level options workshop was undertaken in May 2022 to determine the best methodology for the proposal against multiple criteria. A range of options were considered, all of which involved potential works within the wet channel of the existing Waiau Arm. An outcome of the May 2022 workshop was to undertake the trial investigations to confirm the characteristics of the bed materials within the Waiau Arm, and to assess the potential for sediment to be generated as a result of works within the wet channel (see Section 2.5 of this AEE).

The results of the trial were analysed, and then discussed in a second options workshop held in May 2023. Two primary options were shortlisted following the trial investigations:

1 An ‘in-stream option’ involving the excavation of material directly from the wetted area of the Waiau Arm; and

2 A ‘parallel option’ consisting of the construction of a new channel adjacent to the existing Waiau Arm, but principally outside the existing wetted area.

Alongside Meridian representatives who provided guidance on the internal and operational matters associated with the Project and the MPS, workshop participants included technical experts covering a variety of relevant fields, including experts from:

[4] Clause 6(d)(ii) of Schedule 4 and Section 105 of the RMA.

[5] Subject to the constraint that the works would need to be located in the Waiau Arm, in order to remove the physical constraint to flow conveyance through the MLC.

- Damwatch Engineering Limited, who have significant experience and familiarity with the Waiau Arm and in engineering more generally;
- Boffa Miskell Limited, who provided guidance and insight into terrestrial vegetation, wetland ecology, and landscape and visual effects;
- NIWA, who have significant experience and familiarity with the Waiau Arm, its biota, water quality and monitoring; and
- Tonkin & Taylor Limited, who provided statutory planning guidance.

Each option was assessed against the same criteria in respect of potential effects and consenting risks. The assessment covered:

- Hydrology (including high flows, minimum flows and hydraulically connected water);
- Sediment control, methodology and management;
- Plant communities (macrophytes, periphyton and phytoplankton);
- Macroinvertebrates;
- Fish (including effects of elevated sediment, fish passage, fish migration and fish communities);
- Wetlands (onsite and offsite);
- Birds (including nesting areas);
- Landscape and visual impacts;
- Cultural values;
- Construction effects (including dust management, contaminant spills and management, noise management and light spill); and
- Existing consent conditions (trap and transfer programme, fish pass management, salmonids, water quality monitoring, periphyton and recreational flow management).

Further details of the options assessed are provided in the following sections.

3.3 Instream option (including sub-options)

The instream option involved the direct removal of gravel and accumulated material in the existing Waiau Arm, including in areas which frequently submerge underwater (depending on lake levels). Several methodology options for the excavation were considered as identified in Table 3.1.

Of the instream methodology sub-options, excavators operating from the banks was considered the most preferred solution. This methodology would involve working in both an ‘upstream’ and ‘downstream’ reach separated by a diversion bund. In the upstream reach, finger bunds would be installed at regular intervals along the Waiau Arm, with excavation occurring in the still water between the bunds. The bunds would be progressively removed, and the process repeated as works migrated downstream. In the downstream reach, work would primarily occur behind the diversion bund and not require the same extent of finger bunding. Figure 3.1 illustrates the ‘instream methodology’ considered.

It was estimated that construction of the instream option would take approximately 3-5 months, with most of this being within the wetted area of the Waiau Arm. The total volume of gravel requiring removal was estimated at about 100,000 m^3.

Table 3.1: Instream methodology sub-options

Instream Methodology Sub-option	Potential Issues and Effects
Excavators operating from the banks and temporary structures such as bunds	Potential for high levels of sediment generation over prolonged periods of instream works with limited management techniques / measures available. Significant risk to works from potential adverse weather and hydrological events.
Cutter suction dredging	The varied range of bed materials found in the LWR are unsuitable for this methodology; mobilisation of plant and facilities being more complex.
Dragline excavation	Limited qualified operators and equipment available. Potential for high levels of sediment generation over prolonged periods of instream works with limited management techniques / measures available.
Excavation from barges	Relatively confined work area for barge operations, potential safety issues, complex set up, and inability to disestablish quickly in the event of flooding.
Temporary damming of up and down stream to create a contained work area	Challenging construction and safety issues. Significant risk to works from potential adverse weather and hydrological events.

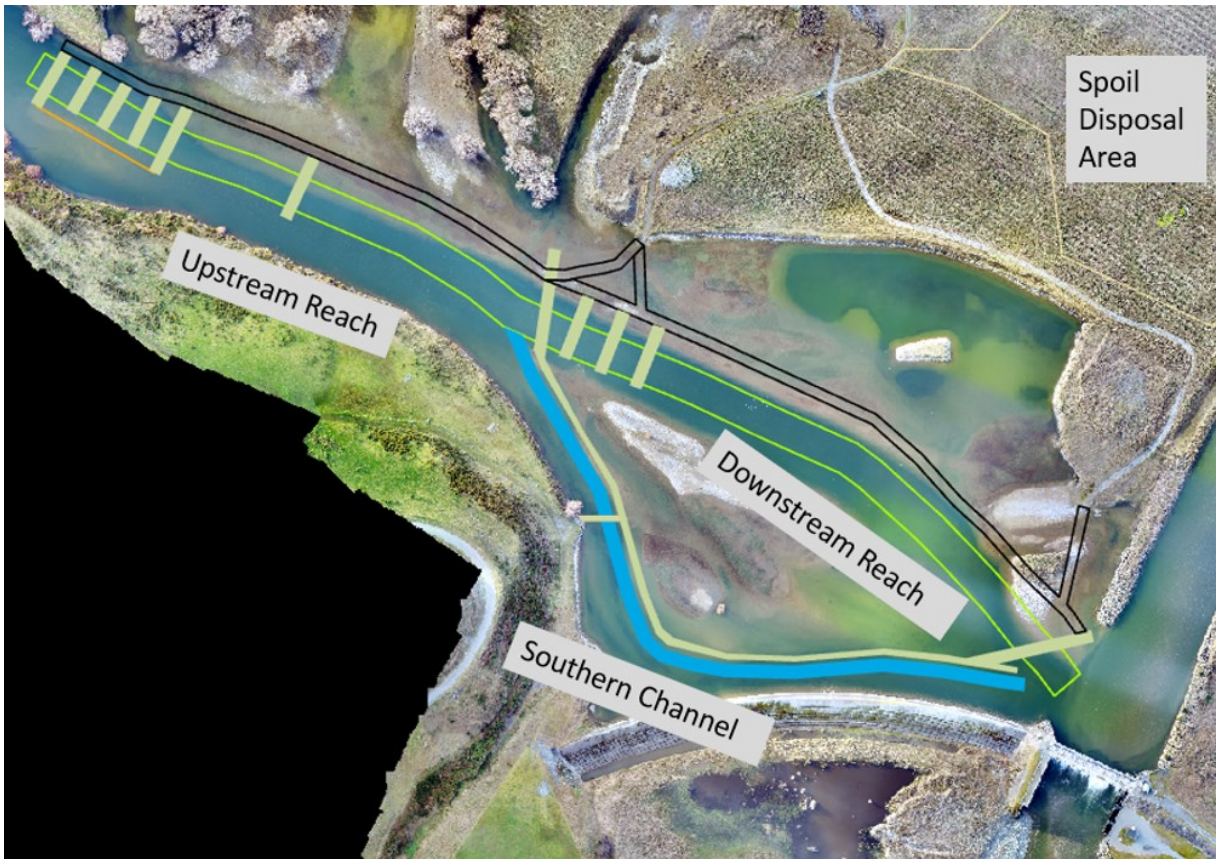

Figure 3.1: Concept plan of a potential instream methodology (Source: Appendix C).

Despite the proposed diversion and finger bund approach to limiting sediment generation, the scale and extent of work in the wet channel presented a significant risk of generating high volumes of suspended sediment over most of the 3-5 month construction period. Additionally, there was a significant safety and practical risk should adverse weather and hydrological conditions occur during the construction period, which might require the abandonment (and subsequent reestablishment) of works.

3.4 Parallel option

Due to the concerns raised in Section 3.3 above, a parallel option was developed which involves most of the excavation work being undertaken outside the wetted area of the Waiau Arm. While the overall amount of material to be excavated and disposed of is over twice as much as the instream option (225,000 m^3 vs 100,000 m^3), the reduction in time spent in the wet channel (from 3-5 months down to approximately 5 weeks) significantly lowers the magnitude and duration of suspended sediment discharges into the Waiau Arm and LWR. The reduced construction period also reduces the risks of adverse hydrology and associated lake spill impacting on the works window.

For these reasons the parallel option was selected as the preferred option. A full description of the proposal is set out in Section 5 of this report.

4 Environmental Setting

4.1 Site location

The Project site is located approximately 9 km south-east of Lake Manapōuri and the Manapōuri township, on the confluence of the Waiau and Mararoa Rivers. It includes the Waiau Arm, the MLC structure and surrounding river terraces. The site is legally described as Section 1 Survey Office Plan 12223 (RT364070). Figure 4.1 below shows the site in the context of the surrounding area.

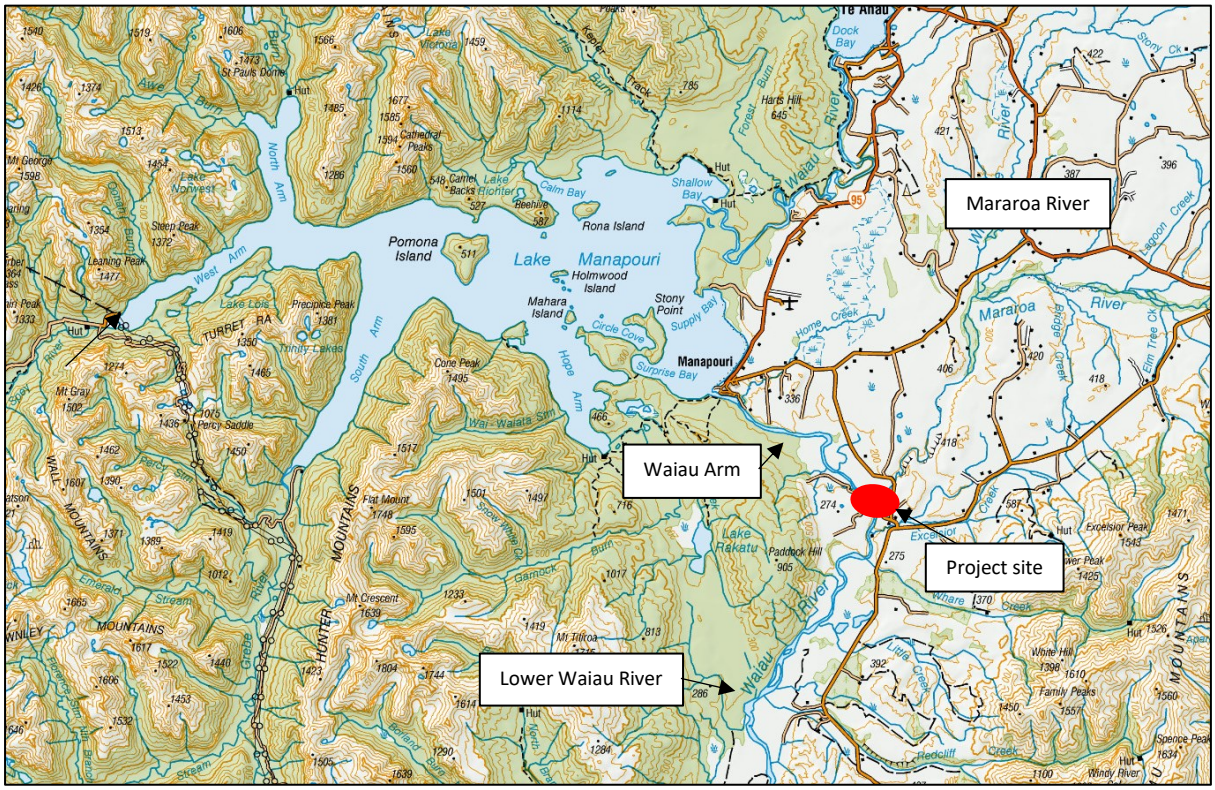

Figure 4.1: Site location plan.

The site is approximately 127 ha in area and is accessed from Weir Road. The surrounding area can be characterised as a rural environment comprised predominantly of farmland. Fiordland National Park is located approximately 2.8 km to the west of the site.

There are a number of dwellings / farm buildings located in proximity to the site. The two closest occupied dwellings are at 567 Weir Road (located approximately 1 km to the north) and 164 Duncraigen Road (located approximately 430 m west of the most western extent of the proposed excavation area).

4.2 Project site

The Project site for the purposes of this AEE is defined as the area directly affected by the temporary and permanent works. This includes the Waiau Arm, the area of land which will become the parallel channel, access and haul roads, spoil disposal area, contractor's establishment area, and areas for other temporary activities.

All areas directly affected by Project activities are within Meridian's 'Core Land' for the MPS at the MLC. Core land is land owned by Meridian and is managed for hydro-generation purposes. Core land provides Meridian the land tenure rights to operate, maintain, and refurbish its assets. This can include the day-to-day activities such as surveillance, asset maintenance and long-term actions such

as providing water overflow paths, protecting sources of civil construction materials, and allowing storage and management of such materials. This area is identified in Figure 4.2.

Figure 4.2: Boundary of the Meridian property including core land.

The core land at the MLC has previously been extensively modified to provide for the construction, operation, and maintenance of the MLC. As previously illustrated in Figure 2.1 of this report, all areas subject to this Project have been extensively modified by construction activities since the MLC was first established in 1976. The historic modifications to the Project site are obvious on the ground, as the landform surface is uneven, contains boulders and rocks of various sizes (some partially buried, others exposed by recent ripping).

The Project area has a varied topography. On the lower levels near the MLC it is generally flat but is surrounded by river terraces and hill country. From the river to Weir Road, the elevation increases by approximately 10 m. Along the northern bank of the Waiau Arm are three lacustrine (lake margin) channels, which were part of the former Mararoa River before it was realigned in the late 1980's.

The proposed spoil disposal area is on land which was formerly part of the Mararoa River delta, prior to the river's realignment. Eucalypt trees were recently planted in this area, but have not established successfully.

At the western extent of the Project area, there is an area that is used by RealNZ Limited (formerly Real Journeys Limited) as a temporary slipway.[6]

Figure 4.3 and Figure 4.4 provide an overview of the Project site.

[6] Further details on the slipway are contained in section 5.8 and section 10.7 of this AEE.

Figure 4.3: The Project site viewed from the Weir Road scenic lookout, looking westward up the Waiau Arm.

Figure 4.4: Waiau Arm and lacustrine channels; viewed northwards.

4.3 Cultural setting

The intrinsic values of Southland's freshwater environment provide a strong spiritual and cultural connection for Ngāi Tahu ki Murihiku. The importance of the area historically, culturally, and spiritually is recognised by the statutory acknowledgement over Moturau (Lake Manapōuri) and Waiau (Waiau River), under the Ngāi Tahu Claims Settlement Act 1998 (NTCSA). The significance of Lake Manapōuri is also reflected in the requirement under the Conservation Act 1987 that the Guardians of Lakes Manapōuri, Monowai and Te Anau must include at least one person nominated by Te Rūnanga o Ngāi Tahu.

As set out in Schedule 45 of the NTCSA, Moturau (or Motu-ua) is one of the lakes referred to in the tradition of "Ngā Puna Wai Karikari o Rakaihautu" which tells how the principal lakes of Te Wai Pounamu were dug by the rangatira (chief) Rakaihautu. The Waiau River features in the earliest of traditional accounts, and was a place and resource well known to the earliest tūpuna (ancestors) to visit the area. Rakaihautu and his followers traced the Waiau from its source in Te Ana-au (Lake Te Anau) and Moturau, to its meeting with the sea at Te Wae Wae Bay.

Schedule 69 of the NTCSA describes the Ngāi Tahu association with the Waiau. The Waiau River once had the second largest flow of any river in New Zealand, making it a significant source of mahinga kai. It also formed an important link between hapū and iwi as it provided a major travel route between Murihiku and Te Ara a Kiwa (Foveaux Straight) to Te Tai Poutini (the West Coast). Numerous archaeological sites and wāhi taonga attest to the history of occupation and use of the river. The main nohoanga (occupation site) on the Waiau was at the mouth and was called Te Tua a Hatu. The Rangatira (chief) Te Wae Wae had his kāinga nohoanga on the left bank of the Waiau River mouth.

The mauri of the Waiau represents the essence that binds the physical and spiritual elements of all things together, generating and upholding all life. All elements of the natural environment possess a life force, and all forms of life are related. Mauri is a critical element of the spiritual relationship of Ngāi Tahu.

The Ngāi Tahu ki Murikiku Natural Resource and Environmental Iwi Management Plan 2008 (Te Tangi a Tauira / The Cry of the People) presents a case study 'Te Āhuatanga O Te Waiau'. This is a State of the Takiwā environmental monitoring approach, developed to capture information, assess, and report on cultural health of significant sites, natural resources and the environment within the particular Takiwā. This project assessed the cultural health in the Waiau River catchment, which overall is in a good state of cultural health. The case study noted that '*… the upper catchment, around Te Anau, the tributary sites in the Jericho Block, and sites at the river mouth overlooking te Waewae Bay, were in a healthier state than those sites in the mid catchment or near settlements*'. At the Project location, it is likely that the effects of hydro development contributed to a lower score.

A review of the Southland District Plan and of ArchSite[7] indicates that are no known sites of cultural or archaeological significance such as pā or urupā at the site or that may be affected by the Project.

4.4 Hydrology and water quality

The hydrological and water quality setting is described in detail in *Manapōuri Lake Control Flow Improvement Project – Assessment of Environmental Effects: Freshwater Ecology* by NIWA attached as **Appendix D**. Sections 4.4.1 and 4.4.2 below respectively summarise that information. Section 4.4.3 provides a discussion on the reasonable mixing zone for the purposes of this Project.

[7] New Zealand Archaeological Association's online database of know archaeological sites in New Zealand.

4.4.1 Flows and variability

The Waiau Arm is an approximately 10 km section of the Waiau River between Lake Manapōuri and the MLC. Since the construction of the MLC, the Waiau Arm has effectively functioned as part of Lake Manapōuri, with lake-like rather than river-like characteristics.

Flows from both Lake Manapōuri (via the Waiau Arm) and the Mararoa River together contribute to the composition of water in the LWR, and to flow variability in the LWR. Under operations of the MPS, once the minimum flow in the Waiau River has been provided, Mararoa River water can be diverted to Lake Manapōuri via the Waiau Arm for power generation. Therefore, flows in the Waiau Arm can be in either direction: either towards the MLC in its natural direction (downstream flow), or towards Lake Manapōuri (upstream flow). Since 2012[8], net mean flow in the Waiau Arm has been towards the MLC.

Where the Mararoa River is at or above 30 NTU (nephelometric turbidity units), it must be diverted down the LWR rather than to Lake Manapōuri; this is to protect the Waiau Arm and lake from discharges of turbid water from the Mararoa River.

High flow events in both the Waiau Arm and the Mararoa River are generally less frequent and lower in the summer months, especially February and March. Flow variability in the LWR can be increased during these months by the controlled release of flushing flows for nuisance periphyton management and smaller recreational flow releases. The current Protocol for monitoring and management of nuisance periphyton in the LWR provides for the release of up to five flushing flows in each season (between November and May) in response to "red status" (i.e. high periphyton cover as quantified by instream surveys and determined by the protocol). Releases effective in reducing periphyton cover generally average at least 120 m^3/s over 24 hours and reach a peak flow of around 160 m^3/s.

Although the ability to release large flushing flow for periphyton management has been constrained, smaller recreational flows (typically 35 - 45 m^3/s (at MLC) for 24 hours) are released monthly from October to April and these releases have been provided more consistently over the years.

4.4.2 Suspended sediment and deposited fine sediment

Visual clarity in the Waiau Arm is relatively high because the water originates primarily from Lake Manapōuri. The Waiau Arm is defined in the regional planning documents as being 'lake fed'[9].

Therefore the primary source of suspended sediment to the upper reaches of the LWR is the Mararoa River. The further down the LWR catchment the more that landuse activities and other tributaries contribute to the overall picture. SSC naturally increases during floods and, typically, the larger the flood, the greater the SSC.

Turbidity in the Mararoa River just upstream of the MLC has been characterised using a 3.5-year record of high-frequency (5-minute intervals) turbidity records. This provides estimates of the proportions of time turbidity exceeds certain thresholds. For example, a turbidity of ~225 Formazin Nephelometric Units (FNU) is generally associated with high flows (>~100 m^3/s) that occur less than 1% of the time.

Turbidity in the upper reaches of the LWR tends to reflect that in the Mararoa River because all turbid Mararoa River flows are passed through to the LWR. When flows in the LWR are dominated by flood events from the Mararoa, turbidity tends to reduce in a downstream direction as SSC is

[8] Under the current operating regime of the Manapōuri Power Station which includes the Manapōuri Tailrace Amended Discharge (MTAD).

[9] See Water Quality Map 4 of the Regional Water Plan for Southland.

diluted with additional flows from tributaries and coarser fractions of the suspended sediment are deposited on the bed.

ES have carried out monthly surveys of DFS in the LWR upstream of the Excelsior Creek since 2018. DFS cover in the Waiau River upstream of the Excelsior Creek has been highly variable over time, fluctuating between 0% and over 75% cover, with a median cover of between 22% and 37%. The variability can be partly explained by preceding flows above the monitoring point. High DFS cover is strongly associated with small to medium-sized flows of Mararoa-dominated water which typically has higher turbidity. Low DFS cover is associated with longer periods elapsing since the small to medium-sized Mararoa dominated events, in combination with a relatively recent large lake-dominated flow (up to ~3 months prior to a survey). This indicates that the DFS is primarily sourced from the Mararoa River and catchment.

4.4.3 Reasonable mixing zone

Section 107(1) of the RMA requires that a consent authority must not grant a discharge permit where certain water quality effects arise after "reasonable mixing", subject to exemptions in Section 107(2)[10]. Reasonable mixing is not defined in the RMA, however, the PSWLP contains the following definition:

> ***Reasonable mixing zone:*** *A zone within which relevant water quality standards may be exceeded but which shall not be larger than:*
>
> *(a) For river, artificial watercourse and modified watercourse locations with flowing water present at all times:*
>
> *(i) No longer than 10 times the width of the wetted channel or 200 metres along the longest axis of the zone (whichever is the lesser); and*
>
> *(ii) Occupies no greater than two-thirds of the wetted channel width at the estimated Q95 for that location.*
>
> *(b) For river, artificial watercourse and modified watercourse locations with intermittent flows, no longer than 20 metres at times of flow and 0 metres at no flow;*
>
> *(c) When within a drinking water supply zone, or within 250 metres upstream of a drinking water supply site sourced from surface water, identified in Appendix J, 0 metres; or*
>
> *(d) A distance determined through a resource consent process, having regard to (a) to (c) of this definition.*

The Waiau and Mararoa Rivers fall under clause (a) rather than clause (b). There are no drinking water supply zones (as per clause (c)) affected by the Project.

The reasonable mixing zone for this Project has been developed in accordance with clause (d). The downstream end of the reasonable mixing zone has been determined as the proposed monitoring site located approximately 1,300 m downstream of the parallel channel excavation (just upstream of Excelsior Creek). This is far enough downstream that full mixing of water from the Waiau Arm and Mararoa River will occur and monitoring is practicable and feasible. This monitoring site is shown on Figure 5.5 of this AEE.

As discussed further in Section 5.5 of this AEE, turbidity and DFS thresholds have been developed for the Project which need to be achieved at the downstream end of the reasonable mixing zone. Adherence to the thresholds will mimic the temporary and minor effects which are already experienced naturally by biota at that point in the LWR during flood events.

[10] Refer Section 9.7 of this AEE.

4.5 Geology and hydrogeology

The geological and hydrogeological settings are described in detail in the *Waiau Channel Improvements – Proposed Methodology* by Damwatch attached as **Appendix C** and the *Manapōuri Lake Control Flow Improvement Project – Groundwater Assessment* by Land Water People attached as **Appendix G.** The below is taken from those reports and is a summary only.

4.5.1 Geology

The surficial geology of the Project site comprises a thin layer of post-glacial gravels overlying a relatively thick sequence of glaciolacustrine sediments (clays, silts and sand). These materials accumulated within a glacial lake formed behind the prominent moraine terrace (Ramparts 1 advance) evident along the margins of the Waiau Valley downstream of the MLC.

The surficial alluvial deposits comprise glacial outwash materials deposited and subsequently reworked during entrenchment of the Mararoa River and Waiau Arm over the post-glacial period (last 14,000 years). Test pits excavated along the margin of the Waiau Arm indicate the alluvial materials underlying the Project site typically comprise loose, sandy, fine to coarse gravels containing a varying proportion of cobbles which are interspersed with irregular (possibly lensoidal) layers of fine to coarse sand containing gravels and occasional silt. Such deposits are characteristic of recent (Q1) alluvial deposits in the headwaters of the main river catchments across Southland.

The underlying glaciolacustrine sediments (collectively referred to as the Damsite Formation) are typically 30 to 40 metres thick overlying older lakebed sediments at depth. The Damsite Formation comprises 6 separate units (Members A to F) which generally comprise accumulations of silty fine sand, silt and clay with occasional sand, fine gravel and clasts up to boulder-size. Bedding in these deposits is generally sub-horizontal to gently dipping north of the MLC, rising more steeply (up to 10 to 15 degrees) toward the valley margins.

A planar erosional surface on the Damsite Formation is located in the vicinity of the MLC at around RL 177.7 m. This is consistent with the trial excavations within the Waiau Arm channel which encountered clay around RL 172 m at Locations A and B (approximately 800 and 500 metres upstream of the MLC respectively), rising to around RL 174 m at Location C (approximately 140 m upstream of the MLC).

4.5.2 Hydrogeology

The alluvial deposits underlying the Project site host a thin unconfined aquifer which is hydraulically connected to the Waiau Arm and the Mararoa River. The saturated thickness of the aquifer will vary according to river stage but is typically of the order of 5 to 6 metres.

Groundwater levels were observed at shallow depths (<1 m below ground level) in test pits excavated along the true left bank of the Waiau Arm. Due to impounding of water behind the MLC, the hydraulic gradient across the Project site is likely to be limited, although it is likely that relative groundwater levels will respond rapidly to changes in river stage. A limited component of throughflow may also occur from shallow groundwater in glacial till and outwash deposits forming the higher terrace to the north of the site.

With respect to aquifer hydraulic properties, there is an overall variability of estimated hydraulic conductivity. It is considered that a value of the order of 250 m/day is likely to reflect the bulk permeability of the alluvial materials. Given a saturate thickness of around 6 metres (depending on river stage), this equates to a transmissivity value of 1,500 m^2/day.

4.6 Ecology

4.6.1 Terrestrial vegetation

Terrestrial vegetation at the site is described in detail in *Manapōuri Lake Control Improvement Project: Wetland Assessment Report* by Boffa Miskell, attached as **Appendix F**. The following is a summary of that information.

Terrestrial vegetation within the construction footprint of the parallel channel consists of exotic grassland and crack willow treeland. The exotic grassland is predominantly brown top grassland with other grasses and herbs mixed in. In the dryland areas, scattered mature crack willow trees are present which form a treeland over the exotic grassland.

Within the spoil disposal area, vegetation comprises exotic grassland dominated by exotic Yorkshire fog, sweet vernal, perennial ryegrass, crested dogstail, and cocksfoot. Eucalypt trees have recently been planted, however, most have failed to adequately establish.

Up to 10 Buchanan's sedge plants, which are identified as 'At Risk-Declining', will be removed from the construction footprint and transplanted to a suitable area of lacustrine habitat within the Project site.

Overall, the terrestrial vegetation which may be affected by construction activities has been assessed as being of negligible ecological value.

4.6.2 Wetlands

Wetland values are described in detail in *Manapōuri Lake Control Improvement Project: Wetland Assessment Report* by Boffa Miskell, attached as **Appendix F**. The following sections summarise that information. The regulatory classification of the wetlands is addressed in Section 4.6.2.4.

4.6.2.1 Palustrine wetlands

Palustrine wetlands are marshy areas, generally small in size, which are not connected to other surface water features. They can be ephemeral, seasonally or permanently inundated.

There are 12 small areas of palustrine marsh that support wetland vegetation in the vicinity of the construction footprint. All these features are likely to be only infrequently wet, support only weakly hydrophytic vegetation, and are dominated by exotic plant species (although some support indigenous wetland plant species). They range in size from 44 m^2 to 1,588 m^2. Their locations have previously been shown on Figure 1.1 of this AEE. More detailed figures are included in **Appendix F**.

One palustrine wetland, of low value, will be permanently removed due to being located within the proposed haul road footprint. The remaining palustrine wetlands, of low to low-moderate value, will be protected by at least a 10 m buffer from all construction activities along with implementation of erosion and sediment controls.

The palustrine wetland proposed to be removed by the haul road is referred to as "Wetland 1" in the **Appendix F** assessment. Its location is illustrated in Figure 4.5 below. Wetland 1 is a narrow feature occupying the edge of an existing dirt access road (it was likely formed due to the presence of the road). It comprises a cluster of tall wīwī/fan flower rushes, with an approximate 60% coverage over the 122 m^2 plot. No other indigenous species are present within the plot. Other vegetation within this plot includes various exotic grasses and herbs with low ecological value.

Figure 4.5: Location of Wetland 1; red line denotes construction footprint; yellow transparent area denotes exotic grassland (Source: Appendix F).

4.6.2.2 Lacustrine wetlands

'Lacustrine' means the shore or margin of a lake. At the western extent of the Project site are three lacustrine channels which were formerly part of the Mararoa River delta and are hydrologically connected to the Waiau Arm, which forms part of Lake Manapōuri[11]. These features will be partially affected by construction of the haul road and parallel channel.

The extent and frequency of inundation in the lacustrine channels is driven by the water level of Lake Manapōuri. The western-most channel is also fed by ground and surface water flow from the toe of the terrace to the channel's north and west. The two western channels dry out entirely when lake levels are very low.

The main wetland plant communities and habitats associated with these lacustrine channels have been identified as: Mudfield and water milfoil; Creeping bent – hawkbit grassland or herbfield; Jointed rush rushland; Spearwort – sharp sike sedge herbfield; and crack willow forest and treeland. The presence of representative species and some of moderate rarity (Buchanan's sedge), and the associated breeding and feeding habitat for some birds, means these wetlands are collectively considered of moderate ecological value.

[11] The lacustrine channels, and their location, are described in detail in Appendix F of this AEE.

4.6.2.3 Downstream riparian wetlands

Seven riparian wetlands have been identified in the LWR between the MLC and the confluence with the Monowai River (23 km downstream of the Project site). One wetland was assessed as being of low ecological value and the remaining six were of moderate ecological value.

4.6.2.4 Wetland classification

The lacustrine wetlands, and several of the palustrine wetlands, lie within the maximum operating range of Lake Manapouri (RL 180.5). This means they fall within the 'bed' of a lake as defined in the RMA[12]. Therefore they are arguably not classified as a 'wetland' for the purposes of the RMA[13] nor a 'natural inland wetland' for the purposes of the National Policy Statement for Freshwater Management (NPS-FM) and the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F)[14]. However, as a precautionary approach, this AEE has assessed all such features on the basis they are both 'wetlands' and 'natural inland wetlands'.[15]

For clarity, Wetland 1 (proposed to be permanently removed) meets the definition of natural inland wetland as it is not in the lake bed.

4.6.3 Freshwater environment

The freshwater ecology setting is described in detail in *Manapōuri Lake Control Flow Improvement Project – Assessment of Environmental Effects: Freshwater Ecology* by NIWA attached as **Appendix D**. A separate report by NIWA, titled *Assessment of risk of phytoplankton blooms in the Waiau Arm immediately upstream of the MLC following excavation of a new parallel channel,* is attached as **Appendix E.** Fish presence and habitat in the lacustrine wetlands is addressed in *Manapōuri Lake Control Improvement Project: Wetland Assessment Report* by Boffa Miskell, attached as **Appendix F**.

The below sections are taken from those reports and is a summary only.

4.6.3.1 Plant communities

Benthic plant communities refer to aquatic macrophytes with root systems that attach to the bed. In the Waiau Arm near the Project site these currently consist of sparse populations of non-native weeds and native characean algae and vascular plants, all of which also occur in greater densities farther upstream in the Waiau Arm. The native macrophyte taxa present are all nationally widespread and abundant with no special conservation status.

'Periphyton' is a term used to describe the flora that grows on rocks and gravel in the beds of rivers and streams. In the LWR it is made up mainly of green algae and diatoms, which can be felt as a 'slimy' layer on the surfaces of gravel or rocks taken from the wetted channel.

[12] 'Bed' under s2 of the RMA means: "[…] *(c) in relation to any lake controlled by artificial means, the space of land which the waters of the lake cover at its maximum permitted operating level*".
[13] 'Wetland' under s2 of the RMA "*includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions*".
[14] 'Natural inland wetland' under the NPS-FM "*means as a wetland (as defined in the Act) that is not: (a) in the coastal marine area; or (b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or (c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or (d) a geothermal wetland; or (e) a wetland that: (i) is within an area of pasture used for grazing; and (ii) has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless (iii) the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply*.
[15] Meridian reserves its legal position on these classification matters.

Plant communities in the LWR comprise primarily of periphyton, and are now dominated by the invasive non-native diatom *Didymosphenia geminata* (didymo). None of the species present have any conservation status. Periphyton biomass in the LWR can reach nuisance "red" levels at times during summer and is then controlled by flushing flows.

The potentially toxic cyanobacterium *Microcoleus* (until recently known as *Phormidium*) can proliferate during summer at locations in the LWR. It can be evident on rocks as small black spots with a very musty smell and should not be touched or ingested.

4.6.3.2 Macroinvertebrates

The term 'macroinvertebrate' refers to the small animals that dwell within the wetted substrates of rivers and streams. They do not include fish.

Existing macroinvertebrate communities in the Waiau Arm adjacent to the Project area reflect a habitat with slow-moving water and fine substrate, which will be very largely sourced from the Mararoa River. The community is dominated by the native mud snail *Potomopyrgus*, with oligochaete worms also common.

Macroinvertebrate communities in the LWR both upstream and downstream of the Excelsior Creek are of moderate to poor quality, falling into Bands C or D of the NPS-FM macroinvertebrate attributes, depending on which indices are used. The taxa present are common and widespread with no special ecological values.

Low numbers of kākahi (freshwater mussels), which have a conservation status of 'At Risk – Declining, are present in the Waiau Arm upstream of the Project site.

4.6.3.3 Fish

At least 15 native fish species are known from the Waiau Arm and LWR. These include longfin eels, which have a conservation status of 'At Risk – Declining'. A survey of longfin eels in the Waiau Arm in 2022 indicated high densities but relatively poor body condition. A trap and transfer programme occurs and supports upstream migration of elvers between December and March and downstream migration of adults (migrants) during November to May via the LWR.

Other native fish species include two non-migratory galaxias species known from the Waiau catchment that are classed as 'Threatened - Nationally Vulnerable': the southern flathead galaxias and the Gollum galaxias. Both have been found in the LWR just downstream of the MLC but only in low numbers as they struggle to co-exist with trout and so are much more common in tributaries. The 'Threatened – Nationally Vulnerable' lamprey has also been caught below the MLC in summer although it is highly likely that most adults reside in tributaries. The location of adult lamprey habitat is not well known in the mainstem of the LWR.

In addition, introduced salmonids in the Waiau catchment, including those found in the Waiau Arm and the LWR, support a recreational fishery that used to be among the most valued in New Zealand, although densities in the LWR are 10% of those in the Upper Waiau River, and have declined over the past two decades. Brown trout density in the Mararoa River has also declined since ~2000. Salmonid spawning habitat is limited in the LWR. Pre-spawning trout tend to aggregate just upstream of the MLC.

At the lacustrine channels, particularly the western-most channel, fish and fish habitat may occasionally be present due to their hydrological connection to the Waiau Arm.

4.6.4 Birds

Bird fauna observed at the MLC is characteristic of Southland freshwater habitats. Twenty freshwater bird species have been identified in and around the Project site, including the black-billed gull and banded dotterel which are listed as 'At Risk – Declining' and the black-fronted tern listed as 'Nationally Endangered'. The latter two are also found downstream in the LWR.

Large colonies of black-billed gulls can on occasions be found nesting close to the Project site. The proposed timing of the Project will largely avoid the gull's nesting season.

Meridian's current consent conditions for MLC maintenance include measures to avoid disturbance of black billed gull, black fronted tern, banded and black fronted dotterel. In particular, the period 15 September to 30 January is highlighted as a period when maintenance works (e.g., gravel excavation, dam safety protection works) should not occur if the works would disturb roosting and nesting areas.

During low flows, a 'lagoon' area forms above the MLC, in which a small gravel area is located. The 'bird island' located in the Waiau Arm at the MLC was created as mitigation to provide vegetation free gravel habitat for roosting and nesting birds.

4.7 Landscape and visual values

The landscape context, setting description and visual catchment are described in detail in the *Manapōuri Lake Control Improvement Project: Landscape Effects Assessment* prepared by Boffa Miskell Limited and attached as **Appendix H**. The following is a summary of that information.

4.7.1 Landscape and natural character context

The Project site is located at the southern end of the Te Anau Basin, between Lake Manapōuri and the Takitimu Mountains. Its immediate surroundings are not identified as part of any existing or proposed Outstanding Natural Feature and Landscape or Visual Amenity Landscape within the Southland District Plan.

In terms of the physical aspects of the landscape, the Te Anau Basin has a complex geological history. This was influenced by the subsidence of the north-east trending Moonlight Fault System filled with sedimentary rocks and the subsequent effects of the ice age on Lakes Te Anau and Manapōuri. Over time, extensive vegetation clearance has taken place although larger areas of forest and other habitats remain. More recently, the construction of the MPS resulted in extensive modification through parts of the basin particularly with the construction of the MLC structure and realignment of the Mararoa River in the immediate vicinity of the site.

4.7.2 Visual catchment

Potential external views towards the Project site are limited to transient views from adjoining sections of Weir Road and Duncraigen Road. Beyond such views, the site remains well enclosed within the context of surrounding terraces which contain the modified alignment of the Mararoa River and its confluence with the Waiau Arm.

The main public viewing area is located at the scenic lookout along Weir Road. This provides a local vantage point overlooking the Project site and the MLC in the midground below a broader vista which encompasses the Kepler Mountains. This view remains subject to seasonal changes and differences in atmospheric conditions as part of the broader inland landscape and mountain backdrop.

4.8 Recreation

Recreational activities are undertaken on the LWR and Waiau Arm, consisting mainly of boating and fishing. Boating is generally undertaken around the Lake Manapōuri outlet and rarely occurs down the Waiau Arm as far as the MLC.

Meridian releases recreational flows down the LWR. These are 35 m^3/s or 45 m^3/s for 24 hours on the fourth Sunday of the month between October and April, which for instance enables jet boats to use sections of the LWR with lower flows.

Anglers are not permitted to access the MLC structure, nor fish within 100 metres upstream and 100 metres downstream of the MLC structure. Fishing therefore tends to be predominantly downstream of the MLC, or upstream of the MLC along the Mararoa Cut.

4.9 Amenity

As described earlier, the site and surrounds can be broadly characterised as rural. As such, the amenity values are consistent with a rural area which includes open spaces, farming activities, and associated residential activities.

The Project site is large (approximately 127 ha) and is generally well buffered from nearby sensitive receptors. With the exception of the nearest dwelling located 430 m west of the most western extent of the proposed excavation area, all other sensitive receptors are at least 1 km from the site.

5 Description of Proposed Activities

5.1 Overview

The Project involves the following key activities:

- Site establishment, including upgrade of existing access tracks, a contractors' establishment area, and erosion, sediment and dust control measures (see Section 5.3 for further details);
- In three stages, construct a parallel channel of approximately 50 m wide (comprising of a 16 m wide base and 3:1 side slopes), 1 km length (approximately 850 m through the existing left bank and 150 m in the wet, connecting to and within the existing channel), and with excavation depths ranging from 0 - 12 metres, including the potential need to dewater the excavation area throughout works (Section 5.4);
- Suspended sediment and flow management throughout excavation works (Section 5.5);
- Placement of the excavated material (approximately 225,000 m^3 of gravel, clay and silts) onto a spoil disposal area, in a manner which preserves the opportunity for some of this material to be removed off-site at a later date (Section 5.6);
- Site disestablishment and rehabilitation (Section 5.7);
- Other activities (Section 5.8); and
- Future channel maintenance activities (Section 5.9).

The key Project and site features are shown on Figure 1.1 in Chapter 1 of this AEE.

A detailed construction methodology report has been prepared by Damwatch and is contained in **Appendix C**. This report appends concept design drawings including layout plans and long sections. The final construction methodology and design is subject to the detailed design phase and inputs from the selected contractor. The final design and works will be in general accordance with the information provided in the appended Damwatch report, however, minor variations to the methodology and design can be anticipated.

The overall timing and duration of activities is firstly discussed in Section 5.2 below.

5.2 Timing and duration of activities

Subject to obtaining resource consents, Meridian proposes to undertake the works within a 10-month window of January to October 2025. Should the consent process take longer than anticipated, or adverse hydrology cause delays, works would not be able to commence until the same window in 2026 (or subsequent years).

The overall construction period within the 10-month window is envisaged to be 4 – 5 months. This is based on work occurring on a 7-days per week and up to 24 hours per day basis. The 24-hour operation will require artificial flood lighting outside of daylight hours.

The parallel channel excavation works are targeted to the time of year when hydrological conditions are likely most suitable for safe and efficient delivery of the work. The construction window has also been identified to ensure there is no disruption to Meridian's monitoring requirements under existing resource consent conditions.

Table 5.1 identifies the approximate duration of each stage of works.

Table 5.1: Construction duration estimates (approximate only)

Activity	Estimated Duration
Site establishment (Section 5.3)	2 weeks
Stage 1 (Section 5.4.2)	2 weeks
Stage 2 (Section 5.4.3)	8 weeks
Stage 3 (Section 5.4.4)	5 weeks
Site disestablishment and rehabilitation (Section 5.7)	2 weeks
Total on site duration	**19 weeks**

5.3 Site establishment and management

5.3.1 Access track upgrades

The site is accessed via an existing access track off Weir Road (see Figure 1.1). It is likely this track will require upgrading to enable large machinery and plant to access the site. Anticipated upgrades include increasing the radius of bends of the track and clearing material from the track verges. In addition, filling in of ruts and regrading of the existing track may also be required.

5.3.2 Contractor's establishment area

As identified on Figure 1.1, an area of approximately 20,000 m^2 is identified as the Contractor's establishment area. This area has been selected as it is close to the excavation footprint and is reached via the main access track into the site. The site is relatively flat.

The purpose of this area will be for the contractor's facilities during the construction period, including offices, lunchrooms, portable ablutions and storage of fuel, oil and other substances. In addition, the area will include parking areas and areas for the refuelling of plant. Stormwater from roofs and hardstand will be discharged to ground.

Preparation for the area will include the clearance of vegetation or debris, and identifying and / or constructing flat areas above potential flood levels to locate facilities. A bunded area will be created for the storage of fuel, lubricants, oils and any other hazardous substances.

Part of the establishment area falls below RL 180.5 m and is therefore within the maximum operating level of the lake, although there is no recent evidence of flooding up to this level at this site. As a precaution, all buildings and storage areas (including for fuel etc) will be located above this contour and therefore outside of the lake bed.

At the conclusion of construction, all facilities, plant and machinery will be removed and the site rehabilitated with pasture grass.

5.3.3 Erosion and sediment controls

Erosion and sediment control measures will be installed at commencement of site works to manage land-based activities. In particular, these measures are required to prevent runoff from the contactor's establishment area and the spoil disposal area to wetlands, the Waiau Arm, and the Mararoa River. Further details are described in subsequent sections.

Preparation of an Erosion and Sediment Control Plan (ESCP) is proposed as a condition of consent (Section 8 of this report). The ESCP will detail best practicable sediment control measures to be implemented to ensure discharges to surface water are avoided as far as practicable.

5.3.4 Dust management

If required, up to 60,000 litres of water per day will be abstracted directly from the Waiau Arm or Mararoa River at a suitable point at the Project site and will likely be pumped directly to the tank of a water cart. Appropriate intake screening to exclude fish will be installed. Potentially water in the seepage pond (used for dewatering) might also be a source for dust suppression.

Water will be taken and used on an as-needed basis, during prolonged dry or hot/windy atmospheric conditions. Pumping will be intermittent, with the cart typically filled in the morning and refilled during the day if required, considering an expected cart capacity of 20-30,000 litres. During dry conditions, the water cart will spray up to 5 mm of water per day on dust-prone areas, particularly the haul roads.

5.4 Parallel channel construction methodology

5.4.1 Overview of the three construction stages

The three construction stages are summarised in Figure 5.1-5.3 below. Further details are contained in subsequent sections.

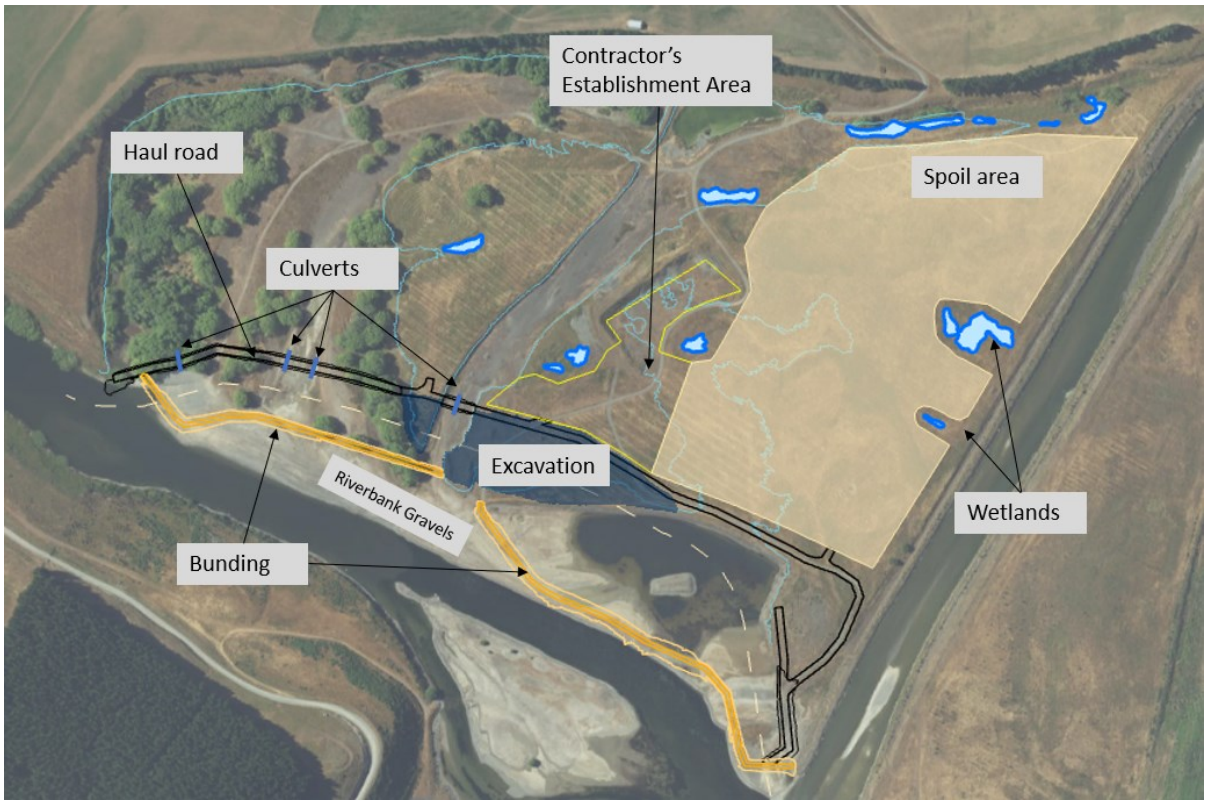

Figure 5.1: Stage 1 – contractor's establishment area (yellow outline), spoil disposal area setup, haul road (and culverts), river bunding (orange), and initial excavation (shown in partly transparent dark blue); RL 180.5 m contour (maximum lake level) shown in light blue.

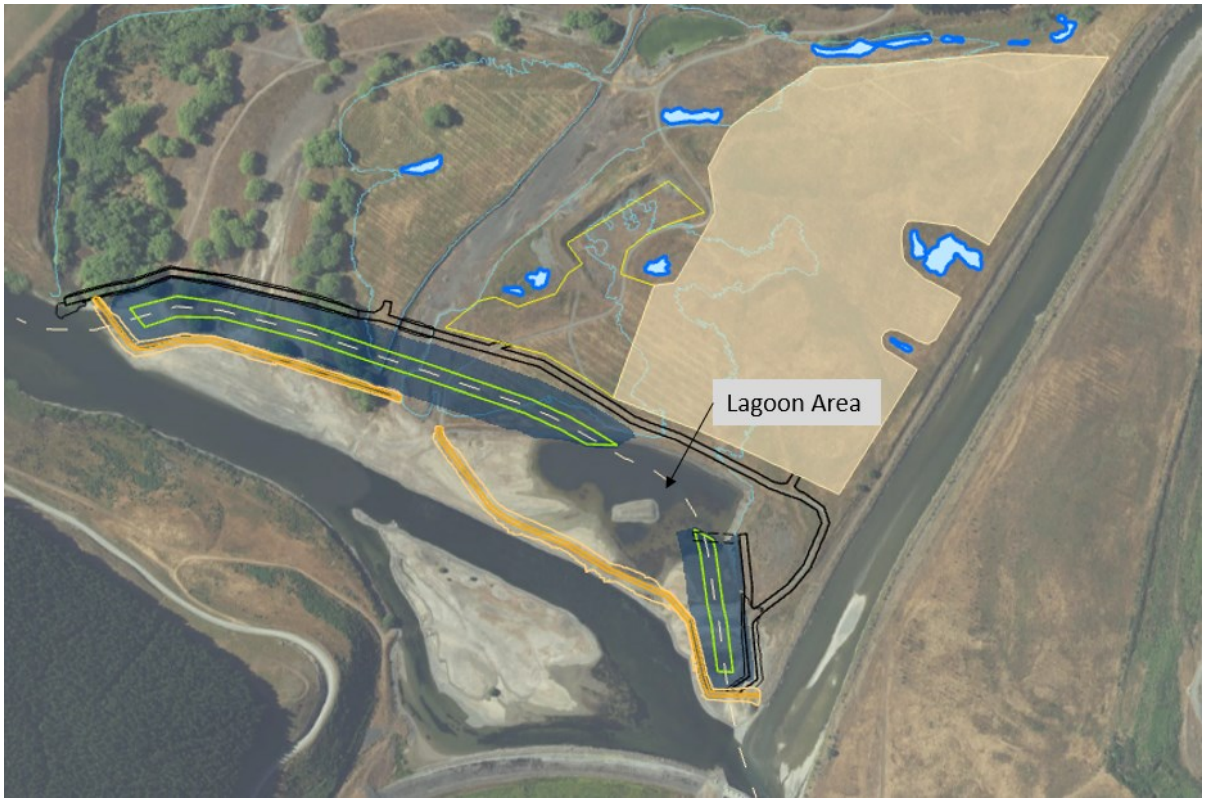

Figure 5.2: Stage 2 – Excavation area shown in partly transparent dark blue; base of channel shown with green outline.

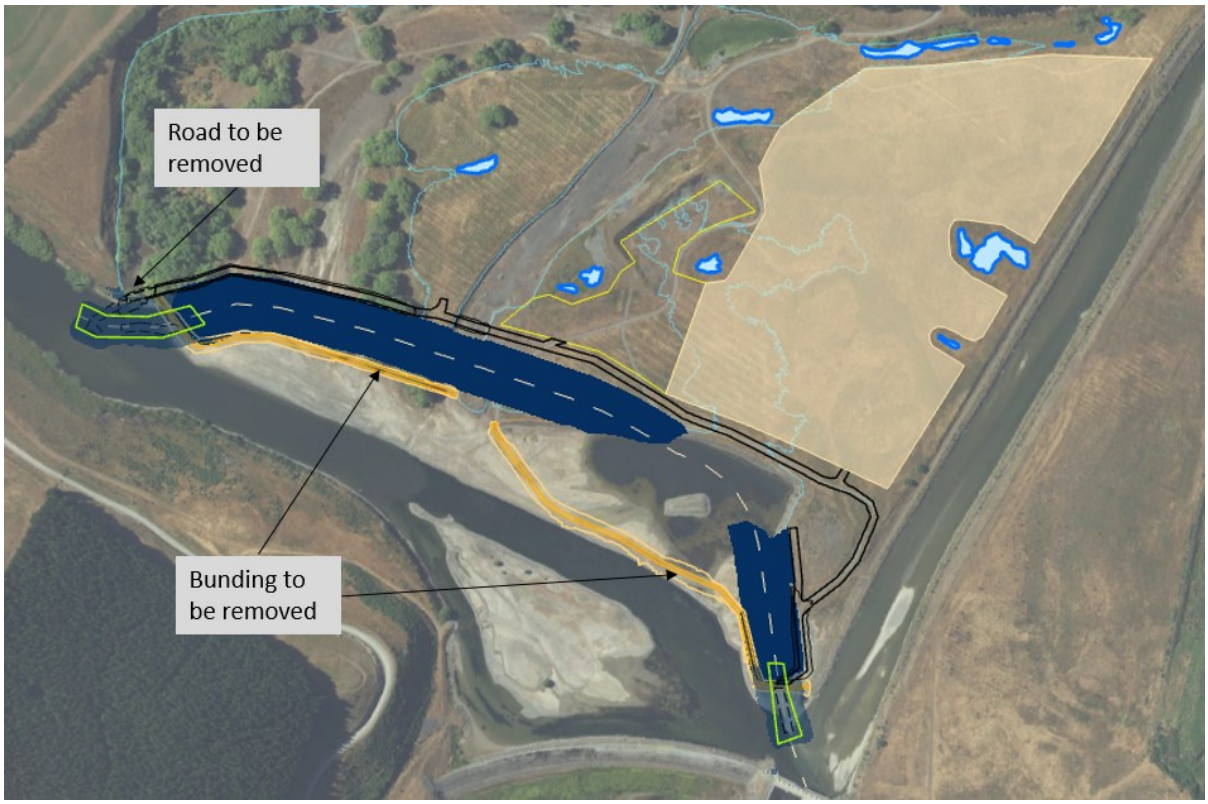

Figure 5.3: Stage 3 – Channel cut-ins to the Waiau Arm shown in partly transparent blue (channel base / plugs shown in green outline); prior Stage 2 excavation shown in opaque dark blue. Bunding to be removed along with western most portion of haul road (over the western lacustrine channel).

5.4.2 Stage 1

Stage 1 (see Figure 5.1) involves site preparation and the excavation of the highest areas along the new parallel channel route, with the most suitable material being used to construct the haul road and bunding. Approximately 32,500 m^3 of material will be removed in total. Topsoil will be stockpiled in the spoil area perimeter bunds.

Bunding will be constructed along the true-right of the parallel channel excavation area and a dual-lane haul road along the true-left. Both the haul road and bunding will be built up to a level sufficient to prevent surface flows up to a 20% Annual Exceedance Probability event (RL 179.3) entering the excavation area.

For the majority of its length the haul road will be on existing ground. The road will need to cross the three lacustrine channels; this means the channels will not be hydrologically connected to the Waiau Arm for a period of approximately 15 weeks.

On completion of the parallel channel, at the two eastern-most lacustrine channels the haul road structure will remain in place to provide for future maintenance. Culverts of appropriate size, to be determined at the detailed design phase, will be installed to provide a hydrological connection back into the lacustrine channels. At the western-most lacustrine channel, the haul road will be removed and the hydrological connection with the Waiau Arm restored.

5.4.3 Stage 2

The majority of excavation works (by volume and duration) occur in Stage 2 (see Figure 5.2 above). With the bunding in place, the excavation will occur at multiple fronts simultaneously along the parallel channel footprint. Figure 5.4 below shows a cross-section through the excavation area (including Stage 1).

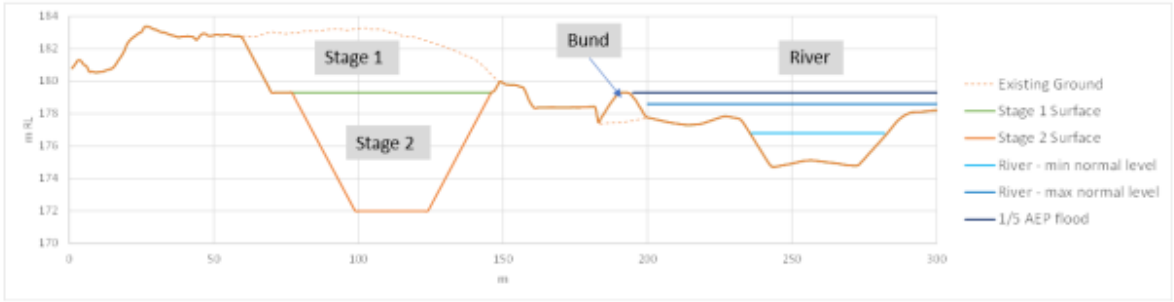

Figure 5.4: Cross section through Stage 2 excavation.

Approximately 163,000 m^3 of material will be removed during Stage 2. Around 75% is likely to be removed using a standard-arm excavator, with the remaining 25% removed using long-reach excavators (on an assumed typical river and groundwater level).

Wet material excavated from the channel may be placed next to the working excavation face to allow water to drain from the material. This may take a few hours and involve a few hundred cubic metres of material at a time. This material will then be carted to the spoil area for disposal.

Within the lagoon area (see Figure 5.2) there is a possibility that some excavation will be required where the RL is above the constructed level. A portion identified by the south-eastern side of the lagoon may be required. In this instance, excavation would be carried out by a long-reach excavator working from finger bunds. If required, the bund would be constructed from selectively stockpiled gravels from earlier channel excavation, and / or riverbank gravels to a nominal 'freeboard' level above the prevailing lake level.

During Stage 2, the selected contractor may elect to undertake dewatering of the excavation area for safety and practical reasons. Further information on this potential activity is contained in Section 5.4.5 below.

5.4.4 Stage 3

Stage 3 (see Figure 5.4) comprises the works to deepen the approach, inlet and outlet of the new channel, and the 'cutting in' (removal of plugs) to the existing main channel of the Waiau Arm. Activities include:

- In-stream excavation at the channel approach and inlet, by long-reach excavators working from finger bunds pushed out from the haul road on the northern (true left) bank;
- Shaping of the bunding previously placed in Stage 1 to a natural-looking topography;
- Removal of the riverbank 'plug' separating the upstream end of the parallel channel from the Waiau Arm, using a long-reach excavator;
- Removal of the haul road across the western-most former lacustrine channel to restore hydraulic connectivity (culverts placed at the other channel crossings will remain in situ);
- In-stream excavation at the parallel channel outlet, by a long-reach excavator working from a finger bund pushed out from the 'plug' behind the Mararoa groyne; and
- Removal of the 'plug' separating the downstream end of the excavated channel from the Waiau Arm, using a long-reach excavator.

The removal of the 'plugs' will result in water in the Waiau Arm permanently diverting into the new parallel channel. However, at most lake levels water is expected to remain in the old channels.

5.4.5 Dewatering (if required)

The contractor may elect to undertake dewatering during Stage 2 to help facilitate the excavation works. Potential dewatering provisions include:

- Submersible pumps in large, excavated sumps adjacent to excavation, drawing down the local groundwater level by pumping to remote seepage ponds; and/or
- A more formal well-point system (with multiple smaller pumps in smaller temporary wells in the same vicinity) may be preferred if the contractor has the equipment available.

The contractor may also choose to use impermeable geomembrane lining places on riverside bund slope to reduce seepage from the river.

Pumping rates, duration, frequency, volumes and times will depend upon lake and local groundwater levels, and the permeability of banks and excavated ground. Based on the permeability estimates from sampled ground particle size distributions, preliminary pumping rates are assumed to be up to 200 L/s to drawdown the water surface within the excavation by up to 2 m. As the excavation extent gets closer to the Waiau Arm, pumping to make an appreciable difference to water level and construction efficiency within the excavation may not be practicable. It is therefore anticipated that pumping to lower water levels within the excavation may only be practicable for the first half of the Stage 2 duration.

Water pumped from the excavation will be directed to a temporary seepage pond constructed within the spoil disposal area footprint. Once the capacity of the pond is reached the dewatering would cease until sufficient capacity became available. The time this takes is dependent on the prevailing surface water levels, groundwater levels, and the permeability of the ground beneath the seepage pond. The seepage pond would be approximately 50 m x 50 m (2,500 m^2) and up to 2 m deep, providing for a total capacity of approximately 5,000 m^3.

When no longer required the pond will be disestablished and spoil disposal will continue in that area.

5.5 Suspended sediment and flow management

5.5.1 Activities potentially generating suspended sediment

The parallel channel has been selected because, relative to other options, it significantly reduces the duration of excavation works which directly interface with surface water in the Waiau Arm. In that regard, it also reduces the magnitude and duration of suspended sediment discharges to the Waiau Arm and LWR.

The excavation activities involving the removal of the "plugs" at the upstream and (particularly) downstream ends of the parallel channel will be partly undertaken in the wetted area of the Waiau Arm. This bed disturbance activity will increase the potential for fine sediment to be mobilised and enter the Waiau Arm and subsequently the LWR. Furthermore, any suspended sediment and DFS within the excavated parallel channel has the potential to mobilise on the first flush and enter the Waiau Arm.

The volume of suspended sediment which could mobilise, and the component of that volume which drops out as DFS, is relatively uncertain. To address this, NIWA has recommended an adaptive management approach which is summarised in the following sections. An assessment of the effects on the environment, in conjunction with the thresholds and monitoring proposed, is detailed in Section 7 of this report. For full details of the approach and predicted effects, please refer to the NIWA report in **Appendix D**.

5.5.2 Suspended sediment thresholds

Suspended sediment can be measured directly (as SSC) or via a proxy variables like turbidity and visual clarity (VC). VC is the distance objects can be seen through water and is often used as a compliance measure.[16] VC is affected by factors other than SSC and therefore it is necessary to establish site specific relationships with SSC and/or turbidity to enable predication of one from the other.

NIWA has determined that thresholds set to protect a river ecosystem from the potential effects of an expected atypical increase in SSC require justification, a numerical concentration threshold, and an exposure duration. The basis for the development of the turbidity thresholds is that they are, on average, 1.75 times the "natural turbidity" that can be expected in the Mararoa River for the duration of the Project. All the thresholds have at times been exceeded naturally in the Mararoa River.

The numeric thresholds for SSC are expressed as values of turbidity (FNU) that should not be exceeded for more than a specified duration. The duration has been determined based on a 'nested' approach, in which high threshold concentrations averaged over short durations are nested within lower thresholds averaged over longer durations.

NIWA has identified four turbidity thresholds with decreasing exceedance duration allowances as the thresholds increase. The exceedance allowances exclude high turbidity that can be attributed to high flows in the Mararoa River. The turbidity due to the Project will be identified as the difference between the measurement between the upstream and downstream monitoring sites described in section 5.5.4 below.

[16] Including in the National Policy Statement for Freshwater Management 2020 (NPS-FM).

During the excavation works, turbidity monitoring will require simultaneous checking of both monitoring sites. The total turbidity generated by the Project shall be calculated by subtracting the mean hourly turbidity in the Mararoa at the Cliffs (upstream) monitoring site from the same mean hourly turbidity at the Excelsior (downstream) monitoring site on the LWR.

Consent conditions are volunteered to achieve the intent of Table 5.2 below. The full conditions are contained in Section 8 of this AEE.

Table 5.2: Total turbidity generated for the duration of the parallel channel excavation works (including an additional 5 days / 120 hours after the channel is fully opened) shall not cumulatively exceed any of the following thresholds

Formazin Nephelometric Units (FNU)	Maximum Total Hours	Maximum Consecutive Hours
>330	36	12
>160 to ≤330	95	32
>30 to ≤160	504	168
>12.4 to ≤30	945	315

Overall, adherence to the thresholds is designed to mimic the temporary and minor effects which are already experienced naturally by biota at the downstream monitoring site in the LWR during large flood events.

5.5.3 Deposited fine sediment

Fine sediment which settles out from suspension and deposits on the river bed can smother invertebrate communities and fish redds. A separate assessment methodology to monitor and manage these effects during the parallel channel excavation works has been recommended by NIWA.

DFS will be monitored for the duration of the excavation works at the downstream monitoring site, being the existing site managed by ES upstream of the confluence of the Excelsior Stream. A "baseline" DFS will be established by monitoring weekly for at least six weeks prior to the Project commencing. During the excavation works, if a change in DFS, assessed as a six week rolling average, of more than 20% is recorded and which is attributable solely to the effects of the Project, further mitigation would be required. This could include passing a flushing flow down the LWR to mobilise the DFS accumulated from the Project.

As DFS is a measure of longer-term effects, Meridian will continue monitoring DFS weekly for at least eight weeks after the parallel channel is fully opened.

5.5.4 Monitoring locations

The upstream and downstream monitoring locations referred to in prior sections are shown in Figure 5.5 overleaf.

The upstream (Cliffs) site on the Mararoa River is an existing site used by Meridian Energy. The downstream site (above Excelsior Creek) is approximately 1,300 m from the downstream plug of the parallel channel excavation. At this point, any suspended sediment from the Project is expected to be fully mixed so that the turbidity recorded is representative of the whole cross-section, including both the Mararoa and Waiau Arm flow and sediment load. This is also the site where DFS will be monitored, as it coincides with a long-term ES site, and is where DFS accumulations can be expected to be highest.

The proposed monitoring sites will use identical equipment so turbidity data can be directly compared in real time.

Figure 5.5: Location of turbidity and flow recorders to be used in the monitoring programme for the duration of the excavation works (Source: Appendix D).

5.5.5 Flow management

During the excavation activities period of the Project, all flow from the Mararoa River will be directed down the LWR and there will be no upstream flows (flows back towards Lake Manapōuri) in the Waiau Arm. This is to reduce the potential for sediment to be directed towards Lake Manapōuri.

Downstream flows from Lake Manapōuri (as opposed to no flow in either direction) will occur in circumstances such as when flow from the Mararoa River is insufficient for minimum flows in the LWR, for recreational flows, supplementary flows, and when Lake Manapōuri has high lake levels and the flood rules apply. High lake levels above maximum control levels will create unsuitable conditions where excavation is unable to take place. Flow management will also be considered if required to manage effects associated with SSC and DFS.

Effects on flow management of the Project are further discussed in section 7.4.1 of this AEE.

5.6 Spoil disposal area

Approximately 225,000 m^3 of gravel and other materials will be excavated from the construction of the parallel channel. This is to be spread at the identified spoil disposal area, comprising approximately 14.5 ha. The spoil disposal area is identified in Figure 5.6.

Figure 5.6: Spoil disposal area (blue outline), gravel stockpile cell (pink outline). (Source: Appendix H).

Preparation of the spoil disposal area will involve the stripping of vegetation and topsoil. Site observations indicate there is little topsoil present, however, what can be recovered will be used as a silt control bund around the perimeter of the disposal area. The bund will be approximately 3 m high with a relatively gentle side slope (e.g. 1V:3H). The bund will retain any dirty runoff water and allow soakage to ground.

The spoil disposal area has been located to minimise cartage distances and associated time, cost, dust and construction traffic emissions. Existing topographic depressions have been identified as palustrine marsh wetlands by an ecological survey. The disposal areas will have a minimum of 10 m setback from these areas.

The area will be filled in layers of approximately 0.3 m, spread and compacted by bulldozer and grader. Where the excavated material is clay, there may be a need for drying and potentially blending this substrate with dry gravels to keep the fill stable. Given the size of the site, the fill area will be up to approximately 2 m high.

The spoil area will be contoured with minimum surface gradients of 2% draining toward the permitter to encourage surficial runoff of rainfall. At completion, the perimeter bunds will be trimmed to a gradient of 10%, with recovered topsoil material (where available) spread for surface rehabilitation.

A portion of the disposal area (approximately 3.5 ha) will be set aside as a 'gravel stockpile cell' to provide an opportunity to local contractors to remove gravel to support local industries. Any

resource consents required to remove, process, and cart the material off-site does not form part of Meridian's current applications; this would be a responsibility of a future contractor should they desire to make use of the material.

Rehabilitation of the spoil disposal area (and other parts of the site) is discussed in the following section.

5.7 Site disestablishment and rehabilitation

Following completion of the parallel channel excavation works, all temporary buildings, facilities and equipment will be removed and the site left in a tidy state. Rehabilitation activities will include all or some of the measures:

- Removal or reshaping of temporary bunds and any other piles by spreading on adjacent land;
- Contouring of the edges of the spoil disposal area to be sympathetic to the surrounding environment; and
- Replacement of topsoil cover of the spoil disposal area and re-grassing in exotic pasture species within the first planting season.

Some of the haul road will remain in place for future maintenance purposes. Where the haul road crosses the two eastern-most lacustrine channels the installed culverts will remain in place to provide hydraulic connectivity. The haul road will be removed from the western most lacustrine channel and hydraulic connectivity reestablished.

As noted in Section 5.6 above, should material from the gravel stockpile site be removed at a later date, further rehabilitation will be required to blend in with this proposed site rehabilitation.

5.8 Other activities on site

RealNZ hold a resource consent at the Project site for a temporary slipway to be installed to support the removal of vessels from Lake Manapouri. This slipway will be affected by the proposed activities and on this basis Meridian has sought further details from RealNZ on their future requirements.

Consequently, Damwatch has identified an area approximately 600 m upstream of the MLC that is considered to provide a suitable slope for the slipway. These requirements will be incorporated into the detailed design of the parallel channel and include an approximate 1V:6H ramp 'notched' into the true-left channel bank, with the sides of the ramp to be excavated to a stable approximate 1V:3H batter. While this has been allowed for in the Project design, it is noted that no resource consent is being sought for the activities associated with this, as these will be the responsibility of RealNZ.

5.9 Future maintenance activities

The construction of the new deeper channel adjacent to and parallel to the Waiau Arm, and the existing channels of the Waiau Arm upstream of and around the confluence with the Mararoa River at MLC, will require periodic maintenance. Maintenance of channel capacity is essential to retain the ability of the MLC to pass flows. Maintenance activities are expected to be necessary only about every 5 – 10 years (over the 35-year term sought).

Due to the smaller scale of these works, the turbidity thresholds and DFS requirements (and related monitoring requirements) set out in Section 5.5 above would not apply to maintenance activities. Instead, a condition is proposed for maintenance activities which allows for short-term increases in turbidity which are much less than those sought for the Project. The full volunteered condition is included in Section 8 of this AEE.

6 Resource Consent Requirements

6.1 Overview

The resource consents requirements for the Project are determined by the rules and regulations of the following statutory documents:

- Manapōuri – Te Anau Development Act 1963 (MTADA);
- Regional Water Plan for Southland (RWP);
- Proposed Southland Water and Land Plan, Part A – Decisions Version, Operative in Part' (PSWLP);
- Southland Regional Air Plan (RAP); and
- Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F).

The zoning and planning notations which relate to the site are set out in Table 6.1 below while consideration of the applicable rules and regulations is set out in subsequent sections.

Due to the application of MTADA the rules of the Southland District Plan do not apply. However, for completeness an assessment has been provided in Section 6.6.

Table 6.1: Zoning and planning notations

Zoning/Planning Limitation	Comment
Operative Regional Water Plan	
Surface water classification – Lake Fed and Hill	The Waiau Arm and LWR fall within the "lake fed" category and the Mararoa River in the "hill" category. The standards for these classifications are set out in Appendix G of the RWP.
Waiau Catchment	The site is within the identified Waiau Catchment.
Proposed Southland Water and Land Plan	
Surface water classification – Lake Fed and Hill	The Waiau Arm and LWR fall within the "lake fed" category and the Mararoa River in the "hills" category. The standards for these classifications are set out in Appendix E – Receiving Water Quality Standards[17].
Waiau Catchment	The site is within the identified Waiau Catchment.
Southland District Plan	
Rural	The site and its surroundings are zoned 'Rural'.
Natural Hazard overlay - Flood	The site has a flood overlay, meaning the area is subject to actual or potential flooding or inundation. This is unlikely to affect the resource consent requirements.

The PSWLP (Map Series 7, Map 9) identifies the Waiau Arm as a regionally significant wetland; and the Beacon online GIS systems identifies the Waiau Arm (Waiau River Lake Manapōuri to Mararoa Weir) as a Regionally Significant Wetland and Sensitive Waterbody (ID 102). This has been recognised by Environment Southland as an error in the PSWLP which will be corrected through a

[17] Currently under appeal.

Schedule 1 amendment process. This classification does not affect which rules apply, or the overall activity status under the PSWLP.

6.2 Manapōuri – Te Anau Development Act 1963 (MTADA)

As previously noted in Sections 1.5 and 2.2 of this AEE, MTADA enables the development and ongoing operation of the MPS. MTADA affords Meridian "*full power and authority*" to undertake certain activities in relation to the MPS that might otherwise require resource consent under the RMA.

MTADA authorises certain aspects of the Project, including:

- Construction related noise, vibration and lighting, land disturbance and earthworks, and vegetation clearance (section 9 of the RMA);
- Excavation, disturbance, reclamation, deposition of material, placement of culverts and wetland removal in, on and under the bed of the Waiau Arm, LWR, and Mararoa River (section 13 of the RMA); and
- Discharge of dust, if any, to air (if restricted under section 15(2) or (2A) of the RMA).

Resource consents under the RMA are therefore not required for these activities. However, Meridian has on a precautionary basis applied for consents in relation to effects on wetlands which are required under regulation 47 of the NES-F, acknowledging the interrelationship between section 14 and section 13 considerations in this regulation.

The activities which would otherwise require consideration under the Southland District Plan are set out in section 6.5 of this AEE.

6.3 Regional Water Plan for Southland (RWP)

The RWP was made operative in 2010 but has now been substantially superseded by the PSWLP, which is now operative in part. All rules of relevance to the Project in the PSWLP have been assessed as operative in accordance with Section 86F of the RMA. The equivalent rules in the RWP are now treated as inoperative, and are not assessed here.

6.4 Proposed Southland Water and Land Plan (PSWLP)

The PSWLP was made operative (in part) on 1 March 2021 and a series of appeals have since been resolved through the Environment Court. The rule assessment in Table 6.2 below is made based on the 'Ninth Interim Decision' version of the PSWLP dated October 2023. All rules in Table 6.2 are considered operative in accordance with Section 86F of the RMA.

Table 6.2: PSWLP rule assessment

Activity	Rule	Assessment
Excavation and disturbance for channel construction and disposal of excavated material	Rule 4 provides for any activity that would otherwise contravene Sections 13(1), 14(2), 14(3) or 15(1) of the RMA and is not otherwise identified in the PSWLP as a discretionary activity.	**Activity status**: n/a (exempt) for Section 13 activities **MTADA status:** MTADA applies to land use activities (Section 13 of the RMA). **Commentary:** The Project involves excavation and disturbance of the lake bed and deposition on the bed of the Waiau Arm, not expressly provided for by another rule in the PSWLP. Resource consent would be required as a discretionary activity under Rule 4, however,

Activity	Rule	Assessment
		MTADA applies and the land use activity is exempt.
Temporary discharge of suspended sediment and water during construction and maintenance activities	Rule 5 provides for discharges to surface water bodies of any contaminant or water into surface water or into land where it may enter surface water as a discretionary activity, provided that the water quality standards in Appendix E are met beyond a reasonable mixing zone and no raw sewage is discharged. The preamble for Appendix E states that a standard for a given parameter will not apply in a lake or river where "*an ancillary activity associated with the maintenance*[18] *of the Manapōuri hydro-electric generation scheme is proposed. This exception only applies where the activity requires a resource consent pursuant to a rule in this plan and will only result in a temporary change in the state of the water*". Rule 6 provides for discharges that do not meet the conditions of Rule 5 as a non-complying activity.	**Activity status**: Discretionary or non-complying **MTADA status:** MTADA does not apply to discharge activities (Section 15 of the RMA). **Commentary:** The proposed discharge may meet all conditions of Rule 5 and is therefore a discretionary activity. This is because the proposal may fall within the exception afforded to the MPS under Appendix E. Should the exception for MPS maintenance not apply to this Project, the water quality class for the site under Appendix E would be for 'Lake Fed' waterbodies. At times the discharge of contaminants associated with the Project may not meet all water quality standards in Appendix E for 'Lake Fed' waterbodies after reasonable mixing (see Section 4.4.3 of this AEE for the reasonable mixing zone for this Project). If the exception for MPS maintenance does not apply, then resource consent is sought under Rule 6 as a non-complying activity.
Dust suppressants (if required)	Rule 17 provides for the discharge of dust suppressants as a permitted activity, provided the dust suppressant is not a hazardous substance or is otherwise approved under the Hazardous Substances and New Organisms Act 1996.	**Activity status**: Permitted **MTADA status:** n/a **Commentary:** The use of any dust suppressant (if required) will be a permitted activity.
Permanent (partial) diversion of water to parallel channel; Temporary take for dewatering purposes; Temporary take for dust suppression	Rule 52(a) provides for any take, damming, diversion or use of water (both groundwater and surface water) from the Waiau catchment as a discretionary activity provided the application is for a replacement of an existing water permit or is a groundwater take with a low degree of hydraulic connection, except as provided in Rules 49(a), 49(b), 49(c), 50(a), 50(b), 51(a), 51(b), 52A and 52B. Rule 49(c) provides for the taking, diversion and use of surface water where the total rate of authorised surface water abstraction does not exceed the primary allocation	**Activity status**: Non-complying **MTADA status:** MTADA does not apply to water diversion activities (Section 14 of the RMA). **Commentary:** Rules 49(a), 49(c), 50(a), 50(b), 51(a), 51(b), 52A and 52B are not applicable to the Project, and the proposed takes are unable to comply with the conditions of Rule 52(a). Rule 49(b) provides for diversions of surface water as a restricted discretionary activity subject to conditions, including that the water must be returned within 100 m of the diversion point (which cannot be met). The primary allocation for the Waiau catchment specified in Appendix K would be exceeded by further surface water abstractions (meaning Rule 49(c) does not apply).

[18] 'Maintenance' is defined in the PSWLP as "*Work on a structure necessary to maintain that structure in good order and repair, including repainting, that does not materially alter its dimensions''*.

Activity	Rule	Assessment
	specified in Appendix K is a discretionary activity. Rule 52(b) provides for any take, damming, diversion or use of water from the Waiau catchment that does not meet the conditions of 52(a) as a non-complying activity.	Resource consent is therefore sought under Rule 52(b) as a non-complying activity.
Placement of culverts in bed and associated diversion and discharge	Rule 59 (a) provides for the placement, erection or reconstruction of any culvert in the bed of a river or wetland, but does not apply to the beds of lakes or natural wetlands (which are relevant to the Project). Rule 69 provides for any use, erection, maintenance, reconstruction, placement, replacement, alteration, extension, removal or demolition of any structure in, on, under or over the bed of a lake, river, modified watercourse or wetland, and any associated bed disturbance and discharge resulting from carrying out the activity, that is not provided for by a rule in the Plan, as a discretionary activity.	**Activity status**: n/a (exempt) for Section 13 matters, discretionary activity for Section 14 and 15 matters. **MTADA status:** MTADA applies to land use matters (Section 13 of the RMA) but not to water diversion and discharge activities (Sections 14 and 15 of the RMA). **Commentary:** The Project involves placement of a number of new culverts in the bed of the Waiau Arm (lake bed), including temporary and permanent culverts. MTADA applies to the land use elements of culvert placement, but not the associated diversion and discharge. Resource consent is sought as discretionary activity.
Excavation and disturbance within lake bed for channel realignment or deepening	Rule 71 provides for excavation and disturbance of a lake bed for the purpose of realignment, widening or deepening any channel within the bed as a discretionary activity, except as provided for elsewhere in the PSWLP.	**Activity status**: n/a (exempt) **MTADA status:** MTADA applies to land use activities (Section 13 of the RMA). **Commentary:** The Project involves excavation and disturbance of the Waiau Arm (lake bed) to create a parallel channel. This may constitute the partial realignment of the channel. Resource consent would be required as a discretionary activity under Rule 71, however, MTADA applies and the land use activity is exempt.
Excavation and disturbance within lake bed for gravel extraction	Rule 73 (a) provides for the excavation or disturbance of the bed of a lake for the purpose of extracting gravel or aggregate as a permitted activity, subject to a number of conditions. Rule 73(c) provides for the excavation or disturbance of the bed of a lake for the purpose of extracting gravel or aggregate that cannot meet conditions in Rules 73(a) or 73(b) as a discretionary activity.	**Activity status**: n/a (exempt) **MTADA status:** MTADA applies to land use activities (Section 13 of the RMA). **Commentary:** The Project involves excavation of gravel from the Waiau Arm to create the parallel channel. The gravel extraction is not able to meet the permitted activity conditions of 73(a), notably the quantity of gravel removed will exceed 120 m^3. Resource consent would be required as a discretionary activity under Rule73(c), however, MTADA applies and the land use activity is exempt.

Activity	Rule	Assessment
Wetland removal	Rule 74 (c) provides for the use of land within a natural wetland that is not for the purposes identified in Rule 74(a) or 74(ab) as a non-complying activity.	**Activity status**: n/a (exempt) **MTADA status:** MTADA applies to land use activities (Section 13 of the RMA). **Commentary:** The construction of the haul road involves permanent removal of one wetland (Wetland 1) and two sections of the eastern lacustrine channels (wetlands), and temporary use of western-most lacustrine channel (wetland). The use of land is not for the purposes identified in Rule 74(a) or 74(ab). Resource consent would be required as a discretionary activity under Rule 73(c), however, MTADA applies and the land use activity is exempt.

Overall, a section 14 water permit and section 15 discharge permit are required under the PSWLP as a non-complying activity.

6.5 Regional Air Plan 2016

The Regional Air Plan 2016 (Air Plan) sets out way in which ES controls and manages discharges to air. The Air Plan comprises Stage 1 and Stage 2. Stage 1 includes rules in relation to domestic heating, outdoor burning, the application of agrichemicals and fertilisers and fire training. Stage 2 encompasses the remaining framework from the Regional Air Quality Plan for Southland (1999) and includes rules in relation to discharges from industrial or trade premises, odour discharges and motor vehicle emissions.

None of the rules in either Stage 1 or Stage 2 are applicable to potential discharges to air associated with the Project (e.g. construction dust and other discharges/emissions to air) and additionally there is no 'catch-all' rule to cover other discharges to air. Further, there is no applicable National Environmental Standard and therefore any discharge to air associated with the Project is a permitted activity pursuant to Section 15(2) and (2A) of the RMA. Alternatively, these discharges would be authorised under MTADA.

6.6 Southland District Plan

The Southland District Plan (SDP) has been updated as of October 2023 in accordance with the national directive to standardise district plans.[19] Updates relate to the structure of the documents and definitions to align with the National Planning Standards. Policies and rules have not changed.

The Southland District Plan 2018 states the following:

> *Obligation to Comply*
>
> *[…]*
>
> *In addition to the above, the Manapouri-Te Anau Development Act 1963 (MTADA) is a special legislation that permits the owner of the Manapouri Power Scheme "full power and authority" to erect, construct, provide, use and operate all works, appliances and conveniences associated with the generation and transmission of electricity.*
>
> *Section 9 (3) of the Act does not apply to land use activities that are necessary or requisite to operate the Manapouri Power Station and associated works pursuant to section 4 of the Manapouri – Te Anau*

[19] The SDP was made operative in 2018. For the purposes of this report, the 'SDP' relates to the 'Draft District Plan 2023'.

Development Act 1963. Section 9 (3) does, however, apply to all other Manapouri Power Station land-use activities.

MTADA has been assessed to apply to the section 9 activities associated with the Project. However, for completeness, the following rules would be relevant under the SDP.

Table 6.3: SDP rule assessment

Activity	Rule	Comment
Noise	NOISE-R1 provides for activities to be permitted unless otherwise specifies where they comply with the relevant noise standards, zone, and district wide rules. This relates to vibration (NOISE-R10) and construction noise (NOISE-R12).	**MTADA status:** MTADA applies to land use activities (Section 9 of the RMA). **Commentary:** The Project will mostly comply with the relevant construction vibration and noise standards that are identified in the District Plan. The exception to this is the night-time limits under both GRUZ-R7.4 and NZS 68-3, during excavation stages 1 and 3. Meridian is developing a construction noise management plan to manage the effects of this on adjacent landowners. The Project would require resource consent as a discretionary activity under NOISE-R14. However, the rule does not apply given the application of MTADA.
	NOISE-R14 provides for noise generating activities that do not comply with NOISE4-14 as a discretionary activity.	
	GRUZ-R7.4 provides for noise in the rural zone provided it complies with the listed conditions and performance standards.	
Lighting	INF-R6 is the performance standard for lighting which requires it to comply with the relevant noise, lighting, and glare provisions for the relevant zone.	**MTADA status:** MTADA applies to land use activities (Section 9 of the RMA). **Commentary:** The Project will require lighting in the rural zone. Provided the standards are complied with, this is a permitted activity under the District Plan. However, the rule does not apply given the application of MTADA.
	GRUZ-R7.1 provides for lighting in the rural zone as a permitted activity where it complies with the listed conditions and performance standards.	
Vegetation removal	ECO-R1 provides for indigenous vegetation removal associated with the operation, maintenance or upgrading of regionally significant infrastructure or existing renewable energy facilities.	**MTADA status:** MTADA applies to land use activities (Section 9 of the RMA). **Commentary:** Vegetation removal is required as part of the Project. As this is associated with the operation and upgrading of regionally significant hydro infrastructure, it is a permitted activity under the District Plan. In addition to this, the rule does not apply given the application of MTADA.
Earthworks	GRUZ-R1 (7) and (8a) provides for earthworks as a permitted activity where they meet the conditions (including volumes and height). Where these are not complied with, GRUZ-R4 provides for activities that cannot be undertaken as a permitted, controlled or restricted	**MTADA status:** MTADA applies to land use activities (Section 9 of the RMA). **Commentary:** The Project requires earthworks that exceed the permitted standards in the SDP. The activity would require resource consent as a discretionary activity under GRUZ-R4 of the District Plan. However, the rule does not apply given the application of MTADA.

Activity	Rule	Comment
	discretionary activity, or not listed as a non-complying or prohibited activity, as discretionary activities.	

6.7 National Environmental Standard for Freshwater Management

The Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F) came into effect on 3 September 2020. Part 3, Subpart 1 contains standards for activities occurring within or within 100 m of a 'natural inland wetland'. As discussed in Section 4.6.2.4 of this AEE, not all the wetland areas within and adjacent to the Project footprint are considered to be natural inland wetlands due to their location in a lake bed. However, as a precautionary approach, the assessment below has assumed all such features fall under this definition.

The MPS and MLC are 'specified infrastructure' for the purposes of the NPS-FM and NES-F[20]. Table 6.4 provides an assessment against the relevant NES-F regulations which apply to maintenance and operation of specified infrastructure insofar as it affects natural inland wetlands.

Regulations in the NES-F pertaining to culverts apply to the bed of a river. The culverts proposed under the haul road are in the bed of a lake and therefore those regulations are not assessed here. However, effects will still be appropriately managed as set out in Section 7.6.3 of this AEE.

Table 6.4: NES-F regulation assessment for specified infrastructure affecting natural inland wetlands

Regulation	Assessment
Regulation 46 provides for a number of activities as a permitted activity where they are related to the maintenance and operation of specified infrastructure and other infrastructure and where they comply with the conditions. This includes vegetation clearance and earthworks or land disturbance within or within a 10 m setback from a natural inland wetland; and the taking, use, damming, diversion, or discharge of water within a 100 m setback from a natural inland wetland. The conditions set out in regulation 46 (4) are: a) The activity must comply with the general conditions on natural inland wetland activities in regulation 55, but regulation 55(2), (3)(b) to (d), and (5) do not apply if the activity is for the purpose of maintaining or operating— i) Hydro-electricity infrastructure; or ii) Any public flood control, flood protection, or drainage works that are specified infrastructure; and b) The activity must not be for the purpose of increasing the size, or replacing part, of the specified infrastructure or other infrastructure unless the increase or replacement is to provide for the passage of fish in accordance with these regulations; and c) The activity must not result in the formation of new pathways, boardwalks, or other accessways; and	**Wetland 1** Wetland 1 will be irreversibly lost. The works require vegetation clearance within a natural inland wetland, earthworks within a natural inland wetland, and the diversion and discharge of water within a natural inland wetland. While this activity is for the overall purpose of maintaining and operating hydro-electricity infrastructure (meaning the general conditions in regulation 55(2), (3)(b) to (d), and (5) do not apply), the vegetation clearance and earthworks will occur over more than 10% of the area (total loss) and therefore the activity does not comply with the permitted activity condition in regulation 46(4)(d). Regulation 47 therefore applies. **Lacustrine wetlands** At the haul road crossings of the lacustrine wetlands, there will be vegetation clearance within a natural

[20] Specified infrastructure includes regionally significant infrastructure identified as such in a regional policy statement or regional plan, and any water storage infrastructure.

Regulation	Assessment
d) If the activity is vegetation clearance, earthworks, or land disturbance, the activity must not occur over more than 500 m^2 or 10% of the area of the natural inland wetland, whichever is smaller; and e) If the activity is earthworks or land disturbance,— i) Trenches dug (for example, to maintain pipes) must be backfilled and compacted no later than 48 hours after being dug; and ii) The activity must not result in drains being deeper, relative to the natural inland wetland's water level, than they were before the activity; and If the activity is a discharge of water, it must not be a restricted discretionary activity as described in regulation 47(3A).	inland wetland, earthworks within a natural inland wetland, and the diversion and discharge of water within a natural inland wetland. While this activity is for the overall purpose of maintaining and operating hydro-electricity infrastructure (meaning the general conditions in regulation 55(2), (3)(b) to (d), and (5) do not apply), the vegetation clearance and earthworks may occur over more than 10% of the area and therefore the activity does not comply with the permitted activity condition in regulation 46(4)(d). Regulation 47 therefore applies. **All other wetlands** At all other wetlands at the Project site, there will be no vegetation clearance, earthworks, or land disturbance within 10 m of those features. However, there may be takes, diversions and discharges within 100 m of those features. Therefore Regulation 47 also applies to those activities.
Regulation 47 provides for maintenance and operation of specified infrastructure activities which do not comply with any of the conditions in regulation 46(4) as a restricted discretionary activity.	Vegetation clearance, earthworks / land disturbance and the diversion and discharge of water in and near the natural inland wetlands requires resource consent as a restricted discretionary activity under regulation 47 of the NES-F. Matters of discretion are set out in regulation 56 (discussed below).

Overall resource consent is required under the NES-F as a restricted discretionary activity.

While the activity will be bundled to an overall non-complying status, the following matters of discretion are identified in Regulation 56:

a) The extent to which the nature, scale, timing, intensity, and location of the activity may have adverse effects on—
   i) The existing and potential values of the natural inland wetland, its catchment, and the coastal environment; and
   ii) The extent of the natural inland wetland; and
   iii) The seasonal and annual hydrological regime of the natural inland wetland; and
   iv) The passage of fish in the natural inland wetland or another water body.

b) Whether there are practicable alternatives to undertaking the activity that would avoid those adverse effects;

c) The extent to which those adverse effects will be managed to avoid the loss of the extent of the natural inland wetland and its values;

d) Other measures to minimise or remedy those adverse effects;

e) How any of those adverse effects that are more than minor may be offset or compensated for if they cannot be avoided, minimised, or remedied;

(ea) The extent to which the effects of the activity will be managed through applying the effects management hierarchy;

f) The risk of flooding upstream or downstream of the natural inland wetland, and the measures to avoid, minimise, or remedy that risk; AND

g) The social, economic, environmental, and cultural benefits (if any) that are likely to result from the proposed activity (including the extent to which the activity may protect, maintain, or enhance ecosystems).

Wetland 1, and partial areas of wetland affected by the parallel channel and haul road at the two eastern-most lacustrine channels, will be permanently lost as a result of the Project. These losses cannot be avoided as there is no alternative location for the haul road and parallel channel. The effect of these losses has respectively been assessed as Very Low and Low (refer Section 7.6.2 of this AEE). As the effects are no more than minor, offsetting or compensation has not been further considered. The overall benefits and positive effects of the Project for the freshwater environment including water quality resulting from improved conveyance and reliability of flows to the LWR, are considerable.

6.8 Existing resource consents

Meridian holds a suite of operational resource consents from ES for water takes, diversions, and discharges associated with the MPS. Meridian is obligated to operate the MPS so that the Guidelines are complied with. These consents are subject to a number of conditions and monitoring programmes.

Specifically in relation to the MLC, Meridian holds five resource consents from ES, being:

- **96022** to dam and divert the waters of Lake Manapouri and the Waiau and Mararoa Rivers by means of a structure (with a crest level of 179.25 metres above mean sea level) near the confluence of the Waiau and Mararoa Rivers and to dam and divert the waters of the Marara River to an artificial diversion channel;
- **96023** to discharge the waters of Lake Manapouri and the Waiau and Mararoa Rivers to the bed of the Waiau River below the Manapouri Lake Control Structure;
- **206156** to dam and divert the waters of Lake Manapouri and the Waiau and Mararoa Rivers, for the purposes of the take and use of water for hydro-electricity generation at the Manapōuri Power Station by means of the Manapouri Lake Control Structure;
- **204160** for maintenance works associated with the MLC. This consent expired on 11 December 2021. A replacement resource consent application was lodged with ES at least 6 months before the expiration of the existing consent, and as such Meridian have continuance rights under section 124 the RMA to continue exercising the existing consent until the replacement is decided; and
- **AUTH-20202022** for the operation and maintenance of the fish pass structure which forms part of the MLC. This consent was granted on 8 July 2020 and expires on 8 July 2045.

6.9 Other consents and approvals

6.9.1 Heritage New Zealand Pouhere Taonga Act

The Heritage New Zealand Pouhere Taonga Act 2014 makes it unlawful for any person to modify or destroy, or cause to be modified or destroyed, the whole or any part of an archaeological site without an Archaeological Authority issued by Heritage New Zealand. An archaeological site is

defined as any place in New Zealand (including buildings, structures or shipwrecks) that was associated with pre-1900 human activity, where there is evidence relating to the history of New Zealand that can be investigated using archaeological methods or any sites associated within human activity in or after 1900 where there is significant evidence relating to the historical and cultural heritage of New Zealand.

An archaeological authority has not been sought for the Project given that there are no known archaeological sites affected by the Project. A condition requiring implementation of an accidental discovery protocol is volunteered in Section 8 of this report.

6.9.2 Wildlife Act

The Wildlife Act 1953 is the principal means for protecting wildlife, including some of New Zealand's most endangered species. The Department of Conservation (DOC) administers the Wildlife Act and a Wildlife Authority is required to hold, catch, handle or release certain species. Before any development can occur on land where New Zealand native lizards or frogs are found, DOC approval and a Wildlife Authority must be obtained.

It is not anticipated that a Wildlife Authority is required for the Project given that there are no protected species that are required to be moved.

6.9.3 Freshwater Fish Regulations 1983

Under the Freshwater Fish Regulations 1983 (the FFR83), a permit may be required from DOC for the installation of the culverts and haul road across the lacustrine channels in relation to effects on fish passage.

6.9.4 Fisheries Act 1996

Permitting requirements for fish transfers depend on the species and location of transfer. To capture and relocate native species, a special permit may be required from the Ministry of Primary Industries (MPI) under s 97 of the Fisheries Act 1996. A permit may also be required from the Minister of Fisheries under s 26ZM of the Conservation Act 1987. [21]

[21] Given that the fish are being transferred to a place where they already exist, a permit from the Department of Conservation (DOC) under section 26ZM of the Conservation Act 1987 is not anticipated to be required.

7 Assessment of Effects on the Environment

7.1 Overview

In accordance with section 104 of the RMA and subject to Part 2, the consent authority must have regard to any actual and potential effects on the environment of allowing the activity. The following assessment identifies and assesses the types of effects that may arise from the Project including:

- Positive effects (Section 7.2);
- Effects on cultural values (Section 7.3);
- Effects on hydrology and water quality (Section 7.4);
- Effects on geology and hydrogeology (Section 7.5);
- Effects on ecology (Section 7.6);
- Effects on landscape and visual values (Section 7.7);
- Effects on recreation (Section 7.8); and
- Effects on amenity (Section 7.9).

7.2 Positive effects

The Project will improve the conveyance and reliability of flow releases to the LWR including flushing flows and recreational flows. As discussed throughout this report, this will assist with the management of undesirable periphyton growth and have associated benefits for freshwater environment outcomes in the LWR.

The proposed works have been designed to have the least possible adverse effects on the environment, particularly in terms of sediment generation, over the shortest duration practicable. The construction of a new parallel channel will mean that flows can be more reliably provided through the MLC.

7.3 Effects on cultural values

Ngāi Tahu are best placed to assess the potential effects on Ngāi Tahu cultural values. Te Tangi a Tauira – The Cry of the People and the Ngāi Tahu Freshwater Policy Statement provide some direction to resource consent applicants about matters which are of particular cultural importance. The key provisions of these documents are assessed in Section 9.8 of this report. A summary of cultural effects related matters is contained below.

The Cry of the People recognises the MPS has changed the environment from its natural state. It also recognises the effects on the Waiau River as a result of hydro-electricity generation. This includes increased risk of nuisance periphyton accumulations, including didymo.

The Project will improve freshwater outcomes in the LWR by increasing the reliability of a range of flows, including flushing flows. The option selection process indicated that the adopted parallel channel option would have significantly less adverse effects on freshwater ecology and water quality than a full instream option. Any potential adverse effects of the Project on aquatic ecosystems will be temporary and of short duration.

During construction an Accidental Discovery Protocol will be adopted in relation to excavation activities. This will ensure that should any cultural or historical artifacts be discovered, appropriate actions will be taken.

Meridian has commenced consultation with Te Ao Mārama Incorporated (TAMI) on behalf of Ngāi Tahu ki Murihiku manawhenua and has provided TAMI with a copy of this resource consent application upon lodgement.

7.4 Effects on hydrology and water quality

Effects on hydrology and water quality are described in detail in *Manapōuri Lake Control Flow Improvement Project – Assessment of Environmental Effects: Freshwater Ecology* by NIWA attached as **Appendix D**. The sections below are a summary of that information.

7.4.1 Flows and variability

During excavation activities, all flow from the Mararoa River will be directed down the LWR and there will be no upstream flows (flows towards Lake Manapōuri) in the Waiau Arm. This is to prevent suspended sediment being transported towards Lake Manapōuri.

Downstream flows (from Lake Manapōuri) will occur in the following circumstances:

- When flow from the Mararoa River is insufficient to provide minimum flows in the LWR (i.e., 12 m^3/s from May to September, 14 m^3/s in October and April, and 16 m^3/s from November to March);
- To provide monthly recreational flows in the LWR (approximately 35 m^3/s to 45 m^3/s for 24 hours on the last Sunday of the month from October to April);
- Spill flow resulting from compliance obligations to meet the Lake Manapōuri Flood Rules; and
- Supplementary flows for managing nuisance periphyton in accordance with the Protocol.

At high lake levels rising above maximum control level the Waiau Arm discharge will be high and will create a situation where it will be unsuitable for the excavation works to progress.

Subject to the above, the Project is not expected to have any adverse effects on surface flows in the Mararoa River, Waiau Arm, and LWR.

7.4.2 Suspended sediment and deposited fine sediment

Suspended sediment decreases water clarity, and direct relationships exist between the two. Suspended sediment may lead to a slight increase in water temperature (as suspended sediments absorb heat energy) and small changes in dissolved oxygen concentrations (due to a decrease in photosynthesis by aquatic plants). Depending on the chemistry of the sediments, pH may also be slightly altered. An increase in suspended sediment may also to increase phosphorus concentrations in the river. Most of the additional phosphorus would be total phosphorus, which is biologically available to periphyton or aquatic macrophytes.

When suspended sediment falls out of the water column it can settle on the bed as DFS. This can smother invertebrate habitat, fish redds and reduce primary production.

Suspended sediment and DFS thresholds have been designed to allow additional sediment inputs that are within the range experienced naturally by biota within the LWR. Therefore, downstream of the reasonable mixing zone (the downstream monitoring site), the adverse effects are predicted to be no more than minor. All adverse effects on water quality will be temporary and of short duration. Suspended sediment generation is principally limited to the 3-5 weeks when the “plugs” are removed towards the end of the parallel channel excavation.

The predicted effects of suspended sediment on plant communities, macroinvertebrates, fish, and birds are assessed further in Section 7.6 below.

7.4.3 Maintenance activities

Due to the much smaller scale of future activities required to maintain the parallel channel, and the existing channels of the Waiau Arm upstream of and around the confluence with the Mararoa River, the thresholds and monitoring requirements outlined above (Section 7.4.2) are not considered appropriate. A separate condition is proposed (refer Section 8) for maintenance which allows for short-term increases in turbidity above 160 FNU, which is consistent with effects management for construction of the parallel channel. Any adverse effects of maintenance activities are therefore assessed as less than minor.

7.5 Effects on geology and hydrogeology

Effects on the geology and hydrogeological setting are described in detail in the *Waiau Channel Improvements – Proposed Methodology* by Damwatch attached as **Appendix C** and the *Manapōuri Lake Control Flow Improvement Project – Groundwater Assessment* by Land Water People attached as **Appendix G.** The below sections are a summary of that information.

7.5.1 Geology

The Project involves excavation of gravels and other material which may generate release of sediment to water. Measures to manage and limit those adverse effects have been described in preceding sections. Overall, the proposal will not adversely affect the geology of the site.

7.5.2 Hydrogeology

The primary potential effect on hydrogeology and groundwater is from partial dewatering of the excavation area during construction. The decision to undertake dewatering (and accompanying discharge of dewatering flows to land) will ultimately depend on a range of factors including water levels in the Waiau Arm at the time and whether the selected contractor considers it to be a viable and necessary option. If required it is likely dewatering would only be required for approximately 4 weeks.

The proposed dewatering methodology involves pumping from sumps excavated adjacent to the parallel channel excavation. The magnitude of dewatering flows will vary according to the magnitude of water level reduction in the parallel channel excavation sought. Estimated dewatering rates range from 120 L/s for a 1-metre reduction in standing water level in the parallel channel excavation to around 220 L/s for a 2-metre reduction in water level.

Dewatering flows will be returned to surface water (the Mararoa River) via infiltration to ground from a seepage pond constructed along the river margin. The volume of dewatering flows able to be accommodated by ground seepage varies according to river stage and seepage pond area.

The proposed take and subsequent discharge of water will effectively occur contemporaneously from and to the same waterbody, meaning the take is non-consumptive (with the exception of any evaporation which occurs, which can be expected to be negligible).

The dewatering will lower natural groundwater across a significant proportion of the Project site during the initial phase of Stage 2 excavations. This may have an effect on adjoining wetlands, however, given they are already characterised as ‘infrequently wet’, a temporary reduction in groundwater levels (over approximately 4 weeks) is likely to result in a less than minor effect on the hydrology of these features.

With respect to the effects on other water users, there is only one bore within 2 km of the Project site. This bore is assigned ‘proposed’ status, indicating that it may yet to be drilled. Its indicative

location is adjacent to the Mararoa River bridge on Weir Road, approximately 900 metres from the Mararoa River and downstream of the site. The potential for this bore to be affected is minimal.

Based on available information, it is reasonable to conclude the potential dewatering activities will have less than minor adverse effects on the hydrogeological and groundwater setting.

7.6 Effects on ecology

7.6.1 Terrestrial

Effects on terrestrial vegetation at the site are described in detail in *Manapōuri Lake Control Improvement Project: Wetland Assessment Report* by Boffa Miskell, attached as **Appendix F**. The following is a summary of that information.

Terrestrial vegetation will be removed across the construction footprint, as shown in Figure 7.1 below. This vegetation is predominantly exotic grassland and crack willow which has been assessed as being of negligible ecological value. Removing this vegetation has been assessed as having a Very Low (not more than minor) level of effect. Once construction is complete the contractors' establishment area and spoil disposal area will be rehabilitated with pasture grasses.

Less than 10 individual Buchanan's sedge (classified as nationally At Risk – Declining species) were surveyed within the Project site. These will be transplanted to a suitable area of lacustrine habitat within the Project site (but outside the construction footprint).

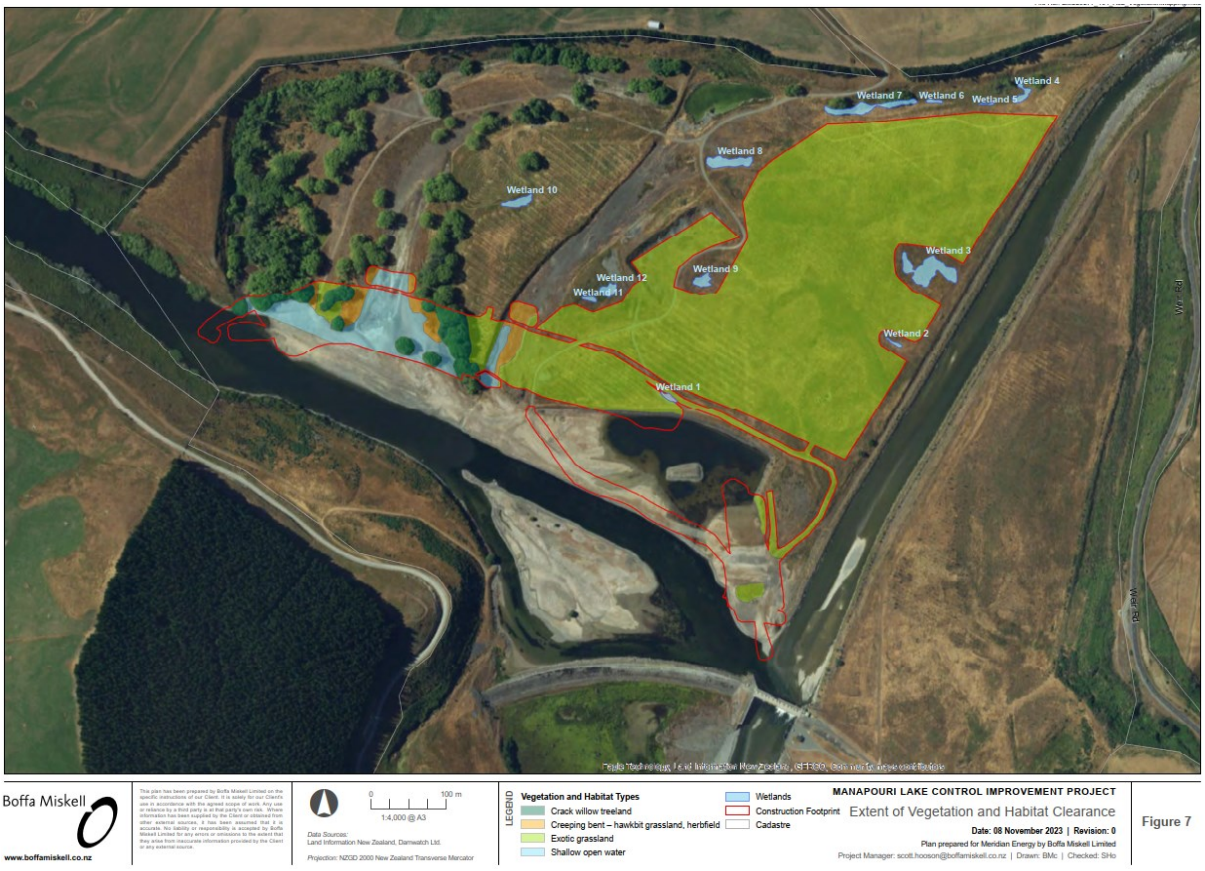

Figure 7.1: Extent of vegetation and habitat clearance. (Source: Appendix F).

7.6.2 Wetlands

Effects on wetlands at the site are described in detail in *Manapōuri Lake Control Improvement Project: Wetland Assessment Report* by Boffa Miskell, attached as **Appendix F**. The following is a summary of that information.

7.6.2.1 Palustrine wetlands

Of the 12 palustrine wetlands identified in and adjacent to the Project site (see Figure 7.1 above), only one (Wetland 1) will be irreversibly lost as it sits within the footprint of the proposed haul road. There are no feasible alternative locations for the haul road so loss of this wetland cannot be avoided. The wetland is small (122 m^2), is located on an artificial / highly modified landform, and does not contain representative vegetation or rare, diverse, or distinct habitat. It has been assessed as having low ecological value with its removal being of Very Low (not more than minor) effect. Offsetting or compensation is not proposed based on this level of effect (based on direction within Regulation 56 of the NES-F) and the overall positive effects of the Project for freshwater.

The remaining 11 palustrine wetlands will be protected by at least a 10 m construction buffer along with appropriate erosion and sediment controls. With those measures in place the level of effect has been assessed as Very Low – Low (not more than minor).

Should dewatering of the parallel channel excavation need to occur during construction, any drawdown has been assessed as having a less than minor effect on the wetland hydrology (see Groundwater Assessment in **Appendix G**).

7.6.2.2 Lacustrine wetlands

Construction of the parallel channel and haul road will lead to loss of hydrophytic vegetation and wetland habitats under that footprint within the three 'lacustrine channels'. Generally, these are species that are common locally and with no national threat status and are expected to re-establish in suitable lacustrine margins of the newly constructed channel. The overall level of effect of this loss has been assessed as Low (not more than minor).

Hydrological connection between the lacustrine channels and the Waiau Arm will not exist for approximately 15 weeks during the parallel channel construction. There will continue to be groundwater connection to these channels over this period and the western channel is expected to continue to receive freshwater flows from the toe of the terrace to its west and north. Hydrophytic vegetation and macrophytes that are killed are expected to re-establish in these habitats following completion of the Project and rehabilitation works. The magnitude of this temporary effect is considered to be Low (no more than minor).

On completion of the parallel channel, at the two eastern-most lacustrine channels the haul road structure will remain in place to provide for future maintenance. Culverts of appropriate size, to be determined at the detailed design phase, will be installed to provide a hydrological connection back into those lacustrine channels. At the western-most lacustrine channel, the haul road will be removed and the hydrological connection with the Waiau Arm restored.

There is the potential that the construction of the haul road and any de-watering sumps placed in proximity to the lacustrine channels may generate localised suspended sediment which could adversely affect the hydrophytic vegetation and macrophytes present in the three lacustrine channels. Any such effect would be temporary with these species expected to reestablish following the completion of the Project.

Potential effects on fish in the lacustrine channels are considered further in Section 7.6.3.3.

The overall effect of the proposed activities on the lacustrine channels has been assessed as Low (no more than minor).

7.6.2.3 Downstream riparian wetlands

Minor changes in flow in the LWR for the duration of the Project are expected to have a Very Low (no more than minor) level of effect on downstream riparian wetlands, which are of Low to Moderate ecological value.

Sedimentation and smothering of wetland vegetation in downstream riparian wetlands has also been assessed as Very Low (no more than minor), primarily because construction works are proposed to be completed under generally low flow conditions, meaning DFS is less likely to occur in riparian wetlands which are elevated above the normal river level. Project design, including avoiding working instream as much as possible and adherence to turbidity thresholds, will also minimise this potential effect.

7.6.3 Freshwater environment

Effects on freshwater ecology are principally addressed within two appended reports:

- ***Construction effects:*** *Manapōuri Lake Control Flow Improvement Project – Assessment of Environmental Effects: Freshwater Ecology* by NIWA attached as **Appendix D**; and
- **Operational effects:** *Assessment of risk of phytoplankton blooms in the Waiau Arm immediately upstream of the MLC following excavation of a new parallel channel* by NIWA attached as **Appendix E.**

Potential effects on fish, specifically as a result of works in the lacustrine channels, are addressed in *Manapōuri Lake Control Improvement Project: Wetland Assessment Report* by Boffa Miskell, attached as **Appendix F**.

The below sections contain summary information from those reports.

7.6.3.1 Plant communities

Construction activities in the Project area will temporarily destroy habitat for macrophytes and periphyton. The predicted effect will be minor because the communities will gradually recover following the Project and the plant communities in this part of the Waiau Arm do not have any special ecological values.

In the LWR, elevated SSC and DFS during the construction period is expected to affect the periphyton community primarily through growth reduction (because of reduced light from decreased water clarity and direct smothering by sediment), followed by increased potential for sloughing of existing periphyton mats. Given the existing state of periphyton in the LWR (i.e., frequent nuisance growths in summer) and the relatively short duration of potentially elevated sediment inputs, these effects can be considered less than minor.

The increased depth of the new parallel channel, and reduced flow in the two existing channels (main and south) following the excavation, are predicted to lead to reduced water velocities compared to those currently experienced at equivalent rates of flow in the Waiau Arm immediately upstream of MLC. This is predicted to increase the risk of phytoplankton blooms in the channels following excavation, over the risk in the existing channels, with three to five times the number of days under high-risk conditions. However, this risk is largely offset by the improved conveyance and reliability of flow releases to the LWR to be achieved by the Project. Flow releases that are part of current flow management in the LWR will provide a “core” set of flow releases that will, in most cases, reduce and /or delay the risk of phytoplankton blooms developing in the parallel, main, and south channels immediately upstream of MLC. The larger flushing flows would reset the risk of

phytoplankton blooms to very low, with a residual effect of several days. In addition, the parallel channel will support continued monthly recreational flows scheduled for the fourth Sunday in each month from October to April. Most recreational flows released in the past seven seasons have been associated with increased water velocities in the Waiau Arm and have replaced much of the water in the Waiau Arm with water from Lake Manapōuri, which would reset the risk of phytoplankton blooms to very low.

7.6.3.2 Macroinvertebrates

Elevated levels of suspended sediment attributable to the Project are expected to have less than minor effects on macroinvertebrate communities in the LWR. This is because the community is of low quality, and so reflects frequent high turbidity events sourced from the Mararoa River and passed down the LWR. Proposed conditions of consent will ensure that any additional suspended sediment generated from the Project is within the range already experienced by the fauna present.

DFS has a potentially greater effect on benthic macroinvertebrates than suspended sediments, primarily through habitat alteration and reduction in food availability and quality. Effects of this are likely to be closest to the MLC where DFS is already high at times. A consent condition is proposed which requires that if DFS (at the downstream monitoring site) increases by more than 20% over the pre-Project baseline, mitigation in the form of a flushing flow is required.

Kākahi (freshwater mussels) are potentially present in the stiller waters of the Waiau Arm, including within the western-most lacustrine channel. They are filter feeders that rely on small aquatic flora in the water column for food. To avoid or minimise impacts on kākahi, if present, a survey for this species will be undertaken prior to works commencing. The findings of this survey will inform the appropriate avoidance or minimisation measures, which could include kākahi relocation. These measures will be included in a Freshwater Fauna Management Plan.

7.6.3.3 Fish

Considering known freshwater fish species distributions in the Waiau catchment, as well as expected sensitivities to elevated fine sediment, the greatest construction-related effects of the Project are likely to be on salmonids (brown trout and rainbow trout) and longfin eel. Species that might be at risk from elevated sediment in the LWR include Southern flathead galaxias and Gollum galaxias.

The effects of additional DFS to salmonid spawning grounds is considered negligible because most spawning occurs in tributary headwaters. In low flow conditions, elevated suspended sediment may impede migration of trout aggregating at the confluence of the Mararoa River and Waiau Arm, which would be expected between May and July. This effect is likely to be minor given the expected relatively short duration (five to seven weeks) of instream excavation (for breakout areas).

Effects on longfin eels are possible due to increased SSC and DFS near the MLC. Suggested mitigation during the Project is for migrant adult eels captured in Lake Manapōuri as part of the trap-and transfer programme to be released further downstream (i.e., not directly below MLC).

Non-migratory galaxias species, such as the Southern flathead galaxias and the Gollum galaxias, are regarded as highly sensitive to increased fine sediment levels. Both are found in the LWR below the MLC, although they are rare as they very largely to tributary streams.

Perch are found in the Waiau Arm and Lake Manapōuri. Perch are considered resilient to increased sediment levels and therefore it is not expected there will be any negative effects on this species.

During construction of the parallel channel, the three lacustrine channels will be hydrologically disconnected from the Waiau Arm for a period of approximately 15 weeks. The two eastern-most channels are unlikely to support freshwater fish as they are generally dry. At the western channel, any fish found immediately prior to construction will be captured and relocated (by a suitably

qualified person) to a connected freshwater habitat upstream of the work footprint in accordance with a Freshwater Fauna Management Plan. With that mitigation in place it is expected the temporary loss of hydrological connectivity at the lacustrine channels will not have any adverse effects on fish.

Following construction of the parallel channel, at the two eastern most lacustrine channels, culverts of appropriate sizing (subject to detailed design) will be installed in the haul road (to remain for maintenance purposes) to provide a permanent hydrological connection. At the western most lacustrine channel, the haul road / protection bund at this location will be removed and hydrological connection restored.

Overall, subject to adherence to turbidity and DFS thresholds, and implementation of a Freshwater Fauna Management Plan (see Section 8 for a proposed condition), any adverse effects for fish species will be no more than minor.

7.6.3.4 Birds

While suspended sediment could negatively affect freshwater bird species (through altering or reducing food availability), freshwater birds are mobile and individuals would likely move away from the area for the duration of the Project if the adverse effects are too great.

The parallel channel excavation will be timed to avoid the breeding season (mid-September to January). A proposed consent condition is proposed to manage any other activities that occur during this window.

Consequently, any adverse effects on birds are anticipated to be less than minor.

7.7 Effects on landscape and visual values

Effects on landscape and visual values are described in detail in the *Manapōuri Lake Control Improvement Project: Landscape Effects Assessment* prepared by Boffa Miskell Limited and attached as **Appendix H**. The following is a summary of that information.

7.7.1 Natural character

Natural character is the naturalness or degree of modification of an area, and an area's combination of natural characteristics and qualities.[22] The highest degree of naturalness occurs where there is the least amount of human induced modification.

The existing environment in this location underwent significant modifications with the construction of the MPS, including the MLC, and the later realignment of the Mararoa River. Whilst the full extent of modification is now less apparent over much of the site given the subsequent cover of exotic grasses, the area remains part of a modified river landscape which includes built structures, engineered river margins, gravel stockpiles, pasture and willow trees with no more than low-moderate existing levels of natural character overall.

During construction, the Project will result in unnatural elements within the immediate upstream context of the MLC. Earthworks and other associated but temporary activities, such as structures and equipment located around the Project site, will accentuate the ongoing human modification in the area, however, it is noted that the works are localised within the Project footprint and the potential effects are contained within a limited visual catchment. While there are some wetlands albeit modified identified on the site, earthworks avoid these by way of setbacks (except for the removal of Wetland 1). The lacustrine channels will remain connected hydrologically to the Waiau

[22] NZILA 2022, Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines, page 205.

Arm post construction. Overall while the construction works are going to be visible, they are considered to be temporary in nature.

On completion of the work, the Waiau Arm will be reinstated to be broadly consistent with the context of an active river/lake channel and adjoining undulating rural floodplain. The spoil stockpiles will be rehabilitated to fit in with the existing environment. Bund removal will also occur with the re-spreading of material to resemble a sinuous organic form. Once operational, the Project site will become re-assimilated within its working rural context. Figure 7.2 and Figure 7.3 provide a visual simulation of the site at low and high lake levels respectively (the full range of images are contained in Appendix H).

Overall, on completion the effects on natural character will be commensurate with existing levels of modification, and are therefore considered to be less than minor.

7.7.2 Landscape

The existing landscape requires modification in order to undertake the Project; this consists of both temporary and permanent modifications. Temporary modifications include the establishment of the contractor set up areas, and the in-stream bunds. Permanent modifications include the new parallel channel and the additional spoil stockpiling. The overall extent of the Project, including the spoil disposal area, is limited by the relatively enclosed lower river terrace, and the previously straightened Mararoa River. This is supported by the limited visual catchment associated with the site, being predominantly from private property surrounding roads, and a scenic lookout identified along Weir Road.

The effects of landscape values as a result of the Project include the perceptual and associative aspects of landscape character. The Project site is part of the broader Te Anau Basin, while also being a highly modified and working part of the MPS. There will be an apparent change from the existing active river/lake margin adjoining a vegetated pastoral context which is progressively transformed throughout the construction period. However, upon completion of the works, including the re-contouring of the spoil disposal area, the site contours will be assimilated and appear consistent with the surrounding rural setting.

Overall, any adverse effects on landscape values are considered to be principally temporary in nature and less than minor.

7.7.3 Rural character

Rural landscapes are a combination of natural and human induced elements with the type of rural activity and land use associated with them that contribute to their character. Rural activities can include (among other things) agriculture, horticulture, forestry, and quarrying.

The Project site is characterised by low producing exotic pasture and colonising vegetation which adjoining visible built infrastructure. In that regard the site is integrated with the broader working rural context.

While the appearance of the Project site will change during construction, it will still retain a distinctive rural character. During earthworks, machinery will be visible however this is typical of many activities anticipated within the rural zone. Giving the relative containment of the Project site, and the temporary nature of the activities, the effects on rural character are considered limited and readily absorbed within the surrounding landscape. Upon reinstatement, the form and scale of the landscape will remain consistent with the rural character.

Overall, any adverse effects on rural character are considered less than minor.

Figure 7.2: Proposed view at completion when lake level is within main operating range of RL 177.59 m (Source: Appendix H).

Figure 7.3: Proposed view at completion when lake level is within low operating range of RL 175.86 m (Source: Appendix H).

7.7.4 Visual effects

Visual effects of a project are influenced by several factors including the nature of the proposal and the landscape in which the proposal occurs. As set out above, the Project site is relatively sheltered by the surrounding environment, however, public views are available from sections of Weir Road and Duncraigen Road, and the Weir Road lookout.

The visual simulations (**Appendix H**) indicate that upon completion, the expanded channel of the Waiau Arm will remain comparable to the existing dynamic river/lake surface, with the spoil reinstated to fit in with the working rural landscape. During high lake operating levels, much of the extent of the Waiau Arm will remain submerged. At this point, all but the tops of isolated vegetation and part of a remaining gravel island (as a result of the parallel channel) will be submerged. During the main operating levels of the lake, gravel islands (including the existing bird island) will become visible in the channel.

Overall, it is considered that while the Project will have visual effects, these are principally temporary in nature and overall any adverse visual effects are considered to be less than minor.

7.8 Effects on recreation

Parts of the Project area, including along the Mararoa Cut and downstream of the MLC are known for being fishing spots. The Waiau River more generally provides for jet boating activities year-round. Specifically, within the Project area, jet boating is not allowed due to the MLC structure. Meridian currently provides recreational flows throughout the year and these will remain throughout construction of the Project.

The Project is unlikely to affect recreational activities upstream of the site. Within the Waiau Arm and downstream of the MLC there will be temporary sediment discharges during the excavation works. However, as discussed previously, these are limited in duration and will be managed through thresholds to limit any adverse effects.

On this basis, any adverse effects on recreational activities as a result of the Project are considered to be less than minor.

7.9 Effects on amenity

7.9.1 Noise and vibration

The excavation activities have the potential to cause noise effects, in particular towards sensitive receptors. Typically construction noise is restricted to compliance with the noise standards as set out in the relevant district plan, and is often restricted to days and time which align with the normal operating / day time hours.

A 'Construction Noise Assessment' (**Appendix I**) has been undertaken by Marshall Day which has calculated the noise levels at sites surrounding the activity for five scenarios during the night-time. Because of the proposed construction time of seven days per week for up to 24 hours, the modelling focuses on the night-time noise levels, as these have the potential to be louder than the daytime noise because of the provision for site lighting and associated generators which may not be required during the day.

With respect to daytime noise levels, these have been assessed to be acceptable and comply with all relevant guidance. While the activity noise may be distinctly audible at some dwellings at times, indoor activities are not anticipated to be adversely affected.

Night-time noise levels are generally acceptable although there may be some instances which fall outside the standards. The perception of audibility may be slightly increased compared to the

daytime, as a result of generally lower residual noise levels at night. Of the eight nearby properties, two may be affected by exceedances to the night-time noise limit standards, being 567 Weir Road and 164 Duncraigen Road.

At 567 Weir Road, there is potential for sleep disturbance for light sleepers, particularly during excavation stage 1. At 164 Duncraigen Road, there is likely to be limited potential for sleep disruption. Overall, the noise levels are considered to be reasonable and the effects arising to be acceptable.

The preparation of a Construction Noise Management Plan to manage and mitigate potential effects of noise from construction activities is volunteered as a condition in Section 8. Meridian has arranged to work with the occupiers of 567 Weir Road and 164 Duncraigen Road in more detail outside of the consenting process.

Vibration is controlled via rules in the district plan, which require vibration emanating from any activity to not exceed the limits of the standards identified. There are no dwellings or other noise sensitive activities sufficiently close to the Project site to require assessment against those standards.

7.9.2 Lighting

The proposed construction window includes a seven day a week, 24 hour a day working day. This will require artificial floodlighting for works outside of daylight hours. Lighting requirements will be determined by the contractor based on the site configuration and requirements. It is anticipated that lighting sources will be moveable and not fixed. The set up will be designed to direct lighting downward and away from potential viewpoints from nearby properties.

This aligns with the performance standards as set out in the SDP in which all on-site lighting shall be designed and maintained so there is no spill of light above the horizontal plane. Additionally, the spill from artificial lighting shall not exceed 8 lux (horizontal and vertical) at the boundary of any other site. Given the substantival separation distances between the Project site and nearby sensitive receptors, it is considered lighting will generate less than minor adverse effects.

7.9.3 Dust

Dust could potentially be generated during construction works, particularly where gravels may be dry or during windy conditions. If not managed correctly, it could have adverse effects on construction workers, the environment, and neighbouring properties.

There will be some parts of construction where dust generation is more likely to occur, such as where excavated materials are from the dry lake bed (Stages 1 and 2), where there is bare land from the excavation, and in the spoil disposal area. Additional construction traffic may give rise to dust generation across the site.

The contractor will have a pump connected to a clean water source on site, which will either be connected to a truck mounted water spray gun, or used to fill a water cart, to be used for dust control as and when required. The stockpile will be progressively rehabilitated to limit the area left exposed at any one time.

Given the above mitigation, and the substantial separation distances to nearby sensitive receptors, any dust effects on neighbouring properties will be less than minor.

8 Volunteered Consent Conditions

8.1 Overview

Throughout Section 7 of this AEE a range of mitigation and monitoring measures have been proposed to manage the environmental effects of the Project. Key matters have been collated into proposed conditions for each consent sought below (water permit and discharge permit).

General conditions which apply to both permits are proposed to be appended to the consents as Schedule 1. Principally these conditions apply to land use matters which are subject to MTADA and for which consents are not sought. However, Meridian volunteers these conditions so that all actual and potential adverse effects of the Project are appropriately avoided, remedied, or mitigated. Schedule 1 also incorporates administrative matters common to each consent sought.

All conditions are preliminary and proposed only. Meridian intends to further discuss and develop the conditions with ES throughout the consent process.

8.2 Water permit (Section 14 RMA)

Purpose: To take, use, and divert water **Duration: 35 years**	
General	
1.	a. Except as provided for in the conditions below and subject to any final design, the Manapōuri Lake Control Improvement Project (MLCIP) shall be constructed, operated and maintained in general accordance with the Assessment of Effects on the Environment prepared by Tonkin + Taylor Limited dated December 2023 including all reports and drawings contained therein and the methodology detailed in "Construction Planning – Proposed Methodology" prepared by Damwatch Engineering Limited dated December 2023, and b. Where there may be an inconsistency between the documents referred to in clause (a) above and the requirements of these conditions, these conditions shall prevail.
2.	This resource consent authorises the take, use, and diversion of water as required to construct, operate and maintain the MLCIP, including for the purposes of: a. On a temporary basis, facilitating construction and maintenance activities, including within and in proximity to wetlands and for dewatering, dust suppression, and erosion and sediment control activities, and b. On a permanent basis, diverting some of the surface water in the Waiau Arm into the parallel channel.
3.	This resource consent shall be exercised in conjunction with Discharge Permit [consent reference] (or any subsequent variation versions).
4.	The Consent Holder shall comply with Schedule 1: General Conditions attached to and forming part of this consent.

8.3 Discharge permit (Section 15 RMA)

Purpose: To discharge contaminants to water and to land in circumstances where contaminants may enter water.

Duration: 35 years

General

1.	a. Except as provided for in the conditions below and subject to any final design, the Manapōuri Lake Control Improvement Project (MLCIP) shall be constructed, operated and maintained in general accordance with the Assessment of Effects on the Environment prepared by Tonkin + Taylor Limited dated December 2023 including all reports and drawings contained therein, and the methodology detailed in "Construction Planning – Proposed Methodology" prepared by Damwatch Engineering Limited dated December 2023, and b. Where there may be an inconsistency between the documents referred to in clause (a) above and the requirements of these conditions, these conditions shall prevail.
2.	This resource consent authorises the discharge of water, suspended sediment, and deposited fine sediment to land and water as required to construct, operate and maintain the MLCIP.
3.	This resource consent shall be exercised in conjunction with Water Permit [consent reference] (or any subsequent variation versions).
4.	The Consent Holder shall comply with Schedule 1: General Conditions attached to and forming part of this consent.

Definitions used in this resource consent

5.	In the conditions of this resource consent: a. "Parallel channel excavation works" means the construction of the parallel channel. b. "Maintenance activities" means those activities, including removal of gravel and bed material, as necessary to maintain the parallel channel, and the existing channels of the Waiau Arm upstream of and around the confluence with the Mararoa River at MLC, in general accordance with their constructed dimensions. c. "Duration of the parallel channel excavation works" means from the commencement of excavation works in the parallel channel to the conclusion of excavation works on the parallel channel including a period ending 5 days (120 hours) after the parallel channel is made fully open to the Waiau Arm. d. The "upstream monitoring site" (UMS) means the existing site monitored by Meridian Energy Limited in the Maraora River at the Cliffs [map reference TBC – as per Figure 5.5 of this AEE], e. The "downstream monitoring site" (DMS) means the existing site monitored by the Southland Regional Council upstream of the confluence of the Excelsior Stream with the Lower Waiau River [map reference TBC – as per Figure 5.5 of this AEE], f. "Total turbidity" shall be calculated by subtracting the mean hourly turbidity reading at the UMS from the same mean hourly turbidity reading at the DMS, g. "Deposited fine sediment" (DFS) means sediment less than 2 mm in diameter, and h. "Baseline DFS" is to be determined in accordance with condition [10].

Parallel channel excavation works: Turbidity thresholds for the Lower Waiau River

6.	Total turbidity generated for the duration of the parallel channel excavation works, as attributable to the works, shall not exceed the maximum total hours for any of the following Formazin Nephelometric Units (FNU) thresholds:

FNU threshold	Maximum total hours
>330	36
>160 to ≤330	95
>30 to ≤160	504
>12.4 to ≤30	945

7.	a. To the extent reasonably practicable, total turbidity for the duration of the parallel channel excavation works, as attributable to the works, shall not exceed the maximum consecutive hours for any of the following Formazin Nephelometric Units (FNU) thresholds:

	FNU threshold / **Maximum consecutive hours** >330 — 12 >160 to ≤330 — 32 >30 to ≤160 — 168 >12.4 to ≤30 — 315 b. In clause (a), measures which are reasonably practicable may include but are not limited to: i. Temporarily suspending work on the parallel channel excavation works, and ii. Increasing the duration of the initial first flush discharge from the parallel channel as it is opened to the Waiau Arm.
8.	In condition [6], an FNU threshold may be exceeded for more than the total maximum hours stated, provided that there is a concomitant reduction in the total maximum hours provided for in the next highest FNU threshold.
9.	In the event that total turbidity does not exceed 160 FNU for a period of at least 180 consecutive days, the turbidity thresholds set out in Condition [6] will be reset to their original maximum total hours.
Parallel channel excavation works: Deposited fine sediment (DFS)	
10.	The Consent Holder shall measure DFS at the DMS weekly for a period of at least six weeks prior to commencing the parallel channel excavation works. The mean average DFS recorded during this period will be the "baseline DFS".
11.	The Consent Holder shall measure DFS weekly at the DMS for the duration of the parallel channel excavation works and eight weeks thereafter, and document any changes to DFS relative to the baseline DFS. These changes shall be determined by using a rolling average of DFS measurements at the DMS over a six week period.
12.	Any changes to the baseline DFS at the DMS shall be assessed proportionately between those changes occurring from turbidity generated from flows in the Mararoa River and those occurring from turbidity generated by parallel channel excavation works. This proportionality shall be calculated by subtracting the mean hourly turbidity at the UMS from the same mean hourly turbidity at the DMS, and then collating all those records together into rolling periods of six weeks in accordance with Condition [11].
13.	If an increase of more than 20% in DFS relative to the baseline DFS at the DMS is observed which is attributable to fine sediment generated by parallel channel excavation works, the Consent Holder shall adopt reasonably practicable measures to avoid, remedy or mitigate this effect. This includes but is not limited to: a. Releasing sufficient flow through the Manapōuri Lake Control Structure to mobilise DFS at the downstream monitoring site; and b. Temporarily suspending work on the parallel channel excavation works, Increasing the duration of the initial first flush discharge from the parallel channel as it is opened to the Waiau Arm.
Maintenance activities	
14.	When undertaking maintenance activities, the Consent Holder shall: a. Adopt all practicable measures to minimise the use of any machinery in flowing water and minimise generation of suspended sediment; and b. Deposit any excavated material in the existing spoil stockpile area.
15.	Any increase in turbidity in the Lower Waiau River, as measured at the DMS, as a result of maintenance activities shall not exceed 160 FNU for more than 12 consecutive hours, and must not exceed 330 FNU at any time.

8.4 Schedule 1: General Conditions

General	
1.	a. Except as provided for in the conditions below and subject to any final design, the Manapōuri Lake Control Improvement Project (MLCIP) shall be constructed, operated and maintained in general accordance with the Assessment of Effects on the Environment prepared by Tonkin + Taylor Limited dated December 2023 including all reports and drawings contained therein, including the methodology detailed in "Construction Planning – Preferred Methodology" prepared by Damwatch Engineering Limited dated December 2023. b. Where there may be an inconsistency between the documents referred to in clause (a) above and the requirements of these conditions, these conditions shall prevail.
2.	All monitoring, management plan, and reporting actions required by the conditions of Water Permit [consent reference], Discharge Permit [consent reference], and the general conditions in this schedule, shall be undertaken by a Suitably Qualified Person. A Suitably Qualified Person means a person (or persons) who can provide sufficient evidence to demonstrate their suitability and competence in the relevant field of expertise.
Ecology	
3.	Except where authorised by Water Permit [consent reference] and Discharge Permit [consent reference], activities within flowing water are to be minimised as far as reasonably practicable.
4.	a. All fuel storage or machinery refuelling shall occur outside the bed of the lake or river, b. All equipment, machinery, or operating plant shall be cleaned before entering, and leaving the site, in accordance with Biosecurity New Zealand's "Clean, check, dry" hygiene procedures for machinery, and c. All equipment, machinery, operating plant and debris associated with the structure or bed disturbance activity shall be removed from the site following completion of the parallel channel excavation works. *Advice Note: Biosecurity New Zealand's hygiene procedures are available at www.biosecurity.co.nz and are intended to prevent the spread of pests and unwanted organisms as defined in the Biosecurity Act 1993, including didymosphemia geminate.*
5.	Any works in the period commencing 15th September and ending 31st January (inclusive) shall not disturb roosting and nesting areas of the black fronted tern, black billed gull, banded dotterel or black fronted dotterel.
6.	Prior to the commencement of parallel channel excavation works, any Buchanan's sedge plants within the construction footprint shall be transplanted to a suitable area of lacustrine habitat within the Project site.
7.	Prior to commencement of parallel channel excavation works a Freshwater Fauna Management Plan shall be prepared, and subsequently implemented, by a suitably qualified person, and shall include: a. Measures to avoid and minimise adverse effects on freshwater fauna in areas where surface water is present at the time of construction works, and b. Measures to avoid or minimise adverse effects on kākahi, including a survey for this species prior to the parallel channel excavation works commencing. The findings of this survey will inform the appropriate avoidance or minimisation measures, such as kākahi re-location, and c. Methods to capture and relocate fish and other fauna that may be affected by parallel channel excavation works, including in the lacustrine channels, and d. Advice around the timing of construction works to occur outside of critical periods, where practicable.
Erosion and sediment control	
8.	Parallel channel excavation works shall be undertaken in accordance with an Erosion and Sediment Control Plan (ESCP). The ESCP shall include details of the best practicable control measures that will be implemented to minimise the potential for sediment to enter surface water.

Noise and vibration	
9.	A construction noise management plan (CNMP) for the parallel channel excavation works shall be developed in accordance with the requirements of NZS 6803:1999 Acoustics – Construction Noise. The CNMP shall address matters in Annex E of the Standard, in particular: a. Consultation b. Responsible Persons c. Complaints Procedure d. Noise performance standards e. Practicable control measures f. Noise monitoring (if required) g. Training and supervision of workers on site h. Other mitigation options i. Other matters as deemed appropriate.
Landscape and rehabilitation	
10.	During parallel channel excavation works, all work areas shall be maintained in a tidy state. Following the completion of the parallel channel excavation works, all temporary buildings and structures, plant, machinery and equipment shall be removed (except machinery required for the works in conditions 11 and 12 below) and the site left in a tidy state.
11.	Following the completion of parallel channel excavation works, the spoil disposal area, contractors establishment area, and any construction area in the Waiau Arm no longer required for permanent structures, shall be shaped and profiled to be sympathetic to the contours of the surrounding landscape and piles or humps shall be avoided.
12.	The spoil disposal area and contractors' establishment area shall be rehabilitated within the next available planting season following the completion of the parallel channel excavation works. This rehabilitation shall achieve a final cover of pasture or similar vegetation.
Future gravel extraction from gravel stockpile cell	
13.	Any future removal of gravel from the spoil disposal area shall be limited to within the defined 'gravel stockpile cell' and shall be completed in sequential stages moving from south to north to facilitate progressive rehabilitation.
14.	Once any future gravel removal from within the 'gravel stockpile cell' is complete, the resultant surface shall be scarified to promote plant growth and rehabilitated within the next available planting season. This rehabilitation shall achieve a final cover of pasture or similar vegetation.
Advice note for Conditions 13 and 14: Any future gravel removal and processing from the gravel stockpile cell may be subject to requirements of additional resource consents.	
Notifications, records and reporting	
15.	The Consent Holder shall notify the Consent Authority in writing: a. No less than ten working days prior to commencing any works under these resource consents; and b. No less than ten working days after completion of the works under these resource consents.
16.	The Consent Holder shall maintain a record of all activities carried out under these resource consents and supply this record to the Consent Authority upon request. The record of activities shall include: a. Turbidity and deposited fine sediment monitoring during the parallel channel excavation works under Discharge Permit [consent reference], b. Dates and times of when key activities are undertaken, and c. A record of any incidents or complaints.
Accidental discovery protocol	
17.	In the event of a discovery, or suspected discovery, of a site of cultural importance (Waahi Taonga/Tapu) during the exercise of this consent, the Consent Holder shall immediately cease operations in that location and inform the local iwi authority (Te Ao Marama Inc, phone 03 931 6032). Operations may recommence at a time as agreed upon in writing with the Consent Authority. The discovery of Koiwi (human skeletal remains) or Taonga or artefact material (e.g.

	pounamu/greenstone) would indicate a site of cultural importance. [Appendix 1] outlines the process that is to be followed in the event of such a discovery.
Review	
18.	The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions of these resource consents at five year intervals , or within two months of any enforcement action being taken by the Consent Authority in relation to the exercise of this consent, for the purposes of: a. Determining whether the conditions of these resource consents are adequate to deal with any adverse effect on the environment, including cumulative effects, which may arise from the exercise of the resource consents, and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of these resource consents; b. Ensuring the conditions of these resource consents are consistent with any National Environmental Standards Regulations, relevant plans and/or the Environment Southland Regional Policy Statement; c. Requiring the Consent Holder to adopt the best practicable option to remove or reduce any adverse effect on the environment arising as a result of the exercise of these resource consents.

9 Statutory Assessment

9.1 Section 104 of the RMA

Section 104 of the RMA sets out the matters to which a consent authority must have regard to, subject to Part 2 of the RMA, when considering an application for resource consent. The provisions relevant to the present applications are:

- Any actual and potential effects on the environment of allowing the activity.
- Any relevant provisions of:
  - A national environmental standard;
  - Other regulations;
  - A national policy statement;
  - A regional policy statement or proposed regional policy statement; and
  - A plan or proposed plan.
- Any other matter the consent authority considers relevant and reasonably necessary to determine the application.

Section 7 of this AEE addresses actual and potential effects on the environment, and Section 8 summarises the measures proposed to manage those effects.

The relevant provisions of the relevant statutory documents are considered throughout the remainder of Section 9. The other matters considered relevant are the Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008, and the Ngāi Tahu Freshwater Policy Statement; these are discussed in Section 9.4 below.

9.2 Part 2 of the RMA

Part 2 of the RMA sets out the purpose and principles of the Act. The purpose of the RMA is to promote the sustainable management of natural and physical resources.

Traditionally, an analysis of the consistency of an application with Part 2 of the RMA was fundamental to the overall assessment of applications for resource consents.

The PSWLP has been recently prepared and has been operative (in part) since 1 March 2021. While some aspects of it are still under appeal, for the most part it is considered to contain provisions prepared having regard to Part 2 and a coherent set of policies to achieve clear environmental outcomes. In conjunction with the existing objectives and policies of the RWP and based on the direction established by the Court of Appeal through *Davidson*, an assessment against Part 2 matters is considered to add little to the overall evaluation. Rather, the focus of this assessment is on the relevant National Policy Statements (NPS) and regional plan provisions. In line with the recent Supreme Court direction from *Port Otago*[23], reconciliation of any competing policies should be done though a disciplined, analytical framework (a "structured approach").

Notwithstanding this, by way of summary the following matters are considered particularly relevant:

- **Section 5**. The proposal seeks to promote sustainable management of natural and physical resources by improving flow conveyance and reliability through the MLC. This will result in a long-term, net improvement to the life-supporting capacity of the water and ecosystem resources. The design of the Project has sought to avoid adverse effects on the environment by way of the parallel channel methodology, which minimises the duration of the works in

[23] *Port Otago Limited v Environmental Defence Society Incorporated* [2023] NZSC 112.

flowing water. The volunteered conditions of consent will remedy or mitigate adverse effects where these cannot be avoided;

- **Section 6(a), Section 7(c) and (f)**. The natural character, quality, and amenity values of the Waiau Arm and LWR is that of a modified environment. The proposed works upon completion will return the environment to a commensurate standard;
- **Section 6(e)**. The relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga will be improved through the Project, by improving the conveyance and reliability of flows, and hence enhancing the mauri of the water; and
- **Section 8**. Meridian has engaged with TAMI during the preparation of this application.

9.3 National Policy Statements

National policy statements have been developed to provide consistent guidance on matters of national significance. For this application, the National Policy Statement for Freshwater Management (NPS-FM) and National Policy Statement for Renewable Electricity Generation (NPS-REG), are considered relevant and are assessed below.

The National Policy Statement for Indigenous Biodiversity (NPS-IB) is not considered relevant as it does not apply to the development, operation, maintenance or upgrade of renewable electricity generation assets (under Clause 13(3)).

9.3.1 National Policy Statement for Freshwater Management

9.3.1.1 Context

The NPS-FM came into effect on the 3 September 2020. Although relevant under section 104(1)(b), the NPS-FM is more specifically targeted at providing national direction for regional plan making processes rather than individual consent applications.

The fundamental concept of the NPS-FM is Te Mana o te Wai. ES has given effect to Te Mana o Te Wai, in the PSWLP, principally through setting out requirements for the development of Freshwater Management Units across the region (Policy 44). Additionally, under the Interpretation Statement of the PSWLP, it states that "*All persons exercising functions and powers under this Plan and all persons who use, develop or protect resources to which this Plan applies shall recognise that: [...] (ii) The plan embodies ki uta ki tai and upholds Te Mana o Te Wai and they are at the forefront of all discussions and decisions about water and land*".

9.3.1.2 Fundamental concept – Te Mana o te Wai

Te Mana o te Wai is a concept that refers to the fundamental importance of water and recognises that protecting the health of freshwater protects the health and well-being of the wider environment. Te Mana o te Wai is relevant to all freshwater management and not just to the specific aspects of freshwater management referred to in the NPS-FM.

The NPS-FM has one objective, which encapsulates this fundamental concept:

> *The objective of this National Policy Statement is to ensure that natural and physical resources are managed in a way that prioritises:*
>
> *(a) First, the health and well-being of water bodies and freshwater ecosystems;*
>
> *(b) Second, the health needs of people (such as drinking water); and*
>
> *(c) Third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.*

The Project's primary purpose is to improve the conveyance and reliability of flows through the MLC. While the Project will have temporary adverse effects during the relatively short construction period, and during future maintenance activities, an improved ability to provide flows following construction will lead to enhanced health and well-being benefits for the LWR and freshwater ecosystems, particularly with respect to periphyton management. The Project site, and the receiving environment where temporary effects from the construction works will be experienced, are not within a drinking water supply zone nor are there any known abstractions for any other purpose. People and communities will continue to be able to provide for their social, economic, and cultural wellbeing.

For those reasons, the Project is consistent with all three priorities expressed within Te Mana o te Wai.

9.3.1.3 Principles

The NPS-FM has six principles; these are assessed against the Project below (principles are in *italics*):

(a) Mana whakahaere: the power, authority, and obligations of tangata whenua to make decisions that maintain, protect, and sustain the health and well-being of, and their relationship with, freshwater.

The RMA determines decision-making roles for individual resource consent applications, which is outside the ability of consent applicants to determine. However, Meridian has engaged with TAMI during the preparation of these applications (see Section 10 of this AEE) and will continue to do so following lodgement.

(b) Kaitiakitanga: the obligations of tangata whenua to preserve, restore, enhance, and sustainably use freshwater for the benefit of present and future generations;

As noted above, Meridian will continue to engage with TAMI to ensure their role as kaitiaki is recognised and provided for;

(c) Manaakitanga: the process by which tangata whenua show respect, generosity, and care for freshwater and for others;

Mana whenua are the only persons who can express how they would show respect, generosity, and care for freshwater and for others. There will be further opportunities for TAMI to provide their feedback after lodgement of these applications.

(d) Governance: the responsibility of those with authority for making decisions about freshwater to do so in a way that prioritises the health and well-being of freshwater now and into the future;

As noted above, the RMA determines the governance structures for those with authority to make decisions about freshwater. However, Meridian welcomes further input from mana whenua, and ES, following the lodgement of these applications.

(e) Stewardship: the obligations of all New Zealanders to manage freshwater in a way that ensures it sustains present and future generations;

The Project's purpose and design (as detailed throughout this AEE), and the proposed conditions of consent (Section 8 of this AEE), are considered to demonstrate a meaningful commitment to managing freshwater in a sustainable manner.

(f) Care and respect: the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation.

Similarly, the purpose of the Project, and proposed consent conditions, demonstrate a commitment to support the health of the LWR and the people who use and enjoy it.

9.3.1.4 Policies

The Project is assessed against the relevant policies of the NPS-FM in Table 9.1 below.

Table 9.1: Assessment of NPS-FM policies

Policy	Assessment
Policy 1: *Freshwater is managed in a way that gives effect to Te Mana o te Wai.*	As discussed in Section 9.3.1.1 above, effect is given to Te Mana o Te Wai principally through regional plan making processes. Notwithstanding this, as detailed further in Section 9.3.1.2, the Project is considered to achieve all three priorities of Te Mana o te Wai.
Policy 2: *Tangata whenua are actively involved in freshwater management (including decision making processes), and Māori freshwater values are identified and provided for.*	Meridian have engaged with TAMI and are having ongoing conversations to understand the effects of the proposal on cultural values. The Cry of the People has been reviewed in preparation of this application as well as the Ngāi Tahu Freshwater Policy Statement. Values have been identified and assessed throughout section 7 and 9.8 of this AEE.
Policy 4: *Freshwater is managed as part of New Zealand's integrated response to climate change*	The renewable energy contributions of the MPS (and the necessary management of freshwater to enable that) are an important part of New Zealand's integrated response to climate change. The MLCIP is consistent with Policy 4 because it will enable improvements in the LWR environment without a significant adverse impact on the MPS's contributions to the climate change response. .
Policy 5: *Freshwater is managed (including through a National Objectives Framework) to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.*	The Project seeks to increase the conveyance and reliability of flows through the MLC, which will have consequential benefits for freshwater ecosystems and the health and wellbeing of waterbodies.
Policy 6: *There is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted.*	The Project cannot achieve this Policy given that the parallel channel construction will result in unavoidable wetland losses. As covered earlier in this AEE, the effect of these losses has been assessed as no more than minor. The effects need to be considered against the considerable overall benefits of the Project for the health and wellbeing of the LWR. It is also relevant that the NES-F, which provides the nationally regulatory framework to give effect to this policy, provides for various exceptions to and nuancing of this policy; any failure to achieve Policy 6 should be viewed in that context.
Policy 7: *The loss of river extent and values is avoided to the extent practicable.*	The excavation works fall within lake rather than river bed and therefore this policy is not relevant. In the event the policy were to be

Policy	Assessment
	considered relevant, the Project increases the overall area available for surface water and associated values.
Policy 9: *The habitats of indigenous freshwater species are protected.*	Habitat for indigenous freshwater species is limited around the Project area, and is mostly located outside of the Waiau Arm itself. Potential effects of the Project on those habitats downstream of the Project site are related to sediment. Subject to adherence to turbidity and DFS thresholds, these effects have been assessed as temporary and no more than minor. While that means the habitats will not be fully protected for a short duration during the construction works, the overall purpose of the Project is to improve the health and wellbeing of the waterbody for the longer-term benefit and protection of those habitats.
Policy 10: *The habitat of trout and salmon is protected, insofar as this is consistent with Policy 9.*	Similarly to the assessment above for Policy 9, where trout and salmonid fish habitat exists, any effects have been assessed as temporary and no more than minor. While the habitats will not be fully protected during construction works, the overall purpose of the Project is to improve the health and wellbeing of the waterbody for the longer term benefit and protection of those habitats.
Policy 11: *Freshwater is allocated and used efficiently, all existing over-allocation is phased out, and future over-allocation is avoided.*	The Project may involve some temporary water abstraction for dewatering and dust suppression throughout the construction period. Apart from evaporation this abstraction will be relatively small and non-consumptive and not have a discernible impact on allocation in the Waiau catchment.
Policy 12: *The national target (as set out in Appendix 3) for water quality improvement is achieved.*	The Project seeks to improve the conveyance and reliability of flows which will provide for improved water quality in the LWR. Construction related effects on water quality will be temporary.
Policy 13: *The condition of water bodies and freshwater ecosystems is systematically monitored over time, and action is taken where freshwater is degraded, and to reverse deteriorating trends.*	Meridian has in place programmes to monitor various aspects of river health in the Mararoa River and LWR. At present, the poor conveyance and reliability for flushing flows influences water quality, particularly during the summer months. The Project will support more reliable flows and therefore better outcomes for freshwater.
Policy 14: *Information (including monitoring data) about the state of water bodies and freshwater ecosystems, and the challenges to their health and well-being, is regularly reported on and published.*	Meridian undertakes a number of monitoring programmes related to the state of the water in LWR. Monitoring is proposed as part of the construction activities associated with the Project.
Policy 15: *Communities are enabled to provide for their social, economic, and cultural well-being in a way that is consistent with this National Policy statement.*	The social, economic, and cultural well-being of people and communities is linked to the health and wellbeing of the LWR. In that regard the Project's purpose aligns with this policy.

By way of summary, although some of the construction activities cannot achieve all of the relevant policies of the NPS-FM (in particular Policies 6, 9 and 10), the improvements sought to the conveyance and reliability of flows from the MLC, particularly flushing flows, will lead to an overall benefit for the health and wellbeing of the LWR and its freshwater ecosystems. On that basis the Project is consistent with the outcomes sought by the NPS-FM.

9.3.2 National Policy Statement for Renewable Electricity Generation

The objective of the NPS-REG is to recognise the national significance of renewable electricity generation activities by providing for the development, operation, maintenance and upgrading of new and existing renewable electricity generation activities, such that the proportion of New Zealand's electricity generated from renewable energy sources increases to a level that meets or exceeds the New Zealand Government's national target for renewable electricity generation.

The ability to effectively operate the MLC is integral to the operation of the overall MPS by way of consent conditions, operating protocols and the Lake Operating Guidelines. The NPS-REG has been given effect to through the Southland RPS and PSWLP; these provisions are considered further below. The Project does not compromise the renewable energy contributions from the MPS.

Overall, the Project will be consistent with the objectives and policies of the NPS-REG.

9.4 National Environmental Standards

The only national environmental standard considered relevant is the NES-F. Resource consent requirements relating to the NES-F have been addressed in section 6.7 of this report.

9.5 Regional planning assessment

A detailed assessment of the Project against the key relevant objectives and policies of the following statutory documents is contained in **Appendix J** of this report:

- Southland Regional Policy Statement;
- Southland Regional Water Plan; and
- Proposed Southland Regional Water and Land Plan.

The assessment concludes that the proposal is not contrary to the key relevant objectives and policies.

9.6 Section 104D of the RMA

Overall, the proposal is to be assessed as a non-complying activity. Before the consent authority can reach a decision on an application for a non-complying activity under the provisions of section 104, it must first address whether one of the two "gateway" tests under section 104D of the RMA can be met. These tests (in summary) are:

- Section 104D(1)(a) – that the adverse effects of the activities on the environment will be minor; or
- Section 104D(1)(b) – that the activities will not be contrary to the objectives and policies of the relevant plans.

If one or both limbs of the threshold test is met, a consent authority can exercise full discretion as to whether or not to grant consent and as to what conditions to impose on the consent if granted.[24]

Having regard to these tests, the following is noted:

- Section 7 of this report has concluded that, subject to the measures summarised in Section 8, the adverse effects on the environment will be no more than minor; and
- Section 9.5 of this report (and the assessment in Appendix J) has concluded the proposal is not contrary to the objectives and policies of the relevant plans.

[24] 87D of the RMA.

On the foregoing basis, this application meets both limbs of the test in section 104D(1) of the RMA.

9.7 Sections 105 and 107 of the RMA

Section 105 requires the consent authority to have regard to the nature of a discharge and the sensitivity of the receiving environment, the applicant's reasons for the proposed choice, and possible alternative methods of discharge. These matters have been addressed throughout this report, particularly in Section 4 which describes the receiving environment, Section 7 which assesses the effects on the environment, and Section 3 which addresses potential alternatives. With respect to freshwater values, the NIWA report in **Appendix D** also discusses the sensitivity of species to elevated suspended sediment.

Section 107(1) restricts the granting of discharge permits if, after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar, or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:

- The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials; or
- Any conspicuous change in the colour or visual clarity; or
- Any emission of objectionable odour; or
- The rendering of fresh water unsuitable for consumption by farm animals; or
- Any significant adverse effects on aquatic life.

Section 107(2) states that a consent authority may grant a discharge permit that allows any of the effects described in subsection (1) if it is satisfied:

(a) T*hat exceptional circumstances justify the granting of the permit; or*

(b) *That the discharge is of a temporary nature; or*

(c) *That the discharge is associated with necessary maintenance work—*

and that it is consistent with the purpose of this Act to do so.

As discussed in Section 4.4.3 of this AEE, the downstream point of the reasonable mixing zone for this Project has been determined as the downstream (Excelsior) monitoring site. At this point, adherence to the proposed suspended sediment and DFS thresholds will mimic that which is experienced naturally by biota during large flood events. Any adverse effects of the discharge downstream of this point are no more than minor (see Sections 7.4 and 7.6 of this AEE).

The proposed discharge of suspended sediment arising from the Project activities may result in a conspicuous change in the colour and visual clarity of water beyond the reasonable mixing zone. However, if this does occur, subsections 107(2)(a) and (b) would apply here, given that:

- Granting of the permit is justified given the exceptional circumstances at play; this is a one-off activity associated with renewable energy infrastructure of national significance, and which will deliver positive environmental outcomes; and
- The discharge and any change in colour and visual clarity will be temporary.

The consents sought also address maintenance activities. These activities may also have adverse effects on water colour and visual clarity, but these are unlikely to be 'conspicuous' beyond the reasonable mixing zone. Further, maintenance activities will occur infrequently, and will be of short duration. The exemption provisions in s107(2)(b) and (c) would therefore apply.

For these reasons, and because the benefits that the improvement in flow conveyance and reliability the Project will enable are clearly consistent with the purpose of the Act, section 107 of the RMA does not restrict the grant of discharge permits required for the Project.

9.8 Cultural matters

9.8.1 Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008

The Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008 – also known as Te Tangi a Tauira (The Cry of the People) – consolidates Ngāi Tahu ki Murihiku values, knowledge and perspectives on natural resource and environmental management issues. It is an expression of kaitiakitanga. The Plan assists Ngāi Tahu ki Murihiku in carrying out kaitiaki roles and responsibilities, and also recognises the role of communities in achieving good environmental outcomes and healthy environments. It is designed to assist others in understanding tangata whenua values and policy.

The Project site sits between Te Atawhenua / Fiordland, and Takitimu Me Ona Uri / High Country and Foothills. Relevant sections of these chapters have been identified below.

Section 3.3.1.1 of the Plan addresses hydro-electricity development and generation in the Fiordland area. The issues identified that relate to this Project include:

- Ability of schemes to minimise or avoid environmental, cultural and social effects;
- Impacts on the Waiau River as a consequence of water takes associated with hydro schemes;
- Increased reliance on hydroelectricity may have implications for reduced flow levels for Manapōuri and West Arm; and
- Discharge of sediments, and adverse effects on aquatic and terrestrial habitat.

With respect to the impacts on the Waiau River the key impacts addressed by this Project include:

- A lessened ability of the river to cleanse itself;
- An increased risk of threats such as didymo due to longer periods running at minimum flows; and
- The discharge of sediment and adverse effects on aquatic and terrestrial habitat.

While the Project is not for the purposes of generating further hydro-electricity, the policies associated with 3.3.1.1 have been taken into account when assessing the effects of the activities. The alternative options process worked through by Meridian has resulted in the selection of the parallel channel option because it will generate the least sedimentation effects relative to other options available. The residual sedimentation effects of the Project will be managed through adherence to turbidity and DFS thresholds, resulting in no more than minor adverse effects on water quality and freshwater ecosystems. Overall, the proposal is considered consistent with Policy 3.3.1.1.

Section 3.5 of the Plan sets out the General Water Policy. There is a focus on the protection of the mauri and wairua of rivers, lakes and wetlands; the recognition of the special significance of particular water bodies to Ngāi Tahu ki Murihiku; enhancing waterways in addition to no adverse effects, and direct and indirect discharges to water. While there are going to be some short-term and temporary effects of sediment as a result of the Project, overall the aim of it is to support the life supporting capacity of LWR, including the principle of *ki uta ki tai – from the source to the sea*. The proposal therefore is consistent with policies 3.5.10.3 and 3.5.10.4.

Section 3.5.11 outlines the issues and policies related to rivers in the Southland Plains. Much like the above, the issues relate to the health of the water and the effects of land use and discharge activities

on the rivers. Impacts of hydro development are also identified as an issue. Further to the policies already identified, the Project is consistent with policy 3.5.11.2, as it adopts the priorities set out in the Ngāi Tahu Freshwater Policy Statement; and policy 3.5.11.16, which seeks to prioritise the restoration of waterbodies of high cultural value.

A large component of the Project is excavation works, particularly in proximity to a waterbody. Section 3.5.8 outlines the issues and policy surrounding earthworks on the Southland Plains, which includes the Waiau catchment. Protection of wāhi tapu and archaeological values is a key concern, as is the impact on cultural landscape values. Effects from earthworks may include the discharge of contaminants (in this case, sediment), into the waterbody. The Project has been designed to minimise as much as possible earthworks within the flowing waterbody. Project design has also been developed to minimise any impact associated with cultural landscape values and there are no known wāhi tapu and archaeological values on the Project site. An accidental discovery protocol will be implemented.

9.8.2 Ngāi Tahu Freshwater Policy Statement

The Ngāi Tahu Freshwater Policy Statement (NTFPS) has been prepared by Te Runanga O Ngāi Tahu and focuses on the management of freshwater resources within the rohe of Ngāi Tahu. It outlines the environmental outcomes sought and the means by within these outcomes can be achieved. These are set out in priority areas, with objectives and policies for each. The objectives include Wāhi Tapu, Mauri, Mahinga Kai and kaitiakitanga.

With respect to the mauri, the NTFPS seeks to restore, maintain and protect the mauri of freshwater resources. This is particularly relevant with water allocation regimes, by prioritising the availability of sufficient quantities of water of an appropriate quality to maintain and protect the mauri of a waterbody. This includes catchment management planning as one of the means of achieving integrated management. In addition, protection of mauri also is required to protect the future opportunities for Ngāi Tahu's uses of freshwater resources. The Project does not impact on allocation in the Waiau catchment.

With respect to mahinga kai, the key objective is to maintain vital, healthy mahinga kai populations and habitats capable of sustaining harvesting activity. Policies include protecting, restoring and enhancing mahinga kai habitats and areas, and ensuring that activities in upper catchments have no adverse effects in the lower catchments. The Project's purpose is to improve the health of the LWR, which will in turn support mahinga kai values.

Kaitiakitanga is another priority with the objective of promoting collaborative management initiatives that enable the active participation of Ngāi Tahu in freshwater management. Meridian intends to have ongoing conversations with TAMI to support Ngāi Tahu participation in this application process.

9.9 Notification assessment

The applicant requests that the application be publicly notified in accordance with section 95A(2)(a) and 95A(3)(a) of the RMA.

10 Consultation and Engagement

10.1 Overview

Schedule 4 of the RMA states that an AEE should include '*identification of the persons affected by the activity, or any consultation undertaken, and any response to the views of any person consulted*'.

Meridian has undertaken consultation and engagement regarding the Project. This section of the report outlines the consultation / engagement undertaken with each stakeholder, key issues or concerns that have arisen, and responses.

By way of summary, while for the most part stakeholders were supportive of the overall purpose of the Project, a number of issues were raised. Some of these are outside of the scope of the Project and others have being addressed through the Project design and this AEE.

Public notification is requested. Members of the public will therefore have the opportunity to raise issues which are relevant to the Project's effects on the environment.

10.2 Approach to engagement

Meridian undertook engagement on the Project with a number of stakeholders throughout 2022 and 2023. This was a combination of in person meetings and communications via email. In person meetings took place in Invercargill and Te Anau between August 8 and 10 2023, and in Te Anau in late August 2023.

Prior to each meeting, a 'consultation package' was provided to each stakeholder. This briefly outlined the Project, including the reasons for the Project, an assessment of alternative options and a high-level assessment of the potential effects.

Stakeholder meetings began with an introduction to the Project. The discussion then focused on specific parts of the Project that were relevant to the stakeholder interest.

Following in person meetings, a series of action points were identified. Meridian has continued to engage with parties where specific actions were agreed to. Meridian has also incorporated a number of refinements and changes to the Project as a consequence of the engagement.

10.3 Te Ao Mārama Incorporated

Te Ao Mārama Incorporated (TAMI) administers Ngāi Tahu ki Murihiku mana whenua interests in resource management and other aspects related to local government in Southland. It is authorised to represent the four Ngāi Tahu papatipu runanga in Murihiku/Southland. It is also involved in the protection of the spiritual and cultural values of the region, including wahi tapu (sacred places), mahinga kai (gathering of food and resource) and other natural resources.

Meridian commenced early engagement on the Project with TAMI in 2022, in recognition of the significant cultural values that the Manapōuri area holds for Ngāi Tahu ki Murihiku, and which is recognised by statutory acknowledgements for Moturau (Lake Manapōuri) and Waiau (the Waiau River) in the Ngāi Tahu Claims Settlement Act 1998.

In August 2023, Meridian met with TAMI to discuss the updated Project, particularly given the change from instream works to the parallel channel option. A brief history of the MPS was provided before discussing the Project, including a discussion around the gravel in the channel and whether what was identified in the trial will be the same material unearthed through this excavation. An assessment of this has been undertaken in section 7 of this report.

10.4 Southland Fish and Game Council (F&G)

The LWR and Mararoa River are known for being fishing / angler spots particularly for trout and salmon. F&G has an interest in work happening in the area, particularly where water quality and ability to access water are concerned. F&G were particularly interested in what the primary effects of the Project are, whether there was the potential for public access being made available on the site, and general questions around the details of the proposal. The questions regarding primary effects and the engineering have been included in section 7 of this report. Meridian has also undertaken to investigate providing better public access to the site, however, that is outside the scope of this Project.

F&G followed up after the meeting querying the potential suspension of the periphyton programme. Further engineering advice has indicated that the suspension of this programme is no longer required.

10.5 Waiau Working Party (WWP)

The Waiau Working Party comprises of members of the community with an interest in the protection and enhancement of the Waiau River. A number of the members of the WWP attended the stakeholder meeting, including representatives from the Waiau Rivercare Group and F&G.

A number of questions were raised related to the Project, with other questions related to activities occurring in the wider Waiau catchment and future flow management. With regard to the Project, key issues raised included:

- Where the flow of water will go when the new channel is constructed;
- What the risk of phytoplankton will be and how this will be managed;
- Where the gravel has come from (in the river), where the excavated material will go, and what those locations will look like when rehabilitated;
- Armouring and erosion protection in the new channel;
- Request for additional drawings;
- Whether the Arm is considered to be part of the lake, and what 'wetlands' are in the area';
- Whether the haul roads will create a new lake edge / impound water;
- What the mixing zone for sediment will be and if it is enough;
- What the level of reliability for flushing flows will be after completion of the works; and
- Whether consideration had been given to how the material excavated might be used for alternative purposes rather than disposing on site.

Meridian via its engagement has responded to the WWP on these points, and where appropriate, addressed them in the Project design or throughout this AEE.

10.6 Waiau Rivercare Group Inc.

The WRG is a member of the WWP and was represented at its meeting in Invercargill. A letter was provided to Meridian and Environment Southland following this meeting raising a number of questions relating to the Project, including:

- How the reliability of flushing flows is likely to change across the Lake Manapōuri operating range;
- What the reliability of flushing flows will be;
- Whether the Waiau Arm should be classified as river bed rather than lake bed;

- Whether the Mararoa River diversion (1987) has contributed to the accumulation of gravel and other material; and
- Impact of the parallel channel on conveyance of water towards Lake Manapōuri.

Meridian has formally responded to the WRG on these points, and where appropriate has addressed them throughout this AEE.

10.7 Guardians of Lakes Manapōuri, Monowai and Te Anau

The Guardians of Lakes Manapōuri, Monowai and Te Anau are a statutory body that makes recommendations to the Minister of Conservation relating to the operation of the MPS. General questions were raised around sediment management, lake level management during construction, what the site will look like upon completion, maintenance requirements, and the nuisance periphyton monitoring programme. These matters are addressed throughout this AEE.

10.8 Pamu (Landcorp)

While Meridian owns the land around the MLC, the largest neighbouring property is Duncraigen Station owned by Pamu/Landcorp Farming Limited. Meridian met with Paul Smith (farm manager) on behalf of Pamu to discuss the project and the potential effects.

While Pamu generally supported the works, concern was raised regarding the proposed 24/7 construction period. The construction noise assessment has identified that one of the houses (567 Weir Road) is likely to be affected by night-time noise levels should the work be undertaken on a 24/7 basis. Meridian is continuing to engage with Pamu regarding management and mitigation of construction noise.

10.9 RealNZ Limited

RealNZ have a land access agreement with Meridian at this site for a temporary slipway. This slipway is installed and used periodically by RealNZ as required for haul out of vessels for required for marine surveys and/ or maintenance. This is usually undertaken during winter when lake levels are higher and when the demand for boats on the water is lower.

The proposed parallel channel cuts in where at the location where the temporary slip way is used. RealNZs main concern is losing the area/ space required for this slipway.

Consequently, RealNZ have provided Meridian with updated requirements for reestablishment of the temporary slipway. This has been incorporated into the Project design, although it is reiterated that resource consent for a temporary slip way or the use of this is not being sought in this application and the responsibility for those consents sit with RealNZ. In general, this appeared to be a workable solution for RealNZ.

10.10 Department of Conservation (DOC)

The Department of Conservation has an interest in all projects that may have any effects on the river, species within the river, or wetlands. DOC was provided with the stakeholder information pack which contained a brief background to the Project, and the discussion focused on a number of questions that DOC had.

These questions predominantly relate to the engineering side of the Project, including how the new parallel channel will stay open and whether it will fill up with gravel; how the hydrology of the wetlands will be affected and the status of these wetlands; the flushing flow requirements (former and current) and the conditions that relate to phytoplankton blooms; and a request for more visuals to better understand the Project.

Following the meeting, DOC provided additional issues which they wished to see addressed in the AEE. These questions included the effects of the raising of the spoil disposal area on wetlands; what maintenance work will be required for the new channel; how splitting the channel will impact water level and habitat, and flooding, in each channel; and what and how cultural values will be addressed.

These questions have been addressed throughout the Project design and in section 7 of this AEE.

10.11 Jet Boating NZ – Southland Branch (JBNZS)

JBNZS has an interest in the Project as parts of the LWR below the MLC are able to be used year round for boating and competitions. In general, JBNZS were supportive of the proposal. Following the meeting they sent a follow up email with a view about gravel being stockpiled for future use instead of being spread out. Meridian has incorporated a 'gravel stockpile cell' into the spoil disposal area, however, any future removal of that material may be subject to further consent applications by that party.

11 Conclusion

This AEE report has been prepared on behalf of Meridian Energy Limited to accompany resource consent applications to Environment Southland for the proposed MLCIP.

The Project will achieve better outcomes for river health in the LWR by improving flow conveyance and reliability through the MLC. This will be accomplished by constructing a new and deeper channel adjacent and parallel to the current Waiau Arm immediately upstream of the MLC. The construction works are of short duration and will have temporary effects on the LWR. Once constructed, periodic maintenance of the new parallel channel may be required, however, these works will be of much smaller scale and expected to be infrequent.

The resource consents sought by Meridian are:

- A water permit under Section 14 of the RMA to:
  - Temporarily take, divert, and use water for the purposes of facilitating construction and maintenance activities, including within and in proximity to wetlands and for dewatering, dust suppression, and erosion and sediment control activities; and
  - Permanently divert surface water into the parallel channel.
- A discharge permit under Section 15 of the RMA to:
  - Temporarily discharge water and suspended sediment to land and water (the Waiau Arm and Lower Waiau River) for the purposes of facilitating construction and maintenance activities, including within and in proximity to wetlands and for dewatering, dust suppression, and erosion and sediment control activities.

Overall, the proposal is to be assessed as a non-complying activity.

The Project involves a number of land use activities, including within the bed of a lake and river, which would ordinarily be subject to Sections 9 and 13 of the RMA. However, under Section 4 of MTADA, Meridian is authorised to undertake certain activities which are necessary or requisite to the operation of the MPS. Under that authority Meridian is not seeking land use resource consents for the Project, however, the environmental effects associated with these activities have been robustly assessed, are described in this AEE, and will be appropriately managed.

As set out earlier in this AEE, the Project:

- Is not contrary to the objectives and policies of the relevant plans; and
- Will have no more than minor adverse effects on the environment.

On this basis the proposal has been assessed as meeting both “gateway” tests for granting resource consents to a non-complying activity under section 104D of the RMA.

Detailed analysis of the anticipated positive effects, and effects on cultural values, noise, ecology, hydrology and water quality, geology and hydrogeology, landscape and visual values, recreation and amenity, have been presented in this application.

The Project will achieve positive effects and beneficial river health outcomes for the LWR by improving the conveyance and reliability of flows, including flushing flows and recreational flows.

The assessments described in this AEE conclude that the adverse effects of the Project will be no more than minor, subject to recommended measures to avoid, remedy or mitigate effects. Mitigation measures have been incorporated into the overall design of the proposal and proffered conditions of resource consent have been volunteered to appropriately manage the adverse effects. Meridian welcomes further discussion with Environment Southland over their final form and wording.

12 Applicability

This report has been prepared for the exclusive use of our client Meridian Energy Limited, with respect to the preparation of this Assessment of Effects on the Environment.

We understand and agree that our client will submit this report as part of an application for resource consents and that Environment Southland as the consenting authority will use this report for the purpose of assessing that application. This report however may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

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21-Dec-23
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Appendix A Application Form

Appendix B Record of Title

Appendix C Construction Methodology

Appendix D Freshwater Assessment

Appendix E Phytoplankton Risk Assessment

Appendix F Terrestrial Vegetation, Wetland Assessment & Freshwater Advice on Construction Effects

Appendix G Groundwater Assessment

Appendix H Landscape Assessment

Appendix I Construction Noise Assessment

Appendix J Objectives and Policies Assessment

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