IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application by Meridian Energy Limited for the resource consents related to the construction of a new channel to enable a permanent diversion of part of the flow of the Waiau Arm and the associated removal of bed material and gravels, together with any maintenance and ancillary activities.

Evidence of Scott Hooson

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QUALIFICATIONS AND EXPERIENCE

1. My full name is Scott Hooson. I hold the position of Ecologist / Associate Partner in Boffa Miskell Limited's (**Boffa Miskell's**) Ōtautahi Christchurch Office.

2. I hold the degrees of Master of Science in Zoology with Distinction and a Bachelor of Science with 1st Class Honours in Ecology and Geography, which I gained from the University of Otago in Dunedin in 2002 and 2000 respectively. I am also a Certified Environmental Practitioner, and a member of the Environment Institute of Australia and New Zealand (**EIANZ**), the Ecological Society of New Zealand and the Ornithological Society of New Zealand.

3. I have over 20 years' professional experience as an ecologist, including 16 years' experience as an ecology consultant. I have been employed as an ecological consultant at Boffa Miskell since March 2008. Prior to working for Boffa Miskell I worked for the Department of Conservation (**DOC**) from 2002 until 2008.

4. In my role at Boffa Miskell I am primarily a terrestrial ecologist. I have experience in ecological surveys and assessments of vegetation, wetlands and birds and in the assessment of significant ecological sites and preparation of ecology reports for Assessment of Effects on the Environment. My project work also involves provision of ecological advice, GIS mapping and analysis, preparation of ecological management plans and advising on ecological restoration projects. I have published ecological research in national and international journals, prepared and presented evidence on ecological matters for Council and Environment Court hearings, and prepared evidence for a Board of Inquiry hearing.

5. I have carried out ecological surveys and assessments in a wide range of ecosystems, including wetlands, estuaries, hāpua, lakes, streams, grasslands, shrublands, forests and alpine vegetation. I have worked widely throughout the South Island including in Nelson, Marlborough, Westland, Canterbury, Otago and Southland.

6. I have worked on numerous projects throughout the South Island that have involved the surveying, monitoring, assessment, mapping and classification of wetlands for both consenting and conservation management purposes. I have also worked on numerous major infrastructure development projects in the South Island, including terrestrial ecology and / or wetland assessments for resource consent applications,

Notices of Requirement and Outline Plans for hydroelectricity projects, wind and solar farms, airports, quarries and gravel extraction projects, and irrigation projects. Examples of my project experience include wetland and terrestrial ecology assessments for the reconsenting of the Waitaki Power Scheme, the North Bank Hydro Project and Hurunui Wind for Meridian Energy Limited (**Meridian**). I also assisted with the Wetlands Assessment for the Manapōuri Tailrace Amended Discharge (**MTAD**) in 2008–2009[1]. I have led and completed the classification and mapping of large wetland complexes such as O Tu Wharekai in the Ashburton Basin and the Awarua and Waituna wetlands in Southland for DOC.

7. I have worked extensively on conservation management projects and ecological assessments within the Te Anau Basin, Milford Sound and Fiordland including:

   (a) Working for DOC as a Biodiversity Ranger in the Te Anau Office in 2002–2003;

   (b) Leading the 'Conservation Analysis' workstream for Stage 2 of the Milford Opportunities Project along the Milford Corridor and Milford Sound; and

   (c) Most recently, leading the Preliminary Assessment of Environmental Effects for Stage 3 of the Milford Opportunities Project.

8. I co-authored the Wetlands Assessment Report dated 15 December 2023 with Dr Jaz Morris (which I will refer to as the **Wetlands Assessment Report**) attached as Appendix F[2] to Meridian's resource consent applications for the Manapōuri Lake Control Structure Improvement Project (**MLC:IP** or **the Project**).

9. The existing configuration of the Waiau Arm, the MLC and the Lower Waiau River (**LWR**), as well as the MLC:IP proposal are described in Sections 2, 4 and 5 of the Assessment of Effects on the Environment (**AEE**) and in Mr Feierabend's evidence and are not repeated here.

[1] Boffa Miskell Limited (2009). *Manapōuri Tailrace Amended Discharge. Wetlands: Assessment of Wetlands in the Lower Waiau valley.* Prepared for Meridian Energy Ltd.

[2] Available here.

CODE OF CONDUCT

10. I confirm that I have read the 'Code of Conduct for Expert Witnesses' contained in the Environment Court Consolidated Practice Note 2023. I agree to comply with this Code of Conduct. In particular, unless I state otherwise, this evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

SCOPE OF EVIDENCE

11. My statement of evidence relates to the effects of the construction and operation of the Project on terrestrial vegetation and wetlands including:

    (a) 'Wetlands' (as defined under the Resource Management Act (**RMA**) and 'natural inland wetlands' as defined in the National Policy Statement – Freshwater Management 2020 (**NPS-FM**);

    (b) Terrestrial vegetation and habitats within the Project site; and

    (c) Riparian wetlands downstream of the Manapōuri Lake Control (**MLC**) Structure (i.e., associated with the LWR).

12. The scope of my evidence does not include the effects of the construction and operation of the Project on:

    (a) The aquatic ecology values of Waiau Arm and the LWR, including benthic plant communities (macrophytes), periphyton (benthic algae), phytoplankton, macro-invertebrates and freshwater fish, which are discussed in the evidence of Dr Hogsden and Dr Hickford.

    (b) Birds, which are discussed by Dr Bull in her evidence.

13. In my evidence I will:

    (a) Explain the methodology used for developing my assessment of ecological effects;

    (b) Describe the existing ecological environment of the Project site and environs, with particular reference to the wetland and terrestrial ecological values within,

and surrounding, the Project site and potentially affected wetlands in the LWR downstream of the Project site;

(c) Summarise the results of my assessment of effects on ecological values;

(d) Recommend measures to avoid, remedy or mitigate terrestrial ecology effects, including through conditions of consent;

(e) Comment on wetland and terrestrial ecology matters raised by submitters;

(f) Respond to issues in the Officers' Report which relate to terrestrial and wetland ecology; and

(g) Provide my conclusions.

SUMMARY

14. The Project site has previously been extensively modified during construction of the Manapōuri Power Scheme in the 1970s, including construction of the MLC structure and the Mararoa Diversion Cut.

15. The terrestrial vegetation and habitats within the construction footprint are exotic grassland, crack willow treeland, and exotic grassland and young planted Eucalyptus trees of Negligible ecological value.

16. There are 12 small, discrete areas of palustrine marsh that support wetland vegetation in the vicinity of the spoil disposal and contractor's establishment areas. Nine of these wetland areas were of Low ecological value and the remaining three were of low–moderate ecological value. To avoid direct effects on these features, I provided project shaping advice to Meridian recommending setting back the proposed spoil disposal area and contractor's establishment areas from these wetlands by a minimum of 10 m. This recommendation was incorporated at the Project design stage.

17. There are three lacustrine[3] 'channels' within the Project site on the northern bank of Waiau Arm. The proposed construction footprint traverses the southern end of these lacustrine channels (nearest Waiau Arm). The wetland vegetation types within the construction footprint that are higher up the lake margin profile are predominantly creeping bent – hawkbit grassland or herbfield and crack willow and are generally highly modified and dominated by exotic species. Areas further down the lakeshore are more frequently inundated and contain a higher proportion of indigenous plant species. During higher lake levels the lacustrine channels are inundated (part of Waiau Arm), but during lower lake levels they are exposed, with a predominant cover of mudwort – water milfoil mudfield. These channels are of Moderate ecological value.

18. Seven riparian wetlands were identified downstream of the Project site between MLC and the LWR confluence with the Monowai River (approximately 23 km downstream of MLC) that could potentially be affected by the Project. One of these riparian wetlands was assessed as being of low ecological value and the remaining six of moderate ecological value.

19. Those areas of the Project site that meet the threshold for significance under the criteria in Appendix 3 of the Southland Regional Policy Statement (**SRPS**) are wetland and lake margin areas of the Project site that support the nationally At Risk – Declining plant Buchanan's sedge. Other areas of the Project site do not meet the threshold for ecological significance when assessed against the SRPS criteria.

20. The main actual and potential adverse effects of the Project on terrestrial vegetation and habitats and wetlands are:

    (a) Removal of a small (122 m^2) area of palustrine *Juncus* rushland marsh (Wetland 1) of low ecological value which is within the proposed channel excavation footprint. I have assessed this as having a Very Low level of effect, but have recommended the implementation of wetland remediation to achieve no net loss of this habitat type within the Project site.

[3] 'Lacustrine wetlands' are defined by Johnson and Gerbeaux (2004) as wetlands associated with the waters, beds, and immediate margins of lakes and other bodies of open, predominantly freshwater which are large enough to be influenced by characteristic lake features and processes such as fluctuating water level, wave action, and usually permanent and often deep water that has nil or only slow flow.

(b) Potential indirect effects on palustrine wetlands adjacent to the spoil disposal and contractor's establishment areas including:

(i) Sediment and stormwater runoff during the establishment and construction of these areas;

(ii) Increased runoff of rainfall from the final spoil disposal area landform increasing water levels or prolonging inundation and / or soil saturation; and

(iii) Temporary reduction in groundwater levels associated with the proposed dewatering of the parallel channel excavation.

I have assessed the level of these indirect effects as Very Low–Low and have recommended several measures to address indirect effects on these wetlands.

(c) Direct and indirect effects to hydrophytic vegetation and wetland habitats in the lacustrine channels arising from earthworks and vegetation clearance at the southern end of the channels including:

(i) Removal of lacustrine habitats and vegetation;

(ii) Temporary sedimentation and smothering of wetland / lacustrine vegetation;

(iii) Temporary loss of hydrological connection to Waiau Arm during construction due to construction of a haul road and bunds; and

(iv) Hydrological changes from possible temporary dewatering and loss of surface water connection.

I have assessed the level of these effects as Very Low–Low and where necessary, have recommended measures to address effects.

(d) The loss of 49 Buchanan's sedge plants. These plants are an ecologically significant feature of the Project site and I have assessed the level of effect of their removal as Moderate. I have recommended translocation and planting of Buchanan's sedge plants to achieve no net loss of this species within the Project site.

(e) Potential effects on riparian wetlands in the LWR, downstream of the Project site, as a result of minor changes in flow (within the consented flow regime) in the LWR during the construction stage, and sedimentation and smothering of wetland vegetation. I have assessed these effects as having no discernible effect, and a Very Low level of effect, respectively.

21. Overall, with implementation of project shaping and the impact management measures I have recommended, I have assessed the level of effect of the construction and operation of the MLC:IP Project on wetlands and terrestrial vegetation, as Very Low to Low.

ASSESSMENT METHODOLOGY

22. My role in this project is as a terrestrial and wetland ecologist.

23. My involvement with the Project began in August 2023 when Meridian engaged Boffa Miskell to prepare a report on the effects of the MLC:IP on wetlands.

24. My assessment of the effects of the Project relies on the plans and project description provided in the Damwatch (2023) report, as summarised in the evidence of Dr Clunie. The Damwatch report notes that the methodology described is not a finalised detailed design, and that the conceptual design is intended to convey an 'envelope' of expected work conditions. It is expected that modifications to this concept will be made by the construction contractor to best suit its available equipment and expertise, and the conditions encountered. I used this conceptual design to assess the potential construction effects of the Project on wetland and terrestrial ecology values.

25. Definitions for key terms I use in my evidence are:

(a) The **Zone of Influence**[4] includes the Project site and the environments beyond the Project site where 'indirect effects' may extend.

(b) The **Project site** is the area directly affected by the temporary and permanent works. This includes the Waiau Arm, the area of land which will become the

[4] The 'Zone of Influence' refers to all land, water bodies, and receiving environments that could be potentially affected by the construction and operation of the Project.

parallel channel, access and haul roads, spoil disposal area, contractor's establishment area, and areas for other temporary activities.

(c) The **Construction Footprint** includes the area that will be directly affected by construction activities. It includes the channel excavation footprint, access and haul roads, spoil disposal area and contractor's establishment area.

(d) The **Spoil Disposal Area** is an area of approximately 14.5 ha on the northern side of Waiau Arm and west of Mararoa River within which spoil will be deposited during excavation of the parallel channel.

(e) The **Contractor's Establishment Area** refers to an area of approximately 2 ha, on the northern side of Waiau Arm and west of the spoil disposal area, where the contractor's facilities will be located during the construction period, including offices, lunchrooms, portable ablutions and storage of fuel, oil and other substances.

26. My assessment of the effects of the Project on wetlands downstream of the Project site relies on the information and analysis provided in NIWA's (2023) report, which is Appendix D to the AEE, as summarised in Dr Hoyle's evidence. In particular, my assessment has relied upon the following sections of that report: Sections 3.6–3.8 ('Proposed Sediment Thresholds: Principles and derivation', 'Monitoring sediment thresholds', 'Mitigation Flows') and Sections 6.1 'Hydrology / flow variability' and 6.2 (Suspended and deposited fine sediment).

27. The Wetlands Assessment Report contains a detailed description of the methods used to assess the effects of the Project on terrestrial ecology and wetland values (at Section 4.6.2). I provide a high level summary of the key components of that methodology below.

28. As part of my assessment, I completed a desktop review of information on the wetlands and terrestrial vegetation within and adjacent to the Project site and the LWR downstream of the MLC. This included reviewing previous reports, evidence, photographs and other data from Meridian's MTAD Project as well as data and photographs from a previous helicopter survey of wetlands downstream of the MLC that I completed between 26 and 27 August 2020.

29. I conducted two site visits between August 2020 and May 2024:

(a) An on-the-ground survey of wetland vegetation within the three lacustrine channels[5] on the northern bank of the Waiau Arm within and near the Project site between 28 February and 1 March 2022.

(b) A more recent site visit on 29 May 2024 to familiarise myself with the terrestrial vegetation and wetlands within the spoil disposal and contractor's establishment areas and to quantify the number of Buchanan's sedge plants within the construction footprint and the wider Project site.

30. In addition to my site visits, a comprehensive survey of the terrestrial vegetation and wetlands within the spoil disposal and contractor's establishment areas was undertaken by members of my team, Boffa Miskell Ecologists Dr Jaz Morris[6] and Ms Jessica Schofield[7] between 19 and 21 December 2022. The purpose of this survey was to determine the ecological values of terrestrial vegetation and to identify and record the ecological values of wetland areas (as defined in the RMA), including determining whether they were 'natural inland wetlands' as defined in the NPS-FM[8] and delineating wetland boundaries using the Wetland Delineation Protocols[9]. My evidence relies on the data and information collected during this survey.

31. I assessed the significance of terrestrial vegetation and habitats, and wetlands, using the criteria for determining significant indigenous vegetation and significant habitats of indigenous biodiversity listed in Appendix 3 of the SRPS.

[5] There are lacustrine wetland features on the northern bank of Waiau Arm. I refer to these as the eastern, middle and western channels in my evidence. Historic aerial imagery shows that the middle and western channels are remnant channels of the former delta of the Mararoa River but following construction of the Mararoa Diversion Cut the Mararoa River was diverted away from its original position and they no longer receive surface flows from Mararoa River. The eastern channel was artificially constructed.

[6] Jaz is an Associate Principal and Senior Ecologist based in Boffa Miskell's Ōtautahi / Christchurch office. He is a terrestrial and wetland ecologist with over 10 years' experience in ecological / botanical survey. Jaz has completed numerous wetland surveys throughout the South Island, including using the Wetland Delineation Protocols.

[7] Jessica was formerly employed as a Graduate Ecologist in Boffa Miskell's Ōtautahi / Christchurch office. She has 3 years' experience in freshwater ecology and has completed several wetland surveys, including using the Wetland Delineation Protocols.

[8] National Policy Statement for Freshwater Management 2020 (Amended February 2023).

[9] Ministry for the Environment (2020). *Wetland delineation protocols*. Wellington: Ministry for the Environment.

32. I use the most current versions of the respective New Zealand Threat Classification System (conservation status) lists[10, 11] when referring to the conservation status of nationally Threatened and At-Risk indigenous species in my evidence.

EXISTING ENVIRONMENT AND ECOLOGICAL VALUES

33. The detailed description of the existing ecological environment, as it relates to wetlands and terrestrial ecology associated with the Project site and LWR is contained in the Wetlands Assessment Report, at Section 4. In the interests of brevity, I do not repeat that description here. However, I have summarised below the key aspects of the existing wetland and terrestrial ecological environment. I have expanded on some points, where it is relevant in responding to submitters in later parts of my evidence.

Context and General Description

34. 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. It is within the Upukerora Ecological District (**ED**)[12]. A more detailed description of the Project site is contained in the AEE, and in Mr Feierabend's evidence.

35. As described by McEwen (1987), extensive areas of the ED are now grazed farmland. The remaining indigenous vegetation of the ED includes beech forest, tall tussocklands, manuka scrub, and indigenous shrublands. Wetlands are common (especially in the west and southwest) with extensive raised peat bog wetlands an important feature of the area.

36. The proposed excavation works will primarily occur adjacent to or on the northern bank of the existing channel of the Waiau Arm. Spoil from the channel excavation

[10] https://nztcs.org.nz/

[11] The conservation status of vascular plants is from: de Lange, P. J., Rolfe, J. R., Barkla, J. W., Courtney, S. P., Champion, P. D., Perrie, L. R., Beadel, S. M., Ford, K. A., Breitwieser, I., Schönberger, I., Hindmarsh-Walls, P. B., Heenan, P. B., & Ladley, K. (2018). *Conservation status of New Zealand indigenous vascular plants, 2017* (New Zealand Threat Classification Series 22). Department of Conservation.

[12] McEwen, W. M. (Ed). (1987). *Ecological Regions and Districts of New Zealand.* Third revised edition in four 1:50,000 maps. Booklet to accompany Sheet 4. New Zealand Biological Resources Centre. Publication No. 5., Part 4, Department of Conservation, Wellington.

will be placed on an area of the former Mararoa River delta, located between the channel excavation footprint (and Waiau Arm) and the Mararoa River.

37. The Project site has previously been extensively modified during the construction of the Manapōuri Power Scheme (**MPS**) in the 1970s, including construction of the MLC (Figure 1 and Figure 2, Attachment 1). The landform on the former Mararoa River delta, that was previously modified, has been re-established in exotic grassland and young eucalyptus trees (the eucalyptus were planted in approximately 2021). Crack willow treeland occurs in the western part of the Project site, primarily in the remnant lacustrine channels of the former Mararoa River delta.

Terrestrial Vegetation

38. The terrestrial vegetation within the construction footprint, including the spoil disposal area and contractor's establishment area, is exotic grassland and crack willow treeland.

39. The terrestrial vegetation within the construction footprint is almost entirely dense exotic grassland. This primarily comprises browntop – Chewings fescue grassland, with areas of cocksfoot grassland. The grasslands within the spoil disposal and contractor's establishment areas were mechanically ripped by machinery and planted in eucalyptus trees in approximately 2021; these trees are now typically 1–2 m tall. The historic modifications to the Project site (Figure 1 and Figure 2, Attachment 1 and Figure 3 and Figure 4, Attachment 2) are obvious on the ground, as the landform surface is uneven, contains boulders and rocks of various sizes (some partly buried, others exposed by recent ripping).

40. As well as abundant browntop, Chewings fescue and cocksfoot, the exotic grassland also contains a range of other exotic herb and grass species including frequent lotus and occasional Yorkshire fog, sweet vernal and the herbs catsear, and hawksbeard. Other exotic grasses including Timothy, perennial ryegrass and crested dogstail, and exotic herbs such as yarrow, dandelion, narrow-leaved plantain, white clover, St John's wort, were less frequent. Indigenous dryland plants were very infrequent and included a few individual plants of grassland sedge, short-flowered cranesbill, creeping pōhuehue and onion-leaved and white sun orchids. These indigenous species are locally and nationally common and widespread and are nationally classified as Not Threatened. Weedy exotic species, which were infrequent across the area, included Scotch broom, gorse, tree lupin, Californian and

Scotch thistles and stonecrop (which was recorded at one location). These exotic grasslands are of Negligible ecological value.

41. Scattered mature crack willow trees are present in dryland (terrestrial) areas beyond the margins and typical hydrological influence of the lacustrine channels. They form a treeland over the exotic grassland described above. This crack willow treeland is also of Negligible ecological value. Meridian is planning to undertake a control operation, separate to the MLC:IP, to kill the crack willow trees within the Project site prior to construction commencing.

Palustrine Wetlands in the Vicinity of the Spoil Disposal and Contractor's Establishment Areas

42. Twelve small areas of palustrine wetland vegetation were identified in the vicinity of the proposed spoil disposal and contractor's establishment areas. The location and extent of these areas are shown in Attachment 3. All are small marshes ranging in size from 44 to 1,588 m^2.

43. The landform that most of these wetland areas occupy (Wetlands 1–3, and 8–12) has previously been extensively modified during the construction of the MPS in the 1970s. As a result, the land surface that these wetlands occupy is uneven and has a modified soil structure. These wetlands typically occupy depressions in the uneven land surface where water sits following rain. All areas are likely to be only infrequently wet. The four remaining wetlands (Wetlands 4–7) to the north of the proposed spoil disposal and contractor's establishment areas are within the remnant channel of the former Mararoa River.

44. The wetland vegetation within these twelve wetland areas is typical of highly modified wet areas and comprises species that have established since historic site works were completed. All twelve wetland areas were dominated by exotic plant species and most supported only weakly hydrophytic vegetation, with the dominant cover comprising Facultative[13] or Facultative Wetland plant species, rather than Obligate wetland species.

45. Within these wetlands the vegetation was dominated by exotic grass, herb, rush, and sedge species, with a variable component of taller indigenous rush species

[13] Refer to Clarkson et al. (2013) for definitions of wetland indicator status ratings.

(*Juncus sarophorus, J. australis* and *J. edgariae*). Typical exotic species included kneed foxtail, Yorkshire fog, creeping bent, lotus, clover species, marsh bedstraw, spearwort, oval sedge, jointed rush, and soft rush (*J. conglomeratus*). Notable indigenous species present included the At Risk – Declining species Buchanan's sedge[14] (within areas of palustrine marsh, present in Wetland 8 only), and a small number of individuals or patches of sharp spike sedge, Glen Murray tussock, Gaudichaud's sedge, and pūkio / swamp sedge. Other than Buchanan's sedge, all wetland plant species are locally and nationally common and widespread, and are nationally classified as Not Threatened.

46. I have assessed nine of twelve wetland areas as being of Low ecological value. These wetlands are not representative, they support either no indigenous wetland plant species or very few indigenous wetland species, do not support a high diversity / pattern of wetland species / habitat types, and they are not important in terms of ecological context and provide limited habitat for fauna. The remaining three wetlands of Low–Moderate value supported a slightly greater range of indigenous wetland plant species and rate higher as their overall ecological value is generally improved by a diversity rating of low rather than very low. Being wetlands, which have been reduced nationally to less than 20% of their original extent, all twelve wetland areas are (essentially by default) of at least moderate value in terms of their rarity value (although based on my experience, rushes in exotic grassland more broadly are common in farmland and are not rare at the national and ED level).

47. Only one palustrine wetland will be directly impacted by the Project (Wetland 1). This area is a small (approximately 122 m^2) *Juncus* rushland marsh occupying the edge of a gravel access track (Figure 5, Attachment 2). Google Earth imagery shows that this wetland developed between December 2014 and 10 August 2018, following the creation of the access track. Surveys undertaken in December 2022 and May 2024 found the wetland to comprise indigenous fan-flowered rush (*J. sarophorus*) plants, which had a cover of 60% within the plot measured. The only other indigenous species was infrequent leafless rush (*Juncus australis*). All other

[14] Buchanan's sedge has a threat classification of At Risk–Declining based on an estimated population of 20,000–100,000 mature individuals and a population decline of 10–30%. The qualifier is Data Poor, that is, confidence in the listing is low due to the poor data available for assessment.

vascular plant species recorded were exotic.[15] This area is considered a wetland because it passes the 'rapid test', 'dominance test' (because of the cover of fan-flowered rush) and the 'prevalence index' using the hydrophytic vegetation wetland delineation methods. This wetland does not contain representative vegetation and occurs on a modified landform. Being a wetland, an ecosystem type that has been reduced nationally to less than 20% of its original extent, it is of moderate rarity[16]. It does not support Threatened or At Risk species, has a very low diversity of indigenous species and only one vegetation type, and is not of importance in terms of its ecological context. Overall, it is of Low ecological value.

48. All twelve wetland areas identified during the field investigation are 'natural inland wetlands' under the NPS-FM definition. Following Section 3.21 of the NPS-FM, no 'exclusions' to the definition apply, as none of the wetlands are:

(a) In the coastal marine area;

(b) Deliberately constructed wetlands;

(c) Wetlands that have developed around deliberately constructed water bodies;

(d) Geothermal in origin; or

(e) Within an area of pasture used for grazing[17.]

Lacustrine Wetlands / Channels

49. There are lacustrine wetland features on the northern bank of Waiau Arm. I refer to these as the eastern, middle and western channels. The southern ends of these features are within the construction footprint (Attachment 3). Historic aerial imagery shows that the middle and western channels are remnant channels of the former delta of the Mararoa River but following construction of the Mararoa Diversion Cut, the Mararoa River was diverted away from its original position, and they no longer

[15] These were the grasses creeping bent, sweet vernal, perennial rye grass, Kentucky bluegrass, Yorkshire fog, crested dogstail, and blue sweet grass, as well as the herbs white clover, hawkbit, lotus, curled dock, broad-leaved dock, spearwort, suckling clover, hawksbeard, narrow-leaved plantain, mouse-ear chickweed, and turf speedwell. Also present were exotic jointed rush and, oval sedge.

[16] As I have described earlier, nationally, wetland areas are of at least moderate value in terms of their rarity value (although rushes in exotic grassland more broadly are not rare at the national and ED level.

[17] Because the site is not used for grazing, other relevant matters (e.g., pasture cover) under definition e). do not apply.

receive surface flows from the Mararoa River. The eastern channel was artificially constructed.

50. The distribution and extent of wetland plant communities within the three lacustrine channels are primarily driven by inundation from the Waiau Arm, to which they are connected. The extent and frequency of this inundation is dependent on water levels in Lake Manapōuri (including Waiau Arm). The eastern and middle channels appear to dry out entirely when lake levels are low. The western channel appears to have permanent water along some of its length. Based on my site observations, this channel is also fed by surface water flow from the toe of the terrace to the channel's north and west.

51. As I have discussed in paragraph 12(a), my evidence does not include the effects of the construction and operation of the Project on benthic (generally submerged) lacustrine plant communities in Waiau Arm.

52. Because the construction and operation of the MLC:IP has the potential to affect wetland vegetation both within the construction footprint, and further up the lacustrine channels (north of the construction footprint), I will summarise the main wetland vegetation types that are both within and further up these lacustrine channels.

53. The proposed construction footprint traverses the lower part of the three lacustrine channels nearest the Waiau Arm. The wetland vegetation types within the construction footprint that are higher up the lakeshore profile are typically highly modified and dominated by exotic species. These communities are predominantly creeping bent – hawkbit grassland or herbfield and crack willow. Areas further down the lakeshore are more frequently inundated and contain a higher proportion of indigenous species. During higher levels they are inundated (part of Waiau Arm), but during lower lake levels they are exposed, with a predominant cover of mudwort – water milfoil mudfield. I will now provide a summary of the vegetation communities within the construction footprint. The vegetation in the eastern channel differs from that of the western and middle channels, so I describe it separately.

54. Less frequently inundated areas on the margins of the western and middle lacustrine channels support exotic dominated creeping bent – hawkbit grassland and herbfield growing amongst embedded cobbles, gravels or bare substrate. Other characteristic plant species in this community were occasional jointed rush and

curled dock, as well as very infrequent exotic dryland plant species that had likely recently colonised (due to low lake levels), such as catsear, white clover, narrow-leaved plantain and the grasses Yorkshire fog and sweet vernal. The indigenous herb *Euchiton involucratus* was locally common in places and leafless rush (*Juncus australis*) was also present in some areas. Other indigenous plant species were very infrequent. This vegetation type is both within and north of the proposed construction footprint.

55. During low lake levels, within the parts of the middle and western lacustrine channels that are usually inundated (i.e., during typical lake levels), there were extensive areas of mudfield (deposited fine sediment), with sparse turf species and aquatic macrophytes. This vegetation typically comprised a sparse cover of low-stature indigenous plant species including mudwort, water milfoil, red pondweed, *Lobelia perpusilla* and *gratiola*. Yellow marsh cress, sharp spike sedge and Gaudichaud's sedge were also present, but sparse, in higher, less frequently inundated areas. This vegetation type occurs both within and north of the proposed construction footprint.

56. Crack willow trees of up to approximately 15 m in height occur as treeland within lacustrine wetland habitats on the western side of the Project site[18]. The construction footprint includes a small total area of this vegetation type (0.7 ha), but most of it is north of, and outside, the construction footprint. The understory of the crack willow treeland in this area is generally open and characterised by exotic herbs and grasses including frequent creeping bent, monkey musk and blue sweet grass. In the westernmost channel, north of the construction footprint, infrequent indigenous wetland plants were present in wetter areas under the willow canopy. They included swamp sedge, localised areas with a few plants of purei (*Carex secta*), and very rarely, Sinclair's sedge, Glen Murray tussock and the fern swamp kiokio. Elsewhere, including within the construction footprint, crack willow trees grow over creeping bent – hawkbit grassland or herbfield.

57. The eastern channel has been artificially constructed, has different topography and supports different vegetation to the western and middle channels described above. The eastern channel is inundated to a varying degree during higher lake levels, with the part of the channel furthest from Waiau Arm likely being inundated only very

[18] I have described crack willow treeland where it occurs is dryland / terrestrial environments earlier, in paragraph 41 of my evidence.

infrequently during very high lake levels. The distribution and extent of the vegetation in this channel appeared to be driven by elevation / inundation, the presence of depressions that hold water for longer, and substrate. Much of the higher elevation parts of the eastern channel further from Waiau Arm supported occasional wetland vegetation with more extensive areas of cobbles, gravel and sparse dryland herbs and grasses in less frequently inundated areas. Generally, the areas of wetland vegetation in this eastern channel are highly modified and dominated by tolerant exotic species such as frequent hawkbit and creeping bent, occasional jointed rush, with jointed rush rushland in deeper depressions, and curled dock and infrequent spearwort, water forget-me-not, marsh bedstraw, blue sweet grass, *Alopecurus* sp., oval sedge, South American rush and track rush. There were few indigenous species although sharp spike sedge was occasional in wetter depressions, Sinclair's sedge and Gaudichaud's sedge occurred in localised areas, and there were sparse plants of Buchanan's sedge (At Risk–Declining).

58. Some areas of the middle and western and lacustrine channels and small areas within the eastern channel contain species and species assemblages that are moderately representative of lacustrine wetland habitats (e.g., sharp spike sedge, and areas of mudwort, water milfoil and *Lobelia perpusilla*). This vegetation is of moderate rarity (it only generally occurs on stable river or lake margins, or in wetlands) and contains an At Risk–Declining species (Buchanan's sedge). Overall, these lacustrine channels have low-moderate indigenous species diversity and habitat pattern and are likely of moderate importance in terms of ecological context, as they provide a sequence of habitats for fauna along a gradient of freshwater (lake margin) to dryland and provide feeding and loafing habitat for a small range of widespread and common indigenous bird species.

59. Overall, I have assessed these lacustrine channels as being of Moderate ecological value.

60. In terms of their status as wetlands under the RMA definition, the lacustrine channels are either the 'bed'[19] of Lake Manapōuri (the hydrophytic vegetation associated with the lacustrine channels occurs on areas that are below the

[19] Under the RMA, in relation to *any lake controlled by artificial means*, 'bed' means *the space of land which the waters of the lake cover at its maximum permitted operating level*, which, for Lake Manapōuri, means land below 180.5 m a.s.l. / 180.36 NZVD 2016.

maximum permitted operating level of Lake Manapōuri), or wetland[20] or both. If the lacustrine channels are wetlands under the RMA definition, then the middle and western lacustrine channels are also 'natural inland wetlands', as following Section 3.21 of the NPS-FM, none of the 'exclusions' to that definition apply. Wetland areas within the eastern channel are not a 'natural inland wetland' because the eastern channel was constructed and logically 'exclusion' (c) of the definition in Section 3.21 of the NPS-FM applies. That is, it is:

> *(c) "a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body".*

61. Whether the lacustrine channels are natural inland wetlands or not, I have assessed the wetland vegetation of these areas for completeness and reached conclusions as to effects on these values.

Buchanan's Sedge

62. On 29 May 2024 I completed a survey to quantify the number of Buchanan's sedge plants within the construction footprint and the wider Project site; it was the only At Risk plant species in the Project site. I recorded 49 Buchanan's sedge plants within the construction footprint and a total of 339 plants within the Project site. This species occurs sparsely within the construction footprint in the eastern lacustrine channel, on the lake margin north of the MLC structure at the confluence of the Mararoa River and Waiau Arm, and there is a single plant on the eastern side of the middle lacustrine channel. Within the Project site, but outside of the construction footprint, Buchanan's sedge occurs infrequently in the eastern lacustrine channel north of the construction footprint and is frequent in Wetland 8 and on an area of gravel north of Wetland 8. The number of plants found within the construction footprint during this survey was greater than that reported in the Wetland Assessment Report, primarily because additional plants were found in an area not described by that report (the lake margin north of the MLC structure at the confluence of the Mararoa River and Waiau Arm).

[20] The RMA definition of 'wetland' is: ***wetland*** *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*

Ecological Significance of the Project Site

63. Southland District Council has not listed any Significant Natural Areas (SNAs) in the operative Southland District Plan and there are no 'Regionally Significant Wetlands' within the Project site. However, the Waiau Arm, including part of the channel excavation area is listed in Part A of proposed Southland Water and Land Plan (**pSWLP**)[21] and mapped in Part B[22] as a 'sensitive waterbody' named 'Waiau River from Lake Manapōuri to Mararoa Weir'. 'Sensitive waterbody' is not defined in the pSWLP.

64. Appendix 2[23] of the SRPS (Schedule of Threatened, At Risk and Rare Habitat Types) lists lake margins as a 'Rare Habitat Type'. The three lacustrine channels could be considered part of the margin of Lake Manapōuri and could possibly be considered to meet the definition of 'Rare Habitat Type'.

65. However, the three lacustrine channels within the Project site are not naturally occurring components of the lake margin. The middle and western channels were formerly active river channels of Mararoa River, and the eastern channel was artificially constructed. Therefore, I do not consider that these lacustrine channels are a 'Rare Habitat Type'.

66. The Wetlands Assessment Report contains my detailed assessment (at Section 4.6.2) of the significance of terrestrial vegetation and habitats and wetlands, using the criteria for determining significant indigenous vegetation and significant habitats of indigenous biodiversity listed in Appendix 3 of the SRPS. In summary, my assessment found that those wetland and lacustrine margins of the Project site that support the nationally At Risk–Declining plant Buchanan's sedge are significant under the rarity / distinctiveness criterion iv. Lake margins within the Project site could be considered ecologically significant under the rarity / distinctiveness criterion

[21] Proposed Southland Water and Land Plan, Court Version May 2024.

[22] Proposed Southland Water and Land Plan, Part B – Maps, Decisions Version, 4 April 2018.

[23] The introduction to Appendix 2 of the SRPS includes an explanatory statement that the Schedule describes characteristics of habitat types as they are expressed at the regional scale, that it will continue to evolve as more information on habitat types comes to light, and that it provides an indication of areas likely to be significant and significance will be determined through an ecological assessment using the ecological significance criteria listed in Appendix 3.

vi because all lake margins are defined as originally rare ecosystems[24,25] and lake margins that support indigenous vegetation, or an association of indigenous species, are significant under this criterion regardless of their specific ecological values. However, as I have discussed, the lacustrine channels within the Project site are not naturally occurring, and I do not consider them to be significant under this criterion. Other areas of the Project site do not meet the threshold for significance under the criteria in Appendix 3 of the SRPS.

Lower Waiau River Riparian Wetlands (Downstream of the MLC)

67. There are numerous wetlands between MLC and the coast, but no effects are possible on many of these wetlands because:

    (a) They are distant from, or elevated above, the river;

    (b) They do not have a surface water connection with the river, even during high flow events; and

    (c) Other hydrological drivers are more important, and the river has no, or only a limited hydrological connection.

68. Any discernible effects on riparian wetlands downstream of the Project site are likely to occur closest to the Project site because the effects of suspended sediment reduce with distance down the LWR due to dilution, as additional tributary flows join the LWR, and as coarser fractions fall out of suspension and are deposited on the bed of the river. I have taken a highly conservative approach in my assessment and considered the potential for effects on wetlands as far downstream as the Monowai River, a major tributary approximately 23 km downstream of MLC.

69. Seven riparian wetlands were identified between MLC and the LWR confluence with the Monowai River that are known or likely to receive flood inflows from the LWR. Other than the Mararoa Weir Wetland immediately downstream of MLC, there are no riparian wetlands between MLC and Excelsior Creek, the proposed monitoring

[24] Williams, P. A., Wiser, S. K., Clarkson, B. R., & Stanley, M. C. (2007). New Zealand's historically rare terrestrial ecosystems set in a physical and physiognomic framework. *New Zealand Journal of Ecology,* 31(2), 119–128.
[25] Williams et al. (2007) define historically rare ecosystems as those having a total extent less than 0.5% (i.e. < 134,000 ha) of New Zealand's total area (268,680 km^2).

location on the LWR, approximately 1.3 km downstream of the Project site [26]. The location of these wetlands is shown in Attachment 4.

70. I have described each of these wetlands in the Wetland Assessment Report and included a summary of the key information on each wetland in Table 1, Attachment 5 along with photographs of each wetland in Attachment 6 (Figure 8–Figure 14). These seven wetlands support a range of wetland vegetation types. Six are of moderate ecological value and one is of low ecological value.

71. Six of the seven are 'natural inland wetlands' under the NPS-FM definition. The exception is Mararoa Weir Wetland (Figure 8, Attachment 6), immediately downstream of the MLC. This wetland has formed below the Mararoa Weir following its construction and in my view is logically not a 'natural inland wetland' because 'exclusion' (c) of the definition in Section 3.21 of the NPS-FM applies.

ASSESSMENT OF EFFECTS ON WETLANDS AND TERRESTRIAL ECOLOGICAL VALUES

72. In this part of my evidence, I will discuss the effects of the MLC:IP on wetlands and terrestrial ecology values, summarising the key findings of the Wetlands Assessment Report, (Section 6). I do not repeat the full assessment here.

Direct Vegetation Clearance

73. The Project, including excavation of the parallel channel, construction of the haul road and spoil disposal and contractor's establishment area will result in the removal of the existing vegetation within the construction footprint. This comprises approximately:

(a) 16.31 ha of terrestrial exotic grassland;

(b) 0.012 ha (122 m^2) of *Juncus* rushland, i.e., Wetland 1;

(c) 0.70 ha of crack willow treeland;

[26] As part of the Project, suspended sediment release from the excavation is proposed to be monitored at this location for the duration of the excavation, using a turbidity sensor installed in the LWR about 100 m upstream of the confluence with Excelsior Creek.

(d) 0.46 ha of creeping bent – hawkbit grassland and herbfield associated with the lacustrine channels;

(e) 1.26 ha of turfland / benthic substrate, predominately mudwort – water milfoil mudfield, in the lacustrine channels when exposed during low lake levels.

74. The extent of each of these vegetation types is shown in Attachment 7 of my evidence.

Terrestrial Vegetation

75. Terrestrial exotic grassland (with small recently planted eucalyptus trees) and crack willow treeland within the construction footprint will be removed during construction works. Exotic grassland, including a few individual plants of five indigenous plant species (that are locally and nationally common and widespread, and are nationally classified as Not Threatened), and several crack willow trees growing in dryland areas within the footprint of the parallel channel will be removed. Following completion of the Project[27], the spoil disposal area (approximately 14.5 ha of the total 16.3 ha of exotic grassland that will be removed during construction works), will be rehabilitated and re-grassed with exotic grass species to match the surrounding grassland. The permanent loss of 1.8 ha of exotic grassland and crack willow treeland and temporary loss of 14.5 ha of exotic grassland is not of ecological concern. I also note that if this project were not to proceed, in the longer term, growth of the planted eucalyptus trees will substantially alter the terrestrial habitats of the spoil disposal and contractor's establishment area.

Wetland 1 – Juncus Rushland

76. One small area of palustrine *Juncus* rushland marsh, of approximately 122 m^2 in size, is within the construction footprint and will be permanently removed. I have described the values of this area in detail in paragraph 47 of my evidence. In terms of the indigenous values present, these are the presence of fan-flowered rush and leafless rush. Both are Not Threatened species typical of modified wetland habitats within exotic grassland and are common and widespread in the immediate and wider area. The wetland itself is of Low ecological value. The removal of this

[27] As part of rehabilitating the spoil disposal area, a defined 'gravel stockpile cell' of approximately 3.5 ha is proposed to provide an ongoing source of extracted gravel material made available to local contractors. Once the gravel is extracted, the resultant surface will also be rehabilitated to exotic grassland.

wetland equates to a loss of 2.5 percent of the twelve mapped areas of palustrine marsh within the Project site. I have assessed the loss of this wetland area as having a Very Low level of effect at the Project site and ED scale. As I have also noted above for exotic grasslands in the spoil disposal area, if the Project were not to proceed, I would expect that growth of the planted eucalyptus trees would likely result in the loss of this wetland.

77. All other palustrine wetlands within the Project site were avoided during the design stage of the Project and will not be directly impacted.

Lacustrine Channels

78. Construction of the parallel channel and haul road will also result in the loss of lacustrine vegetation within the lacustrine channels including creeping bent – hawkbit grassland and herbfield and mudwort – water milfoil mudfield in areas that are most often inundated. These vegetation types include indigenous hydrophytic and macrophyte plant species. These species are nationally Not Threatened species, are common locally (e.g., *Lobelia perpusilla*, water milfoil), and are expected to re-establish along the lacustrine margins and on the bed of the newly constructed channel. Based on the total extent of clearance, and likely re-establishment of similar species following construction, I have assessed the overall level of effect as Low at the Project site scale and Very Low at the ED scale.

79. Approximately 0.7 ha of crack willow treeland will be removed during channel excavation at the southern end of the lacustrine channels. At the locations where this vegetation type will be removed it does not support indigenous understory species (indigenous understory species are present outside the construction footprint). Crack willows are a pest plant, this vegetation is of Negligible ecological value and the level of effect of its removal is Very Low at the Project site and ED scale, and not of concern from an ecological perspective.

Effects on Buchanan's Sedge

80. Forty-nine of the approximately 340 Buchanan's sedge plants within the Project site, or approximately 15%, will need be removed to construct the parallel channel. Although the loss of this number of plants is unlikely to affect the local population (and will have a Very Low level of effect at scale of the ED), it will have an impact on the population within the Project site and result in the removal of most of the plants

along the margin of the part of Waiau Arm that is within the Project site. These plants are an ecologically significant feature of the Project site, and I have assessed the level of effect of their removal as Moderate at the scale of the Project site, and Low at the scale of the Ecological District. I provide recommendations for remediation of this species later in my evidence.

Indirect Effects on Vegetation and Habitats

Spoil Disposal and Contractor's Establishment Areas

81. Following completion of the detailed wetland vegetation survey to determine whether areas within the proposed channel excavation and spoil deposition works area and environs contained 'natural inland wetlands', project shaping advice was provided to Meridian recommending that direct effects on palustrine natural inland wetland areas (Wetlands 2–12) be avoided by setting back the proposed spoil disposal area and contractor's establishment areas from these features by a minimum of 10 m. Although direct effects were avoided through project design, there are potential indirect effects on these eleven small areas of palustrine marsh.

82. Sediment and stormwater runoff to wetlands during initial topsoil stripping and vegetation removal, during formation of bunds, and following spoil deposition but prior to topsoil capping and rehabilitation with grass, could potentially affect Wetlands 2–9 and 11–12[28]. Implementation of erosion and sediment control measures, including creation of bunds surrounding the spoil deposition area, is proposed as part of the Project to avoid or minimise the effects of sediment and stormwater runoff, as described in the evidence of Dr Clunie. If these control measures were to fail, and sediment were to run off to any wetland, impacts would range from slight deposition of fine sediment to complete burial depending on the extent of the failure. The wetland areas that could be affected contain a relatively low proportional cover of a small number of indigenous sedge and rush species, all of which are common in the wider area (ED) and nationally classified as Not Threatened. Notably, these areas of wetland vegetation have developed following a history of earthworks at the Project site, demonstrating that similar features would likely re-establish following disturbance. At the scale of the Project site, in the worst case, the combined temporary loss of all these wetland features, which I consider

[28] Wetland 10 is over 120 m from the construction footprint and no sediment and stormwater runoff effects are anticipated.

would be very unlikely, would constitute a Very High magnitude of effect and a Moderate–High level of effect. At the scale of the ED, fine sediment impacts or even the combined temporary loss of all these wetland features would constitute, at worst, a Low magnitude effect which equates to a Very Low–Low level of effect, depending on the ecological value of the individual wetland area(s) potentially impacted.

83. The final landform of the spoil disposal area will be higher than the adjacent wetland areas (Wetlands 2–9[29]) that have been avoided. This has the potential to result in altered runoff of rainfall into the wetlands, which may change the hydrology and their vegetation composition. Because the outside slopes of the spoil disposal area would slope towards Wetlands 2–9, I would expect runoff to them to increase. Currently these wetland areas support only weakly hydrophytic vegetation (mostly Facultative or Facultative Wetland species, rather than Obligate species). This may mean more prolonged inundation / saturated soils, increasing in turn the range of habitat niches for wetland species, albeit within limits, as all these existing wetland features are very small. Therefore, and although I have considered the possibility for permanent changes to wetland hydrology in Wetlands 2–9, I find that there is unlikely to be any adverse impact (i.e., No Effect), or else there may possibly be a slight positive effect (i.e., Net Gain) at the scale of the Project site, but essentially No Effect at the scale of the ED.

84. As Dr Clunie has described in his evidence, partial dewatering of the excavation area is being considered during Stage 2 of the construction works to reduce the proportion of excavation work performed by long-reach excavators. If this approach is used, it would lower natural groundwater levels across a substantial proportion of the Project site for approximately 4 weeks. The Groundwater Assessment concluded that a temporary reduction in groundwater levels associated with the proposed dewatering of the parallel channel excavation would likely to result in a less than minor effect on the hydrology of these features. It is most likely that, in terms of their hydrology, rainwater is the primary driver for the presence of hydrophytic vegetation in the small palustrine marshes in the vicinity of the proposed spoil disposal area and contractor's establishment area. All these wetlands contain only weakly hydrophytic vegetation, and any hydraulic connection between the wetlands identified and the underlying water table is likely to occur on a very infrequent basis associated with periods when lake levels are well above their normal operating

[29] Wetlands 10–12 are approximately 75, 100 and 200 m from the spoil disposal area. Due to their distance, and the topography they will not be potentially affected by altered rainfall runoff.

range or during high stage events in the Mararoa River. Therefore, and although I have considered the possibility of temporary dewatering of Wetlands 2–12, I find that this is highly unlikely to arise, and at worst would be a temporary effect resulting in Very Low level effects at the scale of the Project site, and essentially No Effect at the scale of the ED.

Lacustrine Channels

85. Construction of bunds and the haul road will mean there will be no surface water connection between Waiau Arm and the three lacustrine channels for up 15 weeks. Culverts placed under the haul road during its construction will restore direct hydraulic connectivity to the eastern and middle channels once the parallel channel is in service. Construction of the haul road and any dewatering sumps will create sediment that has the potential to affect hydrophytic vegetation and macrophytes within remaining areas of the three lacustrine channels north of the construction footprint.

86. Due to the highly permeability of the alluvial materials[30], 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 upslope to its west and north. Sedimentation and smothering of habitat, or loss of hydrological connection could both reduce the condition or health of, or kill, the hydrophytic vegetation and macrophytes present, but overall, would not result in long-term changes to, or the permanent removal of, this habitat following construction. Hydrophytic vegetation and macrophytes that are killed are expected to re-establish in these habitats following completion of the Project and rehabilitation works. I have assessed the level of this temporary effect as being Low at the scale of the Project site and Very Low at the scale of the ED.

87. As I have discussed in paragraph 84 of my evidence, partial dewatering of the excavation area (including the lacustrine channels) may be implemented for a four-week period during Stage 2 of the construction works. The effect of this would be to de-couple the lacustrine channels from lake levels in Waiau Arm. If partial dewatering is undertaken, which is dependent on the groundwater level during the excavation period, this will likely lower the water level in, or remove any water

[30] Land Water People (2023). *Manapōuri Lake Control Flow Improvement Project: Groundwater Assessment.* Report prepared for Meridian Energy Ltd. October 2023.

present in the eastern and middle lacustrine channels during this time. It may also result in drawdown of water in wetland habitats associated with the western lacustrine channel. However, all three channels are subject to drying during low lake levels and the wetland vegetation that is present is clearly tolerant of these conditions. Both the eastern and middle lacustrine channels dry out completely during periods of low lake levels, which can last for weeks or months. Consequently, a four-week reduction in groundwater levels associated with the proposed dewatering does not represent a departure from normal hydrological conditions. If lake levels are low, and remain low for the duration of this period, there would likely be no water in the eastern and middle lacustrine channels anyway and No Effects are anticipated. If groundwater levels are higher and partial dewatering is implemented, although I have considered the possibility of potential effects on wetland habitats, at worst, this effect would be temporary and result in Very Low-level effects (at the Project site and ED scales).

Downstream Wetlands

Changes in Flow in LWR During Construction Stage

88. For the duration of the Project, aside from site establishment and disestablishment works occurring on dry land areas, Mararoa River flows will be released directly through MLC and down the LWR to minimise flow in the Waiau Arm during the works and avoid flows toward Lake Manapōuri. However, during this time I understand that river flows in the LWR will remain within the consented flow regime. This includes provision for minimum flows, monthly recreational flows, flushing flows[31], and flood flows during high lake levels. I have assessed the level of effect of changes in flow in the LWR due to the Project (with ordinary consented requirements remaining in place) on downstream riparian wetlands as Very Low (at the Project and ED scale), and unlikely to have any discernible effect because:

(a) river flows in the LWR will remain within the consented flow regime;

(b) most riparian wetlands downstream of MLC have hydrological influences that are independent of the LWR;

[31] If there is the flow conveyance capacity to pass flushing flows.

(c) most receive inputs from the LWR only during flood conditions (and so already experience extended periods without receiving direct river inputs).

Potential Sedimentation and Smothering of Wetland Vegetation in Riparian Wetlands

89. As Dr Hoyle has described in her evidence, during construction of the parallel channel there is the potential for elevated levels of suspended sediment concentration (**SSC**) and deposited fine sediment (**DFS**) in the LWR, although they are expected to remain within the range that occurs naturally. Elevated sediment in the LWR has the potential to smother wetland vegetation and habitats downstream of the MLC. This potential effect is only relevant to riparian wetlands that have a surface water connection to the LWR. Wetlands that do not receive surface water at all, even during flood flows, will not be affected.

90. The most noticeable effects of suspended sediment will be in the reaches immediately downstream of the MLC. This is because suspended sediment is expected to decrease in a downstream direction from the Project site due to dilution by tributary flows and as coarser fractions fall out of suspension and are deposited on the bed. Therefore, I expect potential effects on riparian wetlands to be greatest nearest the Project site.

91. Construction works are proposed to be completed under generally low flow conditions. During these conditions, fine sediment deposition will occur in the wetted bed of the river, rather than in riparian wetlands which are elevated above the normal river level. Under minimum flow conditions (12–16 m^3/s) and monthly recreational flows (approximately 35 m^3/s) I do not expect any adverse effects on riparian wetlands.

92. The only time sediment deposition in riparian wetlands is possible is as a result of the re-suspension and transportation of sediment during large natural or managed flow events in the LWR. Construction works will be undertaken when the risks of flood events are lowest, and lake levels will be managed (as far as possible) to reduce the risk of spill / flood events. However, when Lake Manapōuri is above 187.6 m above sea level, flood rules will apply and consequently there is a chance that flood flows containing elevated SSC could arise over the duration of the Project.

93. NIWA have developed Project specific thresholds for SSC and DFS, based on the natural range of turbidity experienced in the LWR, as described in Dr Hoyle's

evidence. These sediment thresholds have been designed to allow additional sediment inputs that are no more than those experienced naturally by biota in the LWR. Dr Hoyle notes that, provided the thresholds are adhered to, any temporary exacerbation will lie within the range of natural variability. The duration of release of the highest sediment loads from the channel excavation, is expected to be relatively short (5–7 weeks) with the largest release of sediment occurring during the 4-week period when the downstream 'breakout' is completed. The effect of the Project is therefore likely to be an increase in sediment loads within the range that occurs naturally in the LWR, but over a longer duration than would occur naturally. Following channel excavation, SSC and DFS in the LWR would be expected to return to its usual state through gradual transport of sediment downstream, especially during large natural and managed flow events.

94. Based on the information above, I have assessed the level of effect of sedimentation on riparian wetlands, which would arise only if large natural or managed flow events in the LWR occur, as Very Low at both the Project and ED scales.

Improved Flushing Flows

95. The primary purpose of the Project is to allow greater reliability in flow releases including allowing flushing flows of 160 m^3/s to be released at lower lake levels than is currently possible. Potentially, improved conveyance of flushing flows may contribute to more regular wetland recharge with positive effects, such as excluding dryland weeds via increased water levels, or prolonged inundation / saturated soils increasing the range of habitat niches for wetland species. Note that I draw a distinction between effects in relation to wetlands that do not receive surface water inputs from the LWR; while these cannot and would not be adversely affected by elevated SSC in the LWR, they may still receive elevated groundwater linked to higher LWR flows. On the other hand, improved flushing flows (as opposed to much larger flood flows) may not be large enough to influence or inundate relatively higher elevation wetland areas, meaning that improved flow conveyance has no effect. Overall, I expect improving flushing flows down the LWR will either have No Effect or potentially result in a slight Net Gain for downstream riparian wetlands at the Project and ED scales.

RECOMMENDED MEASURES TO AVOID, REMEDY OR MITIGATE EFFECTS

96. In this part of my evidence, I will describe the measures I recommend to avoid, minimise, or remedy actual or potential adverse effects on terrestrial and wetland vegetation and habitats.

Recommendations to Avoid / Minimise Effects on Palustrine Wetlands

97. To ensure no part of any wetland within the vicinity of the spoil disposal and contractor's establishment areas are cleared or disturbed during works, I recommend that:

(a) Prior to works commencing in the spoil disposal and contractor's establishment areas, that is before stripping of vegetation and topsoil, a minimum 10 m setback from each wetland boundary should be clearly marked with waratahs or stakes painted with bright dazzle or similar by a suitably qualified ecologist.

(b) Contractors are briefed on avoiding disturbance or damage to those wetlands within the vicinity of the spoil disposal and contractor's establishment areas.

(c) To avoid sediment discharge into the wetland areas adjacent to the spoil disposal and contractor's establishment areas, appropriate and best practice erosion and sediment control measures should be put in place prior to initial topsoil stripping, vegetation removal and formation of bunds. Following deployment, the erosion and sediment control measures should be inspected and maintained in accordance with best practice guidance. Small-scale measures (e.g., straw bales and silt fences) may be needed given the small size of some wetlands (Wetlands 2–12) in this area.

Recommendations to Avoid / Minimise Effects on Lacustrine Channels

98. To avoid / minimise sediment discharge into the lacustrine channels during construction works I recommend that appropriate and best practice erosion and sediment control measures are put in place. A draft condition has been prepared in relation to this recommendation and is included in Mr Murray's evidence.

99. To prevent the spread of crack willows from fragments, I recommend that all willow material including stumps and root balls from trees within the construction footprint is removed, and either mulched or disposed of appropriately, to prevent it from re-growing. Because crack willows can re-sprout from mulched material if it is not mulched finely enough, I further recommend that material should be mulched away from water and as finely as possible, and that it is only spread or deposited well away from water.

Recommendations to Remediate Wetland 1

100. To remedy the reduction in extent of *Juncus* rushland marsh in the Project site due to the permanent removal of Wetland 1 (122 m^2), I recommend that within 12 months of the completion date of the construction works, wetland remediation should be implemented. The objective of the wetland remediation should be to achieve no net loss of indigenous *Juncus* rushland marsh within the Project site.

101. Wetland remediation should involve planting indigenous wetland species, such as *Juncus sarophorus, Juncus edgariae* and *Carex virgata* into a minimum area of 200 m^2 within the area mapped as Wetland 3 (shown on Attachment 3) that has suitable hydrological conditions appropriate for the long-term survival of these plant species. To ensure that additional *Juncus* marsh habitat is re-created, the area to be planted should generally comprise exotic grasses or herbs.

102. The cover of indigenous plant species within a plot measured in Wetland 1 was 60 percent. To ensure the remediated area has a greater canopy cover of indigenous wetland plants, plantings should be at spacings that, when mature, will achieve an overall indigenous wetland plant cover of at least 65 percent (allowing for error) across the wetland remediation area.

103. A draft condition has been prepared in relation to this recommendation and is included in Mr Murray's evidence. I expect that the wetland remediation proposed, will result in a Net Gain in *Juncus* rushland marsh within the Project site.

Recommendations to Remediate Buchanan's Sedge

104. To remedy the loss of 49 Buchanan's sedge plants, I recommend that translocation and planting of Buchanan's sedge plants is undertaken within the Project site. This should include:

(a) Transplanting Buchanan's sedge plants that are currently within the construction footprint into suitable habitat within the Project site (but outside the construction footprint) prior to the commencement of excavation works.

(b) Collecting seed from Buchanan's sedge plants within the Project site, if possible (or elsewhere within the Upukerora ED), and propagating them in a nursery to raise a minimum of 100 plants. Within 12 months of the completion of construction works, at least 100 of these nursery-raised plants should be planted into suitable habitats (lake / shallow water margins) within the Project site.

(c) Recording the number of translocated and nursery-raised Buchanan's sedge plants and marking their locations using a handheld GPS.

105. To ensure remediation of Buchanan's sedge plants has been successful, I recommend the survival of the translocated and nursery-raised plants is monitored 12 months after the nursery-raised plants have been planted. Within 2 weeks of completion of the monitoring, a brief report be prepared including information on:

(a) The number of surviving translocated and nursery raised Buchanan's sedge plants;

(b) A map of the locations of the translocated and nursery raised Buchanan's sedge plants;

(c) Recommendations to achieve no net loss of Buchanan's sedge if monitoring shows that fewer than the original number of plants within the excavation construction footprint have survived.

106. A draft condition has been prepared in relation to this recommendation and is included in Mr Murray's evidence. I expect that the translocation and propagation and planting out of Buchanan's sedge, as I have recommended, will result in a net gain in Buchanan's sedge plants within the Project site.

RESPONSES TO ISSUES IN SUBMISSIONS

107. I have reviewed the submissions received by the applicant and Environment Southland which relate to my area of expertise. Of the 13 submissions received, three raised concerns relating to terrestrial ecology and wetlands. One of these supported the application (subject to conditions), one opposed the application, and one was neutral. Submissions which raised effects on freshwater ecology or avifauna, are dealt with in the evidence of Dr Hickford and Dr Bull, respectively.

108. The concerns raised relate to the following themes:

(a) Insufficient information to assess the ecological values of the site and potential effects on indigenous biodiversity;

(b) Habitat loss, including the loss of one wetland and potential impacts on other areas of palustrine marsh;

(c) The adequacy of baseline information on the ecological values of the spoil disposal area;

(d) The adequacy of impact management for Threatened and At-Risk indigenous flora and wetlands;

(e) Remediation of Buchanan's sedge; and

(f) The potential spread of the stonecrop from the Project site.

Insufficient Information to Assess Ecological Values and Potential Effects

109. In relation to terrestrial ecology and wetlands, DOC is concerned that the application does not identify and address potential adverse effects on Buchanan's sedge (an At Risk – Declining species) and indigenous vegetation in lacustrine channel areas and wetlands, both within the Project site and downstream of the site.

110. Potential adverse effects on Buchanan's sedge are identified in paragraph 80 of my evidence and I recommend measures to address these effects in paragraphs 104–105. I discuss this further below in relation to submissions from The Guardians of Lakes Manapōuri, Monowai and Te Anau (**The Guardians**) and the Waiau Working Party (**WWP**). I discuss potential direct and indirect effects on palustrine wetlands in

paragraphs 76 and 81–84, respectively, and potential direct, and indirect effects on indigenous vegetation in lacustrine channel areas in paragraphs 78–79 and paragraphs 85–87 of my evidence, respectively. I also discuss potential effects on downstream wetlands in paragraphs 88–95.

Habitat Loss

111. DOC is concerned that the proposal will result in the permanent loss of one wetland (Wetland 1) and impact other areas of palustrine marsh (i.e., Wetlands 2–12), and alter and / or de-vegetate instream and wetland areas. DOC has requested that offsetting and / or compensation is provided for the loss of the wetland, and the alteration / de-vegetation of other wetlands, that includes site rehabilitation and / or creating new or enhancing existing wetland areas. In relation to habitat loss, DOC has requested that the recommendations from the Wetland Assessment report be included in and / or form the basis for any conditions to avoid, remedy, or mitigate such effects.

112. One small wetland, 'Wetland 1', is within the construction footprint and will be permanently removed. I have described the effect of the Project on this wetland in paragraph 76 of my evidence. I recommend wetland remediation, as described in paragraphs 100–103 of my evidence to address this effect. I do not consider that this requires offsetting and / or compensation, because the reduction in extent of *Juncus* rushland marsh can be fully remedied within the Project site, and there would be no residual adverse effects to warrant offsetting and / or compensation.

113. All other palustrine wetlands were avoided during the design stage and the Project will not result in any direct effects on these wetlands. The potential indirect effects on palustrine wetlands adjacent to the spoil disposal and contractors establishment areas are described in paragraphs 81–84 of my evidence. I assessed the level of indirect effects as Very Low–Low. I recommend measures to address these indirect effects in paragraph 97. I do not consider that residual effects, if any, warrant offsetting and / or compensation.

114. The potential effects of the Project on wetlands within the lacustrine channels, including the loss of lacustrine vegetation and habitats are described in paragraphs 78–79 of my evidence. These vegetation types are expected to re-establish along the lacustrine margins and on the bed of the newly constructed channel. Based on the total extent of clearance, and likely re-establishment of similar species following

construction, I assessed the overall level of effect of this habitat loss as Low and do not consider that residual effects, if any, warrant offsetting and / or compensation. The loss of instream habitats as a result of bed disturbance during excavation of the breakout areas is discussed in the evidence of Dr Hogsden.

115. I have included recommendations to address the loss of, and effects on, wetland habitats in paragraphs 97–103 of my evidence.

Baseline Information on the Ecological Values of the Spoil Disposal Area

116. DOC is also concerned there is inadequate baseline information on the ecological values of the spoil disposal area.

117. I have described the terrestrial vegetation and habitats within the spoil disposal and contractors establishment areas in Section 4.2.2 of the Wetland Assessment report. The vegetation and habitats within the spoil disposal and contractors establishment areas are entirely exotic grassland of Negligible ecological value. I have provided a detailed description of this vegetation in paragraphs 38–40 of my evidence. For completeness, I have also provided a summary of the ecological values of palustrine wetlands adjacent to the spoil disposal and contractors establishment areas (Wetlands 2–12) in paragraphs 42–46 of my evidence. These wetlands were avoided during the design stage of the Project and are not within the spoil disposal area.

Remediation of Buchanan's Sedge

118. The Waiau Working Party (WWP) consider that given the threat status of Buchanan's sedge, and the limited number of plants identified for transplanting, the suggested mitigation in Section 7 of the Wetlands Assessment Report may be insufficient intervention to secure this population. The WWP have requested that in addition to transplanting, collection of seed and propagation in an off-site nursery for later rehabilitation of Project site.[32]

119. As I have discussed in paragraph 29(b) of my evidence, I completed a specific survey to quantify the number of Buchanan's sedge plants within the construction

[32] The Guardians of Lakes Manapōuri, Monowai & Te Anau (The Guardians) have made a similar submission point, but I understand from Meridian that the legal standing of The Guardians to participate in these processes is disputed.

footprint and the wider Project site on 29 May 2024. The majority of the plants within the Project site (85%) are outside of the construction footprint and will not be impacted by the Project. For this reason, I do not consider the Project is a risk to the long-term security of the population within the Project site. However, as I have discussed in paragraphs 104–105 of my evidence, given that there are 49 plants within the construction footprint, I now recommend a remediation approach that does involve both translocation of the existing plants within the construction footprint prior to the commencement of excavation works, and collecting seed, propagating plants in a commercial nursery and planting a minimum of 100 nursery-raised Buchanan's sedge plants into suitable habitats within the Project site. I also recommend follow-up monitoring and reporting to ensure that that remediation of this species has been successful.

120. I expect that the translocation and planting of Buchanan's sedge plants, as I have recommended, will result in a Net Gain in Buchanan's sedge plants within the Project site.

Potential Adverse Effects on Threatened and At Risk Flora.

121. DOC have submitted that the proposal does not adequately identify and address the potential adverse effects on Threatened and At-Risk indigenous flora, including Buchanan's sedge and indigenous vegetation in lacustrine channels.

122. Buchanan's sedge, which has a threat status of At Risk–Declining, is the only nationally At Risk plant species recorded in the Project site. No Threatened plant species (as defined under the New Zealand Threat Classification System) have been recorded in the Project site. I have provided further information on, and recommended measures to address potential adverse effects on this species in paragraphs 104–105 of my evidence. I have also provided a response to submissions from The Guardians and WWP in relation to the remediation of this species in paragraphs 118–120, above.

Spread of Stonecrop

123. WWP have submitted that DOC and Environment Southland would likely be interested in the presence of stonecrop (*Sedum acre*)[33], within the construction footprint and have suggested that DOC and Environment Southland may wish to initiate a control programme prior to works commencing (although, I note that matters relating to stonecrop are not raised in DOC's submission or by Environment Southland's section 42A Officer).[34]

124. Stonecrop is not specified as a pest in the Southland Regional Pest Management Plan (2019–2029). However, it is an environmental weed that can spread from small fragments, matures quickly and produces many relatively long-lived, well dispersed seeds and is known to spread in open gravel areas and riverbeds. It was recorded in one location within the proposed spoil disposal area where it is very infrequent. It is generally considered to be difficult to effectively control. Nevertheless, Meridian have offered to undertake control of this species prior to works commencing.

RESPONSE TO SECTION 42A REPORT

125. I have reviewed the section 42A Officer's Report prepared by Bianca Sullivan, resource management consultant with Environment Matters Limited, on behalf of Environment Southland, and the supporting technical report (at Attachment 2 of the section 42A Officer's Report), prepared by Dr Thorsen, ecologist Whirika Consulting Ltd.

126. There are no issues raised in the Officer's Report, or Dr Thorsen's supporting technical report, relating to terrestrial vegetation and habitats or wetlands that need addressing.

[33] This species of stonecrop is a succulent, mat-forming, perennial herb that grows on gravel, shingle, sand, rocks and other porous substrates.

[34] This submission point appears in The Guardians' submission also.

CONCLUSIONS

127. I have identified that the key actual or potential adverse effects of the MLC:IP Project on terrestrial vegetation and habitats and wetlands are:

(a) The removal of small (122 m^2) area of palustrine *Juncus* rushland marsh (Wetland 1) of low ecological value. To address this effect, I have recommended the implementation of wetland remediation to achieve no net loss of this habitat type within the Project site.

(b) The loss of 49 Buchanan's sedge plants. I have recommended translocation and planting of Buchanan's sedge plants to achieve no net loss of this species within the Project site.

(c) The potential for sediment and stormwater runoff from the spoil disposal area to adversely affect areas of adjacent palustrine marsh. I have recommended several measures to address this potential adverse effect, including the installation of appropriate and best practice erosion and sediment control.

128. Other effects of the MLC:IP Project on terrestrial vegetation and habitats are generally of a Very Low–Low level of effect.

129. Overall, with implementation of project shaping and the impact management measures I have recommended, I have assessed the level of effect of the construction and operation of the MLC:IP Project on wetlands and terrestrial vegetation, as Very Low to Low.

Scott Hooson

3 September 2024

ATTACHMENTS

ATTACHMENT 1 – HISTORICAL AERIAL IMAGERY OF THE PROJECT SITE

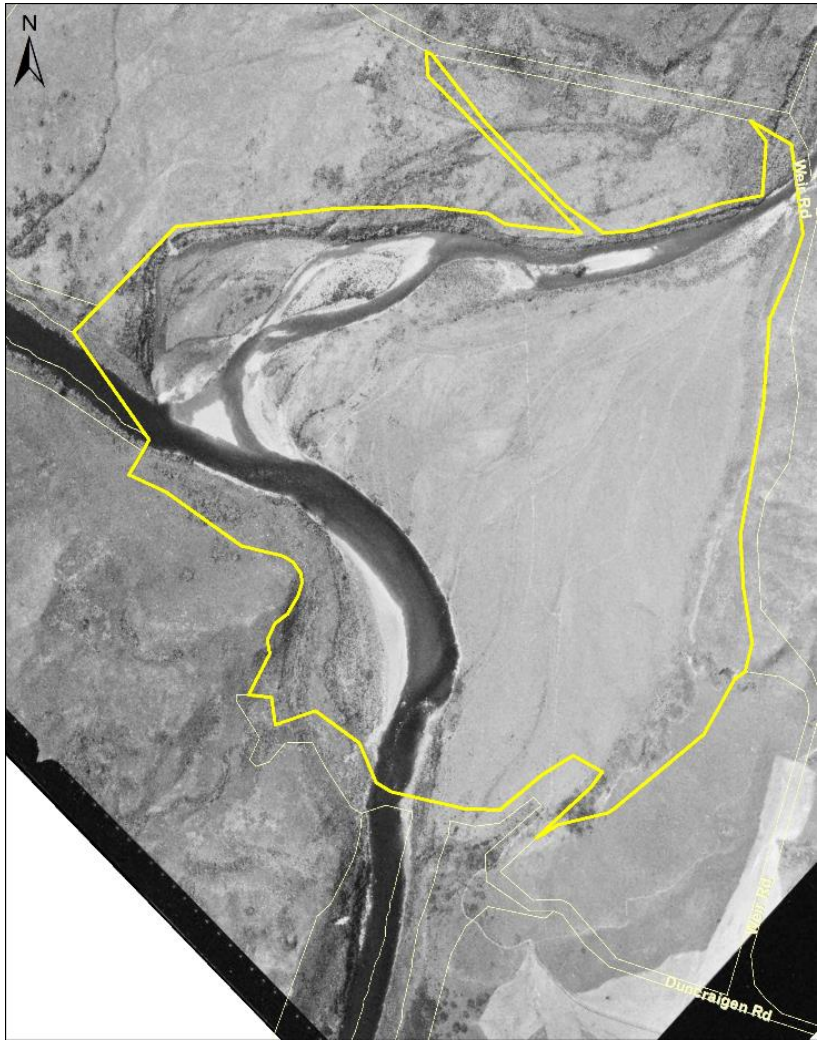

Figure 1: 1964 aerial image of the Project site (sourced from http://retrolens.co.nz[35] and licensed by LINZ CC-BY 3.0)

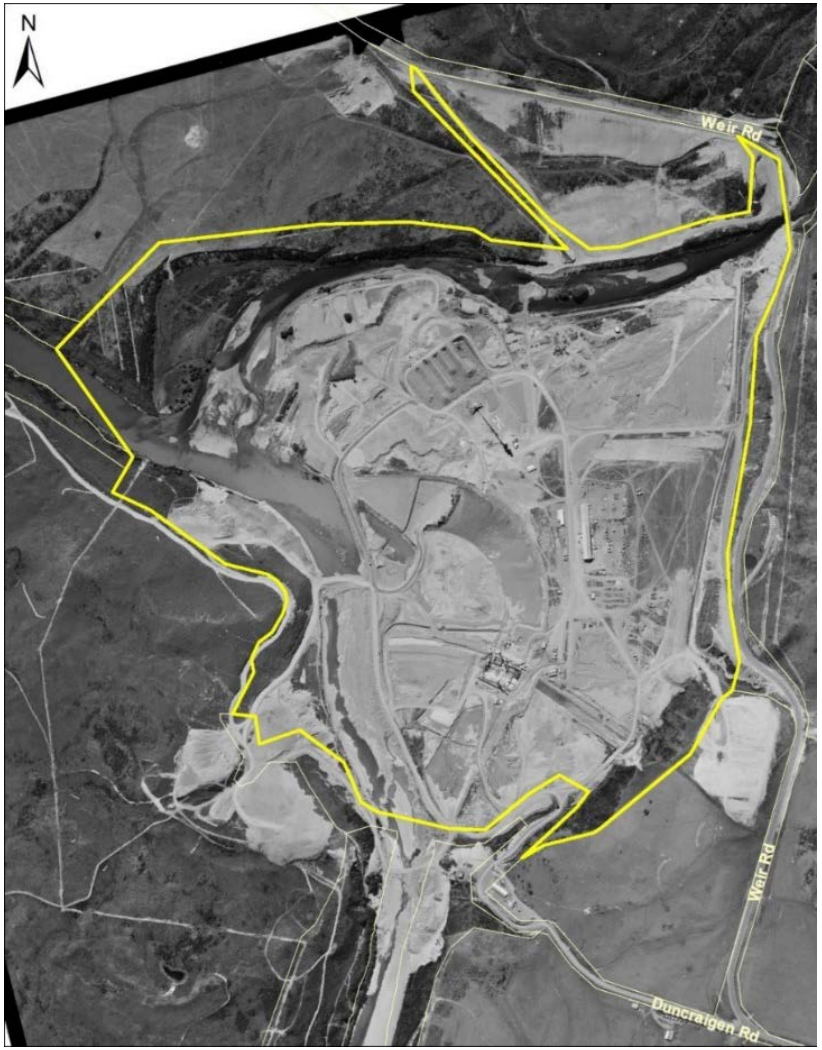

Figure 2: 1974 aerial image of the Project site (sourced from http://retrolens.co.nz and licensed by LINZ CC-BY 3.0)

ATTACHMENT 2 – PHOTOGRAPHS OF THE PROJECT SITE AND WETLAND 1

Figure 3: Manapōuri Lake Control and the Project site (at left) and including part of the eastern channel (foreground) during high lake levels, looking downstream. Lines of mechanical ripping to plant eucalypt trees at the Project site are clearly visible. Photograph provided by Meridian / Nick Key.

Figure 4: The proposed spoil disposal area, across the Mararoa River (middle foreground) as seen from Weir Road, with Waiau Arm at left. Photo taken in 2022 prior to more recent growth of eucalypts in the Project site.

Figure 5: 'Wetland 1' adjacent to the gravel access track.

ATTACHMENT 3 – LOCATION AND EXTENT OF WETLANDS WITHIN THE PROJECT SITE

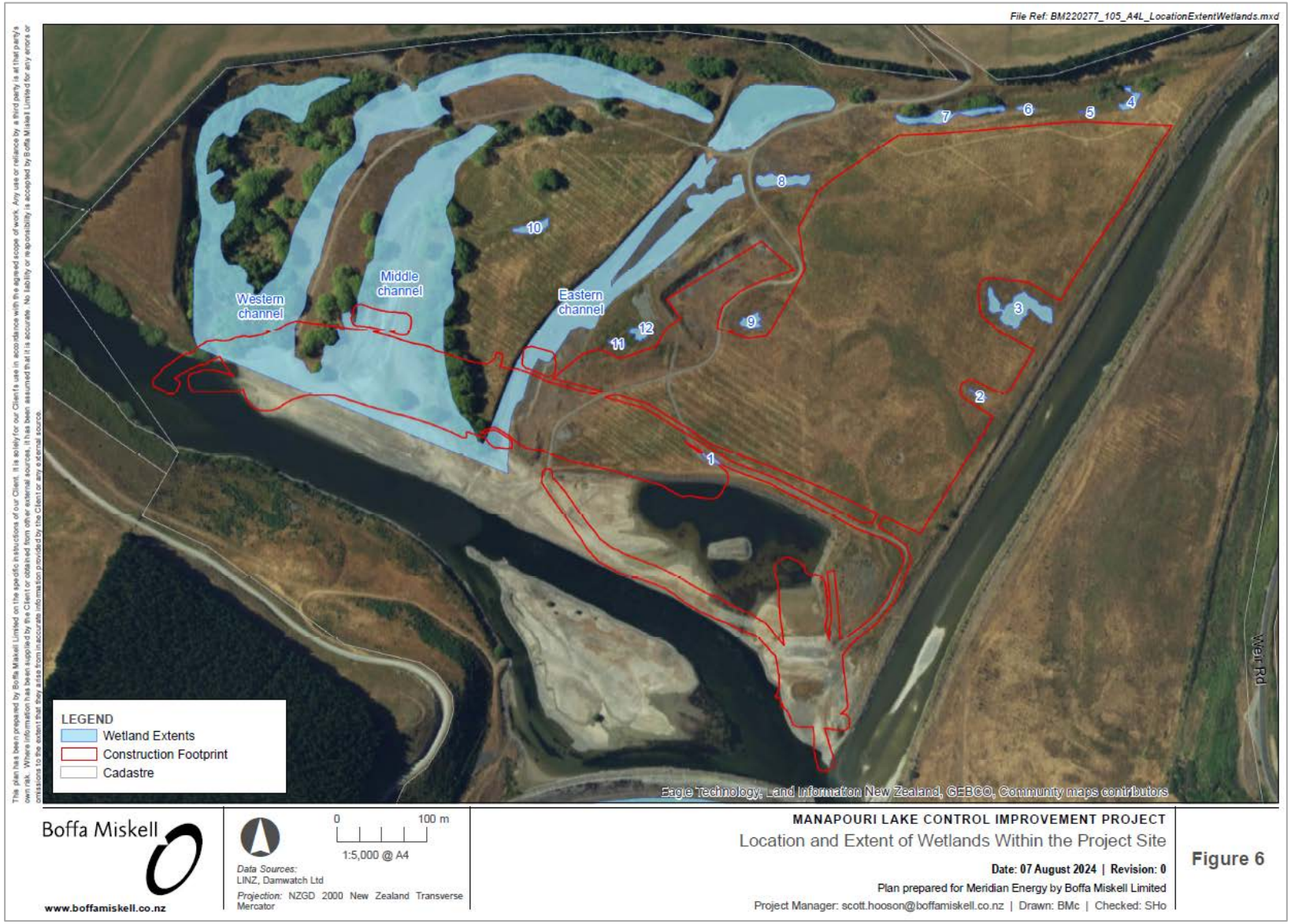

Figure 6: MLC Improvement Project location and extent of wetlands within the project site

ATTACHMENT 4 – LOCATION AND EXTENT OF RIPARIAN WETLANDS DOWNSTREAM OF THE PROJECT SITE

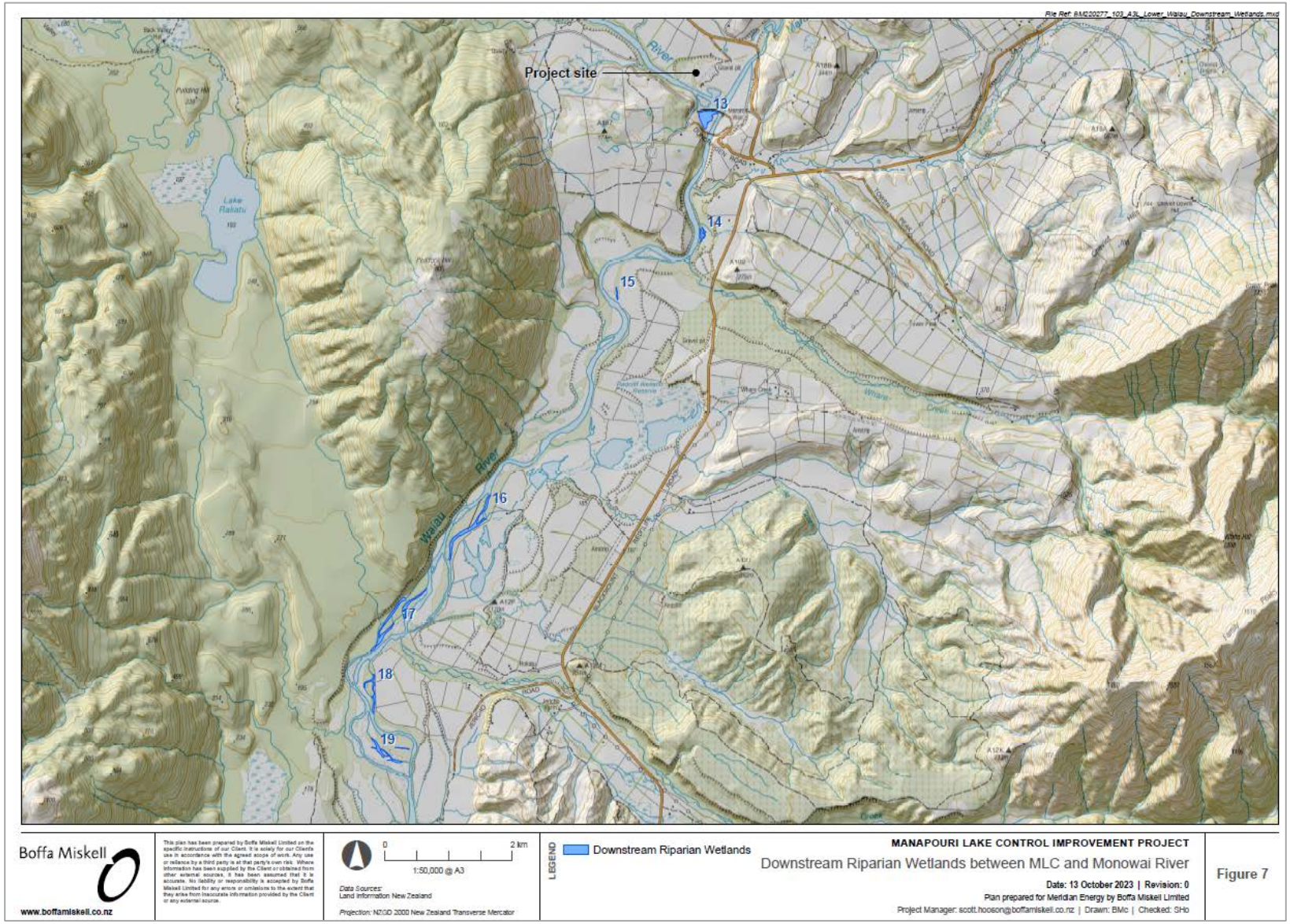

Figure 7: MLC Improvement Project downstream riparian wetlands between MLC and Monowai River

ATTACHMENT 5 – LOWER WAIAU RIVER RIPARIAN WETLANDS, SUMMARY OF KEY INFORMATION

Table 1: Summary of key information for each of the seven riparian wetlands associated with the LWR, downstream of the Project site.

Wetland name / (No.)	Approx. area (ha)	Distance downstream of Project site (km)[36]	Wetland hydrosystem	Wetland class	Ecological value	Importance of hydrological linkage to LWR	Hydrological drivers	Main vegetation types
Mararoa Weir Wetland (13)	4.73	0.0	Riverine	Marsh, shallow water	Moderate	High	• Groundwater (likely primary) • River inundation important during high flood flows due to overtopping of the weir and / or elevated water levels. • Terrace seepage (minor)	• Sharp spike sedge rushland • Spearwort herbfield • Jointed rush rushland • Mudwort – water milfoil mudfield
Tower Peak Terrace Toe Wetland (14)	0.76	1.98	Riverine and palustrine	Swamp, marsh	Moderate	Low	• Terrace seepage (likely primary). • Not strongly connected with the LWR. • Lower wetland possibly influenced by flood inflows	• (Harakeke) / pūrei tussockland • Exotic grass grassland
North of Redcliff Wetland (15)	2.53	4.22	Riverine	Shallow water	Low	High	• River groundwater • Occasional river inundation • Terrace seepage (minor)	• Tall fescue grassland

[36] Measured using river length from MLC to the top / upstream end of each wetland (rather than the straight-line distance between MLC and the wetland).

Wetland name / (No.)	Approx. area (ha)	Distance downstream of Project site (km)36	Wetland hydrosystem	Wetland class	Ecological value	Importance of hydrological linkage to LWR	Hydrological drivers	Main vegetation types
Rakatu Riparian Wetland (16)	4.46	8.80	Riverine	Marsh, shallow water	Moderate	High	• River groundwater • Flood inflows • Southern extent influenced by surface and groundwater outflow from the Rakatu wetland	• Crack willow forest • Tall fescue grassland • Shallow open water with emergent water buttercup
Opposite Redcliff Creek Wetland (17)	5.89	10.63	Riverine and palustrine	Shallow water, swamp	Moderate	High	• River groundwater • Flood inflows • Surface water outflows	• Open water • Rautahi / exotic grass grassland • Toetoe / exotic grass grassland • Mānuka – mingimingi shrubland
Redcliff Side Braid Wetland (18)	1.64	12.56	Riverine	Marsh, shallow water	Moderate	High	• River groundwater • Flood inflows • Surface water outflows	• Crack willow treeland • Exotic grass grassland • Mānuka scrub
Jericho Road Island Wetland (19)	2.12	13.63	Riverine	Marsh	Moderate	High	• River groundwater • Flood inflows	• Turfland • Herbfield • Exotic grass grassland • Rautahi sedgeland

ATTACHMENT 6 – PHOTOGRAPHS OF WETLANDS DOWNSTREAM OF MLC

Figure 8: Mararoa Weir Wetland

Figure 9: Tower Peak Terrace Toe Wetland

Figure 10: North of Redcliff Wetland


Figure 11: Rakatu Riparian Wetland


Figure 12: Opposite Redcliff Creek Wetland


Figure 13: Redcliff Side Braid Wetland


Figure 14: Jericho Road Island Wetland

ATTACHMENT 7 – VEGETATION TYPES WITHIN THE CONSTRUCTION FOOTPRINT

Figure 15: MLC Improvement Project extent of vegetation and habitat clearance