BEFORE AN EXPERT PANEL
SOUTHLAND WIND FARM PROJECT

Under the	**FAST-TRACK APPROVALS ACT 2024**
In the matter of	an application for resource consents, a concession, wildlife approvals, an archaeological authority and approvals relating to complex freshwater fisheries activities in relation to the Southland Wind Farm project
By	**CONTACT ENERGY LIMITED**
	Applicant

SOUTHLAND WIND FARM TECHNICAL ASSESSMENT #8: FRESHWATER ECOLOGY

DR GREG RYDER AND DR RUTH GOLDSMITH

18 August 2025

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EXECUTIVE SUMMARY

1. The Southland Wind Farm Project (**Project**) comprises two main components - a wind farm, where the wind turbines, wind farm substation, and wind farm roads are located - and the Grid Connection works – being the infrastructure required to connect the wind farm to the Transpower National Grid. In addition, an existing forestry road will be upgraded to enable wind farm construction traffic and delivery of the wind turbine components.

2. The Project Site (being all the areas covered by the Project) covers parts of three catchments – the Mimihau Stream catchment, the Kaiwera Stream catchment and the Mokoreta River catchment. Of these three catchments, the Mimihau Stream catchment has the potential to be the most impacted by the construction of the Project – due to the majority of the Project being located in this catchment, as well as the proposal to take water from streams within this catchment during the construction of the Project.

3. In general, the existing freshwater ecology values within the Project Site are high, with benthic macroinvertebrate communities containing a large percentage of sensitive taxa. The non-migratory Gollum galaxias and freshwater crayfish or kōura were present at most Mimihau Stream catchment sites where sampling was conducted and are assumed likely to be present in many of the streams within this catchment, except for those with ephemeral or intermittent flows.

4. Conversely, water quality monitoring within the Project Site area indicates existing impacts in major watercourses from elevated phosphorus levels, which, when considered with a decline in water clarity, suggests that sediment inputs have been increasing over time.

5. The principal potential adverse effects of the Project on freshwater ecological values associated will occur during the construction phase. Without mitigation, these impacts can be primarily attributed to sedimentation, runoff, and the loss of habitat.

6. In our opinion, the effects in question can and will be effectively managed through the implementation of the various management

measures stipulated in the relevant conditions and management plans. Based on the conditions proposed, there will be an overall net positive benefit, with ongoing habitat improvement via riparian planting and stock fencing (which is proposed to offset habitat loss).

Managing earthworks related effects

7. The Project requires earthworks associated with the construction of the access roads, turbine foundations, laydown areas, substation yard area, the concrete batching plant yard areas, the access tracks to the transmission line pylon locations, a Switching Station yard area (for grid connection) and other associated infrastructure. Activities associated with the Project construction could mobilise sediments, and without adequate measures to control erosion, the discharge of sediment to watercourses is possible, especially through stormwater runoff. If not controlled properly, sediment discharge could impact water quality and benthic macroinvertebrate and fish communities downstream of the worked areas.

8. The implementation of an Erosion and Sediment Control Plan (**ESCP**),[1] including water quality monitoring, during construction, will ensure that the proposed Southland Water and Land Plan (**SWLP**) 'Mataura 3' and 'Lowland Soft Bed' receiving water quality standards are met, and existing freshwater ecology values are protected during construction of the proposed Project.

9. Where possible, material disturbed during the construction of the Project will be re-used; however, Surplus Fill Disposal (**SFD**) sites will also be required to deposit excess material back onto the Project Site. Indicative SFD sites have been identified by Riley (2025)[2]. There are three types of SFD – 'Blanket', 'Shoulder' and 'Gully'. A total of 101 SFD sites have been identified (9 gullies, 39 shoulders, 53 blankets). The locations, type, and storage volumes of each SFD are shown on Riley Drawings (Riley Annexure A, included in Part G of the application documents). The proposed conditions require that the placement of fill will avoid permanent or intermittent rivers or streams, wetlands, high or very high ecological value vegetation and habitat types, very steep slopes and erosion prone land and all of

[1] Part of the overall Earthworks Management Plan for the Project.
[2] Riley (2025), Southland Wind Farm Technical Assessment: Construction Effects "Surplus Fill Disposal Sites".

the indicative SFDs meet these criteria. SFD sites will be appropriately rehabilitated as soon as practicable. These measures will assist in avoiding the potential for sediment release into downstream watercourses and the loss of habitat for freshwater communities.

10. A draft ESCP has been prepared and included with the substantive application, and will be finalised and implemented to ensure that sediment is not mobilised from the fill disposal sites, minimising the risk of sediment entering the watercourses downstream.

Water takes

11. Water is required for construction. Two suitable water take locations have been identified within the Project Site, one of which is on the Mimihau Stream South Branch and the other is on a tributary to this stream. Employing fish screening technology, and restrictions on the amount of water that is taken, especially during low flow conditions, to ensure downstream aquatic habitat is not adversely impacted, will ensure that the existing freshwater ecology values of the Mimihau Stream South Branch are protected while water is taken for the construction of the wind farm.

12. The proposed water take is also a temporary activity as the abstraction of water from the streams will cease when the wind farm construction has been completed (i.e., no water will be taken from the streams while the wind farm is operating).

Watercourse crossings / culverts

13. The Project roads follow ridgelines and other elevated areas where possible therefore mostly avoiding streams. However, some stream crossings are required for the Project, including along the forestry road through the Port Blakely Forest (which will be upgraded and used for wind farm construction access). All stream crossings will be by way of culvert, except for one which will be as a bridge (to replace an existing bridge) in the Matariki Forest. The locations of the crossings of the more notable (i.e. higher flow) streams are known with a high degree of confidence and have indicative designs

completed by Riley (2025)[3]. For the smaller stream crossings, the exact locations of these will be confirmed following detailed design, when the final wind farm layout and associated roading network has been confirmed[4].

14. The development and implementation of the ESCP, proposed fish and crayfish recovery, and consideration of fish passage requirements for individual crossings, will ensure that the existing freshwater ecology values of watercourses are protected during watercourse crossing construction for the Project.

15. All notable watercourse crossings are anticipated to be constructed with fish passage maintained, apart from three – two on the main construction access track within the Port Blakely Forest (Notable Stream Crossings 1 and 6) and the other near turbine JED-18 (Notable Stream Crossing 3). At these locations, it has been deemed appropriate based on the results of the aquatic ecology investigations across the Project Site (and including in consultation with DOC) to prevent the passage of trout, in order to protect threatened galaxiids living upstream. This is described in greater detail in paragraphs 120-131, and also in Part F (Freshwater Fisheries) of the substantive application.

Managing potential contamination and pest plant species introduction

16. The presence of construction machinery, ablution facilities for personnel, concrete batching plants etc. on site present a risk of contaminants (e.g., diesel, lubricants, sewage effluent) and new pest species entering watercourses, with the potential to harm freshwater communities. A Construction Environmental Management Plan (**CEMP**) will be adopted during construction to ensure that the risk of contaminant and pest introduction to watercourses during construction is minimised.

Operational effects, offsetting and long-term overall outcomes

17. No potential adverse effects on freshwater ecology values are anticipated in association with the ongoing operation of the Project if

[3] Riley (2025), Southland Wind Farm Technical Assessment: Construction Effects "Stream Culvert and Bridge Design" (Appended to Report 9 in Part H of the application documents).
[4] These crossings have been further revised since the 2023 Freshwater Ecology Report was prepared and this updated information is presented in paragraphs 120-131.

appropriate management measures for any required maintenance works are developed and implemented.

18. The replacement of the existing unformed stream crossings with culverts will reduce sedimentation in the long term, as not only will wind farm traffic avoid driving through streams, but so too will the existing forestry and farming related traffic.

19. Habitat loss to create watercourse crossings will be offset with habitat enhancement by way of riparian planting and fencing and will result in improvement to the ecological value of the watercourses. The proposed riparian offsetting conditions will ensure that there is good quality habitat for the diversity of fish and benthic macroinvertebrate communities, with the outcome being no net loss of stream habitat.

20. Overall, the proposed riparian offsetting will help to protect and enhance other local watercourses to address the loss of stream habitat associated with the construction of water crossings and culverts required for the Project. Ultimately, this Project is likely to enhance local water quality in the medium to long term.

INTRODUCTION

21. Our full names are Gregory Ian Ryder and Ruth Johanna Goldsmith.

22. Greg Ryder is a self-employed Environmental Scientist and has worked as a consultant for over 30 years. His technical work is largely in the fields of surface water quality and aquatic ecology. He has presented evidence as an expert witness at many resource consent hearings, plan or plan change hearings, boards of inquiry, EPA and WCO hearings, and Environment Court hearings. He also fulfils the role of an independent commissioner and has sat on resource consent and plan change hearings throughout the country as well as several EPA board of inquiries.

23. Ruth Goldsmith is an Environmental Scientist with broad skills in freshwater ecology gained from over 20 years as an independent consultant. Ruth is particularly engaged in the assessment of effects and is involved in all parts of this process from undertaking and managing field assessments through to the preparation and

presentation of evidence and at resource consent and environment court hearings.

Qualifications and experience

Greg Ryder

24. Dr Ryder has BSc. (First Class Honours) (1984) and PhD. (1989) degrees in Zoology from the University of Otago. His PhD. thesis examined the effects of fine sediments on the benthic ecology of streams and rivers. Major study areas include the effects of agricultural land use, mining, gravel extraction, renewable energy, irrigation, urban water supplies, urban stormwater and various industrial and municipal sewage discharges on freshwater and coastal ecosystems.

25. Dr Ryder is a member of the New Zealand Freshwater Society and the New Zealand Plant Conservation Network. He was a Board member of the Environmental Protection Authority from February 2020 to November 2023, and was appointed as a Freshwater Commissioner in September 2020, which expired in December 2024. He is accredited under the Making Good Decisions Program to sit on RMA hearing panels (chair certification).

26. Dr Ryder is familiar with the surface waters of catchments associated with the Project. He has been involved in ecological and water surveys at sites in these catchments for Environment Southland as part of wider investigations into the Mataura catchment (Ryder, 1995[5], Ryder 1999[6]), and state of the environment monitoring (e.g., Ryder 2012[7]) and wind farm proposals (Goldsmith *et al*. 2007[8]). He reviewed reports on the freshwater ecology of the locality prepared by Stuart and McQueen (2023[9]) and Goldsmith

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[5] Ryder, G.I. 1995. *Mataura Catchment water quality review*. Report prepared by Ryder Consulting Limited for Southland Regional Council.
[6] Ryder, G.I. 1999. *Mataura River water quality investigation: 1996-1998*. Report prepared by Ryder Consulting Limited for Southland Regional Council.
[7] Ryder, G.I. 2012. *A review of state of the environment data trend anaylsis and reporting for Southland's stream and river monitoring sites*. Prepared for Environment Southland.
[8] Goldsmith, R.J., Ludgate, B., and Ryder G.I. 2007. *Kaiwera Downs Wind Farm Development aquatic assessment: Scoping phase*. Prepared by Ryder Consulting for Russell McVeagh on behalf of TrustPower Limited.
[9] Stuart, R. and McQueen, S. 2023. *Preliminary ecological surveys of the proposed Mimihau wind farm site, Southland*. Contract Report No. 6656. Prepared by Wildlands for Contact Energy.

(2023[10]). He undertook a site visit to the Project area in mid-April 2024, specifically focusing on the watercourses around the site.

Ruth Goldsmith

27. Dr Goldsmith has a BSc. (Zoology, 1998), a Postgraduate Diploma (Wildlife Management, 2000), and a PhD. (Zoology, 2004) from the University of Otago. She has extensive experience in assessing and monitoring effects in relation to instream works, discharge consents, water abstractions and renewable energy generation - including potential effects on water quality, aquatic habitats and fish migrations.

28. Dr Goldsmith authored the freshwater ecology report for the Project (Goldsmith 2023). She also provided freshwater advice for the neighbouring Kaiwera Downs Wind Farm Development (Goldsmith *et al.* 2007), including Stage 2 of this development, which is currently under construction.

Code of conduct

29. We confirm that we have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2023. This assessment has been prepared in compliance with that Code, as if it were evidence being given in Environment Court proceedings. In particular, unless we state otherwise, this assessment is within our area of expertise and we have not omitted to consider material facts known to me that might alter or detract from the opinions we express.

Purpose and scope of assessment

30. This report assesses the potential effects of the Project on freshwater ecology to inform the applications under the Fast-track Approvals Act 2024 (**FTAA**).

31. The scope of the assessment includes:

    (a) A review of existing freshwater ecology values, including a comparison of these values to relevant guidelines and policy documents (e.g. National Policy Statement for Freshwater

[10] Goldsmith, R.J. 2023. *Freshwater ecology assessment.* Prepared by SLR for Contact Energy.

Management 2020 (**NPS-FM**), Southland Water and Land Plan (**SWLP**)). Specific ecological values considered include:

(i) Water quality;

(ii) Benthic communities (periphyton and macroinvertebrate);

(iii) Aquatic plants; and

(iv) Fish communities.

(b) An assessment of effects and effects management measures (construction and operational).

THE SOUTHLAND WIND FARM PROJECT

32. Contact Energy Limited (**Contact**) is seeking various approvals necessary for the construction, operation and maintenance of the Southland Wind Farm Project. The Project includes up to 55 wind turbines and associated wind farm infrastructure, an upgraded forestry road to provide construction access to the site, and the ‘grid connection’ electrical works required to facilitate electrical connection of the wind farm to the Transpower National Grid (i.e., a transmission line and switching station).

33. The full project description for the Project is provided in Part A of the substantive application and a figure depicting the Project Site features is provided at Figure Project Description-2 (Part G). We do not repeat it in our assessment. The figures referred to in this assessment that include the reference (Part G) are included in Part G of the substantive application documents.

METHODOLOGY

34. This freshwater assessment is based on our understanding and knowledge of the Project Site, and also in consideration of previous investigations and reports undertaken by Wildlands (Stuart and McQueen 2023) and SLR Consulting (Goldsmith 2023) in relation to this Project, as referred to above. This includes site visits undertaken by Dr Ryder in April 2024 as well as those undertaken by Wildland Consultants (in December 2022 and in April 2023) and Dr Goldsmith (in September 2023 and previously in 2008).

35. Available data and reports were reviewed to gain an understanding of the existing information on freshwater ecology values within the Project Site area. Environment Southland undertakes regular monitoring of streams and rivers in the Southland region, including some sites in the vicinity of the Project. Dr Ryder was involved in setting up this monitoring programme (Ryder 1992[11], 1993[12]). This information, and other data sources, including the New Zealand Freshwater Fish Database (**NZFFD**), and data obtained from previous surveys, was used to describe the existing freshwater environment.

36. Data from two previous surveys were particularly useful: Ryder Consulting (2009[13]), and a draft report summarising the results of a preliminary ecology survey of the Project site completed by Wildland Consultants for Contact in 2022 and 2023 (Wildland Consultants 2023). The Ryder Consulting (2009) report describes a February 2008 survey of freshwater communities at five sites in the upper headwaters of the Mimihau Stream South Branch and Redan Stream, as part of investigations into an earlier wind farm proposed in the Project Site. Although the Ryder Consulting (2009) survey was completed over 15 years ago, it is considered likely that the freshwater ecology values in the streams surveyed in February 2008 are the same, or similar, today – given there have been no significant changes to land use within these particular catchments in the previous 15 years that would cause changes in ecological value.

EXISTING ENVIRONMENT

37. The existing environment is made up of pastoral land and plantation forestry. It includes an extensive unsealed road network in the upper part of the Mimihau Stream catchment associated with active forestry activities.

38. The vast majority of the construction activities for the Project will be undertaken within the Wind Farm Site, being the area where the wind turbines and wind farm roading network is located. Most watercourses within the Wind Farm Site drain northwards, to the

[11] Ryder, G.I. 1992. *Southland Regional Council. A review of environmental monitoring and baseline information requirements for Southland Regional Council*. Prepared by Ryder Consulting for Southland Regional Council.
[12] Ryder, G.I. 1993. *Proposed Southland Regional environmental monitoring strategy: Discussion Document*. Prepared by Ryder Consulting for Southland Regional Council.
[13] Ryder Consulting. 2009. *Slopedown Wind Farm: Aquatic ecology assessment*. Prepared for Wind Prospect CWP (NZ) Limited.

Mimihau Stream South Branch. The very southern part of the Wind Farm Site drains towards the west and into the Redan Stream, which is a tributary of the Mokoreta River that flows into the Mataura River south of Wyndham township.

39. Approximately two thirds of the construction access track through the Port Blakely Forest traverses the Mimihau Stream North Branch catchment and the remaining (northern) third traverses the Kaiwera Stream catchment. The switching station (aka Grid Injection Point) is also located within the Kaiwera Stream catchment. The two branches of the Mimihau Stream join, just to the north of the wind farm site, and generally flow in a westerly direction, to enter the Mataura River just north of Wyndham township. The Kaiwera Stream flows north out of the Project Site and then east, entering the Waipahi River, then the Pomahaka River before ultimately flowing into the Clutha River / Mata-Au (Figure Aquatic Ecology-1 (Part G)).

40. The existing freshwater ecology environment can be assessed by reference to the following measures:

(a) water quality;

(b) periphyton and aquatic plants;

(c) benthic macroinvertebrates; and

(d) fish.

41. In this section of the report we refer to detailed results of surveys in table form – these tables are found in **Appendix 1**.

Water quality

42. Physical and chemical measurements of water quality are used to assess pressures on the health of rivers. Environment Southland regularly measures physical and chemical water quality monthly at two sites in the Mimihau Stream catchment and one site in the Mokoreta River catchment:

(a) Mimihau Stream South Branch tributary at Venlaw Road – within the general Project area, approximately 4 km downstream of the location of proposed turbine ‘JED-18’.

(b) Mimihau Stream at Wyndham – outside of the Project area, approximately 20 km downstream.

(c) Mokoreta River at Wyndham River Road – outside of the Project area, approximately 18 km downstream.

43. Note that there is no similar monitoring site on the Kaiwera Stream, either within the Southland Region nor in the Otago Region. However, as the extent of the Project works within this catchment are so small, the potential for sediment runoff and impact is extremely low and would be dwarfed by existing forestry and farming related activities. As such, it is not considered further in this report.

44. Table 1 in Appendix 1 presents five-year median data for a range of key monitoring parameters at each site, including phosphorus, nitrogen, clarity and faecal bacteria. Land and Water Aotearoa (**LAWA**) ten-year trend analysis results for the site are also shown, together with a comparison of median values with relevant National Objectives Framework (**NOF**) bands (under the NPS-FM).

45. Ten-year trend analysis (2013 – 2023) indicates that phosphorus, nitrogen and faecal bacteria concentrations are increasing and water clarity is decreasing (i.e., water quality is degrading) in the Mimihau Stream South Branch tributary at Venlaw Road (Table 1, Appendix 1). Dissolved reactive phosphorus concentrations are within NOF band C, indicating ecological communities may be moderately impacted. Nitrogen and ammoniacal nitrogen concentrations fall within NOF band A, indicating current concentrations would have no observed effect on any species.

46. Further downstream in the Mimihau Stream mainstem at Wyndham, monitoring of nutrients, clarity and faecal bacteria up to 2021 indicated that water quality was improving (Table 1, Appendix 1). Nitrogen concentrations were within NOF band A, and phosphorus concentrations within NOF band B, indicating ecological communities may be slightly impacted. However, *E. coli* concentrations, although improving, were within NOF band E, which indicates a predicted average infection risk to swimmers of greater than 7%.

47. As in the Mimihau Stream mainstem, the Mokoreta River at Wyndham River Road (2013 – 2023) also has improving water clarity and concentrations of faecal bacteria, however *E. coli* concentrations were again high and within NOF band D, which indicates a predicted average infection risk to swimmers of greater than 3% (Table 1, Appendix 1). The two phosphorus parameters show opposing trends, with total phosphorus degrading and dissolved reactive phosphorus improving. Dissolved reactive phosphorus concentrations are within NOF band B, indicating ecological communities may be slightly impacted. Apart from ammoniacal nitrogen, nitrogen parameters indicated improving water quality. Nitrate nitrogen is within NOF band B. Although degrading, ammoniacal nitrogen was within NOF band A, indicating current concentrations would have no observed effect on any species.

48. Overall, existing water quality monitoring indicates that the Mimihau Stream South Branch tributary, which is adjacent to the general area of the Project Site, is experiencing impacts from high and increasing phosphorus levels. When these high phosphorus levels are considered with the decline in water clarity, it indicates that sediment inputs to the stream are likely increasing through time. Further downstream of the Project Site, these impacts are less apparent, although faecal bacteria levels are high, likely reflecting the influence of the agricultural land use in the lower catchment.

Periphyton

49. Periphyton (algae) is essential for the functioning of healthy ecosystems, but when it proliferates it can become a nuisance by degrading instream values. Key factors controlling periphyton growth include sunlight, nutrient concentration, temperature, grazing by invertebrates and flow history (i.e., the history of bed disturbance).

50. There is no regular monitoring of periphyton within the vicinity of the Project Site[14]. Ryder Consulting (2009) recorded their observations of periphyton cover at five sites in the upper headwaters of the Mimihau Stream South Branch and Redan Stream in February

[14] The closest is the Environment Southland site in Mimihau Stream at Wyndham, which is approximately 20 km downstream of the Project Site.

2008. They found that periphyton cover levels were very low throughout all sites, with only small patches of benthic algae observed. Periphyton cover was likely low due to the high cover of riparian vegetation reducing light reaching the stream bed, preventing suitable conditions for algal proliferation.

51. There are no records within the Ministry for Primary Industries Database for the invasive nuisance algae Didymo (*Didymosphenia geminata*) in the Mimihau Stream and Mokoreta River catchments, although it has been recorded in the Mataura River.

Benthic macroinvertebrates

52. Benthic macroinvertebrates are a range of aquatic taxa (e.g., insects, crustaceans, molluscs, worms and leeches) that have a crucial role in freshwater ecology and respond to changes in water quality, hydrological patterns and/or habitat. Warm summer water temperatures, increased periphyton cover, high sediment levels, and low flows (combined with lifecycle patterns) can result in less 'sensitive' macroinvertebrate taxa being present and/or increases in the abundance of lower scoring 'tolerant' taxa.

53. Environment Southland surveys benthic macroinvertebrate communities annually at two sites in the Mimihau Stream catchment and one site in the Mokoreta River catchment: Mimihau Stream South Branch tributary at Venlaw Road, Mimihau Stream at Wyndham, and Mokoreta River at Wyndham River Road.

54. Table 2 in Appendix 1 presents five-year median data for a range of key benthic community health monitoring parameters at each site. LAWA ten-year trend analysis results for the site are also shown, together with a comparison of median values with relevant NOF bands (NPS-FM).

55. Benthic macroinvertebrate communities in the Mimihau Stream South Branch tributary at Venlaw Road are diverse, with high taxonomic richness and also a high percentage of sensitive EPT[15] taxa (Table 2, Appendix 1). Macroinvertebrate community health index scores (MCI and QMCI) indicate 'good' quality habitat, with

[15] EPT stands for Ephemeroptera (mayfly), Plecoptera (stonefly) and Tricoptera (caddisfly), which are macroinvertebrate orders that are sensitive to water pollution.

NOF band B indicating mild organic pollution or nutrient enrichment. Reflecting this, another macroinvertebrate community health index, ASPM (Macroinvertebrate Average Score Per Metric), also indicates a mild to moderate loss of ecological integrity. Ten-year trend analysis indicates, however, that the health of benthic macroinvertebrate communities is likely degrading at this site.

56. Macroinvertebrate community richness and the percentage of sensitive EPT taxa is lower further downstream in the Mimihau Stream mainstem and the Mokoreta River than in the Mimihau Stream South Branch tributary (Table 2, Appendix 1). This is also reflected in lower MCI, QMCI and ASPM scores, with MCI and QMCI scores indicating mostly ‘fair’ quality habitat. NOF bands are also lower, ranging from C to D for MCI, QMCI and ASPM. Of the three sites, the Mokoreta River MCI and QMCI scores has the lowest NOF band, with the D band indicating a macroinvertebrate community indicative of severe organic pollution or nutrient enrichment. As in the Mimihau Stream South Branch tributary, ten-year trend analysis indicates that, in general, the health of benthic macroinvertebrate communities is also degrading at the two mainstem sites.

57. The temporal declines in benthic macroinvertebrate communities in the Mimihau catchment are due mainly to land use activities in the catchment downstream of the wind farm footprint. Recent data collected from streams within the wind farm site show that all sites surveyed had an 'excellent' MCI (and SQMCI) score, except site 3, which had an MCI score of 'good'. This local environment includes an existing extensive unsealed road network in the upper Mimihau catchment associated with active forestry and farming land use activities, including forest harvesting on a significant scale.

58. Declines in water quality and ecological health at Mimihau catchment monitoring sites are most likely linked primarily to land use intensification in the mid to lower catchment.

59. The Cawthron Institute has undertaken a relatively recent macroinvertebrate health assessment survey of the Mimihau catchment (Holmes and McNeill 2021[16]). Its report concluded:

> *In general, the MCI scores indicate that most of the catchment has 'good' water quality – at least in terms of water quality attributes that affect macroinvertebrate communities (i.e. not including E coli). The spread of MCI scores within the catchment, calculated 'relative to the highest score in the catchment', shows an overall decline in stream health with increasing distance from the headwaters. Some features of the catchment, including a major tributary and a large section of remnant native riparian forest in the mid-lower catchment, appear to have a negative and positive influence on stream health, respectively.*

60. The Cawthron survey found a slight decline in ecosystem health (as indicated by MCI scores) below the Waiarikiki Stream confluence (the major tributary mentioned above), which has a catchment dominated by agriculture, and joins the Mimihau downstream of the wind farm footprint area. We have previously noted that water quality and macroinvertebrate communities in Waiarikiki Stream are poor relative to other waterways of the Mimihau catchment (Goldsmith et al. 2007). Turner (199417) recorded that the Waiarikiki Stream is nearly always discoloured and that this affects downstream sections of the Mimihau Stream. This comment, and the findings from the recent Cawthron survey, concur with observations of Waiarikiki Stream over three decades (Ryder 1995).

61. Overall, existing monitoring of macroinvertebrate communities indicates that the Mimihau Stream South Branch tributary at Venlaw Road, which is within the general area of the Project Site (approximately 4 km downstream of the location of proposed turbine 'JED-18'), is experiencing the effects of mild organic pollution or nutrient enrichment, although less than that of macroinvertebrate communities further downstream. However, long-term monitoring at this same site indicates that the health of the community is likely

[16] Holmes R, MacNeil C 2021. *Mimihau catchment aquatic health survey using macroinvertebrates.* Prepared for Thriving Southland. Cawthron Report No. 3656. 17 p. plus appendices.
[17] Turner, B. 1994. *The guide to trout fishing in Otago*. Otago Fish and Game Council, Dunedin.

degrading, reflecting the declining water quality also at this site through time (Paragraph 43).

62. In addition to the long-term monitoring of benthic macroinvertebrate communities that has been undertaken in the Mimihau Stream and Mokoreta River catchments by Environment Southland, several one-off surveys of macroinvertebrate communities have also been completed. Results from these surveys are summarised below.

63. Wildland Consultants (2023) undertook macroinvertebrate sampling at five sites within the Mimihau Stream South Branch catchment (sites 1-5), two sites within the Mimihau Stream North Branch catchment (sites 6 and 8) and one within the Kaiwera Stream catchment in the Kaiwera Stream East Branch (site 7). These are shown on Figure Aquatic Ecology-2 (Part G). These sites were chosen specifically to obtain preliminary freshwater ecology information for the Project. The sites were located at elevations ranging from approximately 180 to 370 m asl (Table 3, Appendix 1).

64. Benthic macroinvertebrate communities at the seven Mimihau Stream catchment sites (sites 1, 2, 3, 4, 5, 6, and 8) were moderately diverse, with taxonomic richness ranging from 12-16 (Table 3, Appendix 1). Percent EPT richness at most sites was 50% or higher, which was reflected in MCI scores indicating ‘excellent’ habitat at five of the seven sites. EPT taxa made up a high percentage of community composition (range 49-83%), which was reflected in SQMCI scores indicating ‘excellent’ habitat at all Mimihau Stream catchment sites. Macroinvertebrate community indices for the Kaiwera Stream East Branch site (site 7) were similar to those for the Mimihau Stream sites, with a taxonomic richness of 12, percent EPT richness of 42%, and MCI and SQMCI scores indicating ‘good’ and ‘excellent’ habitat respectively.

65. Ryder Consulting (2009) surveyed benthic macroinvertebrate communities at five sites in the upper headwaters of the Mimihau Stream South Branch and Redan Stream in February 2008 (Figure Aquatic Ecology-2 (Part G)). These sites were located at elevations ranging from approximately 540 to 580 m asl (Table 4, Appendix 1) and as such were at elevations at least 170 m higher than those of Wildland Consultants (2023) survey sites (Table 3, Appendix 1).

Although the Ryder Consulting (2009) survey was completed over 15 years ago, it is considered likely that the freshwater ecology values in the streams surveyed in February 2008 are the same, or similar, today – given there have been no significant changes to land use within these catchments in the previous 15 years that would cause changes in ecological value.

66. Benthic macroinvertebrate communities in the upper headwaters of the Mimihau Stream South Branch and Redan Stream had low to moderate taxonomic richness (range 5-13 taxa) (Table 4, Appendix 1). Percent EPT taxa richness was less than 50% at all sites, and the contribution of EPT taxa to the community was also low at most sites (range 4-51%). This was reflected in generally low MCI and SQMCI scores, which ranged from 'poor' to 'good' at most sites. This is likely due to habitat characteristics, with EPT taxa (such as mayflies and stoneflies) preferring fast flowing, hard bottomed rivers, rather than the slower flowing, softer bottomed habitat available in headwater streams within the Project Site. Further downstream in the catchment the habitat is more suitable for EPT taxa, and this is reflected in the higher SQMCI scores at the sites sampled by Wildland Consultants (2023) (Table 3, Appendix 1).

67. Kōura is a freshwater crayfish often caught (if present) when using the technique of electric fishing to survey fish communities. Freshwater crayfish are classified by the Department of Conservation (DOC) as 'At Risk – Declining' (Grainger *et al.* 2018[18]). There are 16 NZFFD records for kōura in the Mimihau Stream catchment, 25 NZFFD records in the Mokoreta River catchment and 11 NZFFD records in the Kaiwera Stream catchment (Table 5, Appendix 1). NZFFD records for the three catchments have included sites up to an elevation of approximately 380 m asl, with kōura found at the maximum elevation. Ryder Consulting (2009) undertook electric fishing in the upper headwaters of the Mimihau Stream South Branch and Redan Stream (Figure Aquatic Ecology-2 (Part G)) and also found kōura at elevations of up to 580 m asl[19]. It is likely that kōura are present in most of the small headwater streams

[18] Grainger, N., Harding, J., Drinan, T., Collier, K., Smith, B., Death, R., Makan, T., and Rolfe, J. 2018: *Conservation status of New Zealand freshwater invertebrates, 2018*. New Zealand Threat Classification Series 28. Department of Conservation, Wellington. 25 p.
[19] These records are not in the NZFFD.

within the wind farm site area and possibly also in the wider Project Site.

Aquatic plants (macrophytes)

68. None of the reported surveys noted the presence of macrophytes in streams within the Project Site. While they are likely to be present in some areas, the nature of these streams, being set within hilly country and often with significant riparian shading and hard substrate (e.g., cobbles and gravels), do not lend themselves to significant macrophyte cover.

69. An exception to this assessment is in the Kaiwera Stream catchment, where small headwaters bisecting the access road to the Port Blakely Forest were often covered with Monkey musk (*Erythranthe guttata*), an exotic macrophyte that can out-compete native plants and has the potential to choke channels and impede drainage, as was the case for the watercourse (Plate 1, **Appendix 2**). These headwaters often have relatively low gradient and therefore more likely to support macrophyte communities.

Fish

70. There are a total of 90 records in the NZFFD for the Mimihau Stream (23 records), Mokoreta River (52 records) and Kaiwera Stream (15 records) catchments (Figure Aquatic Ecology-3 (Part G)), with the year of collection ranging from 1981 to 2022. Tuna (longfin and shortfin eel), Gollum galaxias, and brown trout have been found in the Mimihau Stream catchment, while longfin eel, giant kōkopu, Gollum galaxias, southern flathead galaxias, kanakana (lamprey), common, redfin and upland bullies, and brown trout have been found in the Mokoreta River and its tributaries (Table 6, Appendix 1). Note that some native fish species recorded in the Mokoreta River catchment, namely redfin bullies, giant kokopu, southern flathead galaxias and kanakana, are commonly found in lowland areas, and have generally not been recorded in streams directly adjacent to the Project Site. Gollum galaxias, southern flathead galaxias and kanakana are threatened species,

with the DOC classification of 'Threatened - Nationally vulnerable' (Dunn *et al.* 2018[20]).

71. Four fish species have been recorded in the Kaiwera Stream catchment, longfin eel, upland bully, brown trout and Clutha flathead galaxias. All four of these species have been recorded in tributaries of Kaiwera Stream in the vicinity of the transmission line, switching station and construction access track through the Port Blakely Forest. Clutha flathead galaxias are a threatened species, with the DOC classification of 'Threatened – Nationally critical' (Dunn *et al.* 2018). NZFFD records for the Mimihau Stream and Mokoreta River catchments include sites up to an elevation of approximately 380 m asl. Almost all of the proposed Project turbines are, however, located at elevations above 380 m asl.

72. The only information on fish communities at elevations close to that of the Project proposed turbines are from Ryder Consulting (2009), who surveyed fish communities by electric fishing at five sites in the upper headwaters of the Mimihau Stream South Branch and Redan Stream in February 2008. The five survey sites were located towards the south-west end of the Project Site, at elevations ranging from 540 to 580 m asl (Figure Aquatic Ecology-2 (Part G)). Unidentified galaxias were the only fish species caught, and they were caught or observed at all five survey sites (Table 7, Appendix 1). Ryder Consulting (2009) concluded that it was highly likely, based on their distribution within the local area, that the unidentified galaxiids were Gollum galaxias. An environmental DNA (eDNA) sample collected from an unnamed tributary of the Mimihau Stream South Branch (the proposed water take site referred to as M1, described below) in September 2023 confirmed the presence of Gollum galaxias as being the only fish species present (kōura were also confirmed present).

73. Gollum galaxias (Plate 2, **Appendix 2**) are a threatened (Nationally vulnerable) non-migratory native fish species. Galaxiids were observed throughout the area surveyed in February 2008, with many galaxiids observed but not caught (due either to the small size of the

[20] Dunn, N.R., Allibone, R.M., Closs, G.P., Crow, S.K., David, B.O., Goodman, J.M., Griffiths, M., Jack, D.C., Ling, N., Waters, J.M., and Rolfe, J.R. 2018. *Conservation status of New Zealand freshwater fishes, 2017*. New Zealand Threat Classification Series 24. Department of Conservation, Wellington. 11 p.

fish, or to the habitat preventing capture, e.g., deep pools, overhanging vegetation) (Plate 3, **Appendix 2**). Individuals of a range of lengths indicated an actively recruiting population. It is likely that this galaxiid species is present in most of the small headwater streams within the wind farm site area and possibly also in the small headwater streams of the wider Project Site area.

Mataura Water Conservation Order

74. The Water Conservation (Mataura River) Order 1997 declared that the protected waters of the Order include outstanding fisheries and angling amenity features. Protected waters included the "Mimihau Stream and the Mokoreta River and each of their tributaries". Our analysis concludes that this does not have any material consequence to the Project, given that the outstanding fisheries and habitats that the order seeks to protect are not directly within the Project Site, but are in the lower reaches of the waterways, and will not be affected by the Project.

Environment at proposed water take sites

75. During construction (but not during operation), the Project requires access to water for activities associated with road compaction, mobile crushing of aggregate, concrete batching, dust control and general activities. Riley (2025) have investigated several locations within the Mimihau Stream catchment as potential sources of this water. Two preferred sites have been identified. These are named by Riley as M1 and M2, but are the same locations as Wildland Consultants (2023) sampling sites 1 and 5, as identified on Figure Aquatic Ecology-2 (Part G). Both are located within the Mimihau Stream South Branch catchment and both within the wind farm site area. Photos of these locations are in Plates 4 and 5, **Appendix 2**.

76. Details of the proposed water take locations are as follows:

    (a) M1 – located on an unnamed tributary of the Mimihau Stream South Branch, at an existing farm track ford crossing within Jedburgh Station (elevation approximately 360 m asl). Near location of proposed turbine 'JED-18'. This site was recorded by Wildland Consultants as Site 1 in their 2023 report.

(b) M2 – proposed water take and bridge crossing located on the Mimihau Stream South Branch mainstem within the Matariki Forest, at the same location of the existing bridge over this stream (elevation approximately 300 m asl). This site was recorded by Wildland Consultants as Site 5 in their 2023 report.

77. In December 2022, Wildland Consultants (2023) undertook preliminary freshwater surveys at these sites. Rapid habitat assessments[21] found moderate-high scores of 74 at M2 (Wildlands Site 5) and 86 at M1 (Wildlands Site 1) – noting that overall scores have a maximum value of 100. Low deposited sediment, high invertebrate habitat diversity and abundance, high fish cover abundance and low bank erosion contributed to these high scores. Reflecting this, benthic macroinvertebrate communities (MCI and SQMCI) at both sites were indicative of 'excellent' habitat [22]. One fyke net and one Gee-minnow trap were set overnight at each site, and Gollum galaxias were found in both (Table 8, Appendix 1). One kōura was also caught at M1 (Wildlands Site 1).

Environment at the 'Notable' Stream Crossing Locations

78. There are nine 'notable' stream crossings – with 'notable' being defined as having catchment areas greater than 40 ha (Riley 2025). These are shown on Figure Aquatic Ecology-2 (Part G). Three of the crossings are on Jedburgh Station - one close to JED-18 (at the location of water take site M1), another just upstream, near JED-19 and the third on Jedburgh Plateau, near turbine JED-29. Five are along the construction access track through the Port Blakely property (which follows an existing forestry road) and one is within the Matariki Forest. Other than the crossing in the Matariki Forest (which is to be via a bridge) the other crossings will all be via culverts. These notable stream crossings are labelled NSC1-9 (ordered by catchment area).

[21] This is a measure of the overall habitat quality score, based on individual scoring for ten habitat parameters (Clapcott 2015). Clapcott, J. 2015. *National rapid habitat assessment protocol development for streams and rivers*. Prepared for Northland Regional Council. Cawthron Report No. 2649. 29 p. plus appendices.
[22] Benthic macroinvertebrate communities at these sites (Site 1 and Site 5) are presented in more detail in Paragraphs 58 and 59, and Table 3, Appendix 1.

79. The largest three of these stream crossings coincide with locations where Wildland Consultants undertook their (2023) stream habitat assessments. These are NSC3 (Wildlands Site 1), NSC2 (Wildlands Site 5) and NSC1 (Wildlands Site 8). As noted in the previous paragraph, the rapid habitat assessment score at NSC3 (Wildlands Site 1) and NSC2 (Wildlands Site 5) were 86 and 74 respectively. The rapid habitat assessment score at NSC1 (Wildlands Site 8) was 68 (Table 8, Appendix 1). The slightly lower rapid habitat assessment score at this site was contributed to by a lower invertebrate habitat diversity and abundance, with the MCI score indicative of 'fair' rather than 'excellent' habitat quality[23]. The SQMCI score at NSC1 (Wildlands Site 8) however indicated 'excellent' habitat, as at NSC3 (Wildlands Site 1) and NSC2 (Wildlands Site 5) (Table 8, Appendix 1). Gollum galaxias were found at all three sites, a single kōura was also caught at NSC3 (Wildlands Site 1) and a single longfin eel was also caught at NSC1 (Wildlands Site 8) (Table 8, Appendix 1).

80. Due to their close proximity on the same stream we can assume that Gollum galaxias and kōura would be present at NSC4, as they were at NSC3. Similarly, NCS5 and NCS7 are upstream of NCS1 and as such we can assume Gollum galaxias will be present at these locations also. The other two culverts (NCS6 and NCS8) are upstream of Wildlands Site 7, where no galaxiids of any species were caught.

81. There are currently no restrictions to fish passage at any of the 'notable' steam crossings identified NSC1-9.

82. However, due to the presence of threatened Gollum galaxias at NSC3 (Wildlands Site 1) and at NSC1 (Wildlands Site 8), and the presence of threatened Clutha flathead galaxiid within the vicinity of culvert NSC6, it is recommended that passage for trout should not be provided at the culverts constructed at these three locations. The crossings should instead be designed as an exclusion barrier to prevent the passage of predatory trout upstream to protect the threatened galaxiid populations.

[23] Benthic macroinvertebrate communities at this site (Site 8) are presented in more detail in Paragraphs 58 and 59, and Table 3 Appendix 1.

83. Section 6 of the New Zealand Fish Passage Guidelines (Franklin *et al.* 2024[24]) provides information on how exclusion barriers to trout can benefit populations of threatened non-migratory native fish, and guidance on the design of exclusion barriers to achieve this. Riley have designed these three culverts with these barriers to fish passage incorporated. In the Mimihau Stream catchment, a barrier to trout passage at NSC1 will allow culverts at the sites of NSC5 and NSC7 upstream to allow fish passage, and similarly, the culvert to be installed at NSC4, upstream of NSC3 (no trout passage) can also be designed to allow fish passage, given the protection measures at the downstream culvert locations. Likewise in the Kaiwera Stream catchment, a barrier to trout passage at NSC6 will allow culvert NSC8 upstream to provide fish passage.

84. At NSC2, the existing bridge will be replaced with a new bridge. As such, fish passage remains unchanged. There are no other NSC's upstream of NSC2.

ASSESSMENT OF EFFECTS

Construction

Construction activities that can potentially cause adverse effects to stream ecosystems

85. The construction of the Project requires a number of activities including large scale earthworks, runoff and drainage control, stream crossings and water abstraction.

86. Earthworks are required to construct access roads, turbine foundations, laydown areas, concrete batching plants, a substation yard area, transmission line support structures (pylons), a switching station yard area and other associated infrastructure. Of note:

    (a) The construction access track through the Port Blakely Forest follows an existing well-formed forestry track.

    (b) The construction works will include some widening, a number of existing culverts may need to be replaced (including those identified in the Notable Stream Crossing

[24] Franklin, P., Baker, C., Gee, E., Bowie, S., Melchior, M., Egan, E., Aghazadegan, L., and Vodjansky, E. 2024. *New Zealand Fish Passage Guidelines Version 2.0.* NIWA Client Report No. 2024157HN.

section), and some fords will need to be replaced with culverts.

(c) The construction of the roads on the Project Site will include both the upgrade of existing roads and the creation of new roads.

(d) Transmission line pylons will require a small amount of earthworks associated with creating access tracks to them and for their foundations. The transmission line pylons and the switching station will not be located in any watercourse.

(e) A total access track length of approximately 71 km will be required, including the 6.4 km wind farm access route through the Port Blakely Forest.

(f) Of the 71 km, approximately 25 km will follow existing metalled farm and forestry tracks, leaving 46 km of new roading, with carriageway widths of up to 8.0 m (with localised widening on corners where necessary).

(g) In specific regard to the Wind Farm Site, the total wind farm footprint (being the area of roads, turbine platforms, substation yard and the operations and maintenance building platforms) equates to 368,000 m^2 or about 37 hectares of roading spread out over the 5,800 hectare footprint of the wind farm. For completeness, the total indicative footprint of the wind farm (excluding disposal fill sites) is approximately 175 hectares.

(h) The Project earthworks are indicatively anticipated to generate approximately 1,920,000 m^3 of cut. A portion of this will be used as engineered fill, with the balance (indicatively anticipated to be approximately 770,000 m^3) to be deposited and recontoured onto the land.

87. Water is required during construction for activities associated with road compaction, mobile crushing of aggregate, concrete batching, dust control and general activities. The typical maximum daily water demand during construction of the Project has been estimated to be between 250-350 m^3/day, with a maximum peak of 500 m^3/day on days where wind turbine foundations are being poured concurrently

with major earthworks (Riley 2025). Two potential water supply sources have been identified by Riley (2025), both located within the Mimihau Stream South Branch catchment, named M1 and M2, as identified on Figure Aquatic Ecology-2 (Part G).

88. Nine 'notable' stream crossing sites have been identified within the Project Site (Figure Aquatic Ecology-2 (Part G)) and all but one will be culverts. These eight crossings are all located on existing roads and are order 2-3 streams[25]. Further, less notable, watercourse crossings will also be required at lower order streams, some on existing roads and some on new roads, however the exact locations of these will be identified during detailed design. Any additional stream crossings will be minor in comparison to the nine sites specifically addressed in this report.

89. The presence on site of construction machinery, ablution facilities for personnel, concrete batching plants etc. present a risk of contaminants (e.g., diesel, lubricants, sewage effluent) entering watercourses, with the potential to harm local stream ecosystems. Machinery brought to the site from elsewhere has potential to bring in new pest species (e.g., Didymo).

90. All these activities have potential for adverse effects on surface waters unless accompanied with appropriate management and mitigation measures. Potential effects and management and mitigation measures are addressed below.

Effects of earthworks as a result of construction of access roads, turbines and other associated infrastructure

91. Activities associated with construction of the Project could mobilise sediments, and without adequate measures to control erosion, the discharge of sediment to watercourses is possible, especially through stormwater runoff. Depending upon the level of sediment entering surface waters, water quality and benthic communities and fish communities downstream of the works areas may be adversely affected.

[25] Strahler stream order: A measure of the relative size of streams. First order streams are the smallest tributaries. When two first order streams flow into each other they form a second order stream.

92. In general, the effects of increased sediment levels on macroinvertebrates and fish can occur both directly and indirectly, through impacts on the chemical and physical properties of the water and benthic algae or periphyton (an important food source for stream invertebrates) (Ryder 1989[26]). The degree of the impact is dependent on the sensitivity of each species to elevated turbidity and their tolerance of deposited fine sediment, which is related to their habitat requirements and the magnitude and duration of the change.

93. The SWLP identifies nine physiographic zones within Southland, which have been developed to understand how water moves across the land within an area. The Project Site is mostly within the 'Bedrock/Hill Country' physiographic zone, and within that the 'Overland flow' variant. This zone is characterised by rolling to steep land below 800 m elevation. This zone has high rainfall due to elevation, which results in a dense network of streams that flow to lowland areas. Overland flow is a key transport pathway, which means that watercourses in developed areas are at risk of receiving contaminants from surface runoff. The amount and duration of earthworks, and therefore the potential effects, will vary within each sub-catchment.

94. In general, the existing freshwater ecology values within the Project Site are high, with benthic macroinvertebrate communities containing a large percentage of sensitive taxa. Gollum galaxias ('Threatened – Nationally vulnerable') and freshwater crayfish ('At risk' - Declining) are likely to be present in most of the small headwater streams within the area.

95. Studies on the effects of fine sediment deposition on benthic communities in small Otago streams indicate that, once fine sediment has been flushed from the upper surface of the stream bed, full recovery of the benthic community is virtually complete in 3-4 weeks (Ryder 1989). This is likely to be the case for watercourses within and immediately downstream of the Project footprint.

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[26] Ryder, G.I. 1989. *Experimental studies on the effects of fine sediments on benthic invertebrates*. PhD thesis. University of Otago. 1989. 216 pp.

96. Well-designed erosion and sediment control measures will reduce the potential for sediment run-off to watercourses within the Project Site area during high rainfall events. These should include methods to minimise erosion and control sediment run-off, and techniques to rapidly stabilise disturbed areas during and post-construction. Avoiding activities and infrastructure in sensitive areas will also avoid or minimise potential adverse effects, and we note that transmission line pylons and the switching station will not be located in any watercourse.

97. An ESCP / earthworks management plan (**EMP**) and site specific management plans (**SSMP**)[27] will be adopted during construction (including during construction of the transmission line and switching station within the wider Project Site), based on industry best practice (e.g., Auckland Council GD05), and which includes the requirement for water quality monitoring.

98. Implementation of the ESCP will ensure that any discharges to surface water meet relevant SWLP rules (e.g., 'Rule 5 – Discharge to surface water bodies' and 'Rule 15 – Discharge of stormwater'). Watercourses within the Project Site in the Mimihau Stream and Mokoreta River catchments are classified as 'Mataura 3' for the SWLP 'Appendix E – Receiving water quality standards', requiring that:

    (a) Any discharge is to be substantially free from suspended solids, grease and oil.

    (b) The daily maximum ambient water temperature shall not be increased by more than 3°C when the natural or existing water temperature is 16°C or less, as a result of any discharge. If the natural or existing water temperature is above 16°C, the natural or existing water temperature shall not be exceeded by more than 1°C as a result of any discharge.

    (c) The pH of the water must be within the range 6 to 9, except when due to natural causes.

[27] As referred to in CM4 of the conditions.

(d) The waters must not be tainted so as to make them unpalatable, nor must they contain toxic substances to the extent that they are unsafe for consumption by humans or farm animals, nor must they emit objectionable odours.

(e) There shall be no bacterial or fungal slime growths visible to the naked eye as obvious plumose growths or mats. Note that this standard also applies to within the zone of reasonable mixing for a discharge.

(f) There must not be any destruction of natural aquatic life by reason of a concentration of toxic substances.

(g) There shall be no more than a 20% change in clarity or colour at the edge of the reasonable mixing zone, relative to the clarity or colour upstream of the discharge point.

(h) The fine sediment (<2mm diameter) bed cover, when measured as a percentage at the downstream edge of the reasonable mixing zone, must not increase by more than 10 percentage points from that measured immediately upstream of the discharge.

(i) The oxygen concentration in solution in the waters must not be reduced below 5 milligrams per litre.

(j) The concentration of faecal coliforms shall not exceed 1,000 coliforms per 100 millilitres, except for popular bathing sites, defined in Appendix G "Popular Bathing Sites" and within 1 km immediately upstream of these sites, where the concentration of Escherichia coli shall not exceed 130 E. coli per 100 millilitres.

(k) The Macroinvertebrate Community Index shall exceed a score of 120, 100 and 90 as the river progresses from mountain, hill to lowland hard bed. The Quantitative Macroinvertebrate Community Index shall exceed a score of 7.5, 5.5 and 4.5 as the river progresses from mountain, hill to lowland hard bed.

(l) Fish shall not be rendered unsuitable for human consumption by the presence of contaminants.

99. Watercourses within the Project Site in the Kaiwera Stream catchment are classified as ‘Lowland Soft Bed’ for the SWLP ‘Appendix E – Receiving water quality standards’, requiring that:

(a) The daily maximum ambient water temperature shall not be increased by more than 3°C when the natural or existing water temperature is 16°C or less, as a result of any discharge. If the natural or existing water temperature is above 16°C, the natural or existing water temperature shall not be exceeded by more than 1°C as a result of any discharge.

(b) The pH of the water shall be within the range 6.5 to 9, and there shall be no pH change in water due to a discharge that results in a loss of biological diversity or a change in community abundance and composition. The pH of the water must be within the range 6 to 9, except when due to natural causes.

(c) The fine sediment (<2mm diameter) bed cover, when measured as a percentage at the downstream edge of the reasonable mixing zone, must not increase by more than 10 percentage points from that measured immediately upstream of the discharge.

(d) The concentration of dissolved oxygen in water shall exceed 80% of saturation concentration.

(e) There shall be no bacterial or fungal slime growths visible to the naked eye as obvious plumose growths or mats. Note that this standard also applies to within the zone of reasonable mixing for a discharge.

(f) When the flow is at or below the median flow, the visual clarity of the water shall not be less than 1.3 metres[28].

(g) There shall be no more than a 20% change in clarity or colour at the edge of the reasonable mixing zone, relative to the clarity or colour upstream of the discharge point.

[28] Visual clarity is assessed using the black disc method or other comparable method employed by Environment Southland.

(h) The concentration of total ammonia shall not exceed the values specified in Table 1 "Ammonia standards for Lowland and Hill surface water bodies".

(i) The concentration of faecal coliforms shall not exceed 1,000 coliforms per 100 millilitres, except for popular bathing sites, defined in Appendix G "Popular Bathing Sites" and within 1 km immediately upstream of these sites, where the concentration of Escherichia coli shall not exceed 130 E. coli per 100 millilitres.

(j) For the period 1 November through to 30 April, filamentous algae of greater than 2 cm long shall not cover more than 30% of the visible stream bed. Growths of diatoms and cyanobacteria greater than 0.3 cm thick shall not cover more than 60% of the visible stream bed[29].

(k) Biomass shall not exceed 35 grams per square metre for either filamentous algae or diatoms and cyanobacteria[30].

(l) Chlorophyll a shall not exceed 120 milligrams per square metre for filamentous algae and 200 milligrams per square metre for diatoms and cyanobacteria[31].

(m) The Macroinvertebrate Community Index shall exceed a score of 90 and the Quantitative Macroinvertebrate Community Index shall exceed a score of 4.5.

(n) Fish shall not be rendered unsuitable for human consumption by the presence of contaminants.

100. In our experience, these conditions are useful, and the water clarity conditions at above, are stringent and designed to protect sensitive freshwater environments from elevated sediment and turbidity (MfE 1992[32]). The SSMPs will also ensure that specific locations and extent of streams identified, along with buffer zones, and that erosion and sediment control measures and water quality monitoring

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[29] Applies to the part of the bed that can be seen from the bank during summer low flows or walked on.
[30] Expressed in terms of reach biomass per unit of exposed strata (i.e., tops and sides of stones) averaged across the full width of the stream or river.
[31] Expressed in terms of reach biomass per unit of exposed strata (i.e., tops and sides of stones) averaged across the full width of the stream or river.
[32] Ministry for the Environment. 1992. *Water Quality Guidelines No. 2: Colour and Clarity*.

are put in place. The Construction Environmental Management Plan also provides measures to address unintended sediment discharge.

101. Monitoring will be carried out at regular intervals during the construction to confirm that ‘Mataura 3’ and ‘Lowland Soft Bed’ receiving water standards are being met (CM7). If the monitoring shows that water quality standards are not being met, necessary maintenance and appropriate measures will be immediately undertaken to ensure the ongoing and future effectiveness of water quality controls.

102. To summarise, the development and implementation of an ESCP (including water quality monitoring) will ensure that the SWLP ‘Mataura 3’ and ‘Lowland Soft Bed’ receiving water quality standards are met, and existing freshwater ecology values are protected during construction of the proposed Project.

Effects of runoff / drainage

103. The new track access is unlikely to affect run-off patterns and drainage to watercourses. It also is minor in comparison to potential changes in runoff associated with local forest harvesting and pasture land over time.

104. A comprehensive construction effects assessment for the Project prepared by Riley (Report 9) is included in Part H to the substantive application documents, which includes an assessment of the potential effects of the construction of the Project associated with runoff. We do not consider any further assessment of the effects of the Project's runoff on freshwater ecology is necessary, and we are comfortable that the Project's proposed conditions appropriately address potential sedimentation and runoff effects.

Effects of fill disposal

105. Indicative Surplus Fill Disposal (**SFD**) sites have been identified by Riley (2025)[33] and meet criteria requiring the avoidance of:

    (a) disposal into any areas identified as wetlands (or within a 10m setback from wetlands), or high value vegetation;

[33] Riley (2025), Southland Wind Farm Technical Assessment: Construction Effects “Surplus Fill Disposal Sites”.

(b) disposal into any permanent or intermittent rivers or streams, and;

(c) disposal into very steep slopes >45 degrees (such as at gully side slopes).

106. There are three types of SFD – Blanket Fill, Shoulder Fill and Gully Fill. These are defined in Riley (2025). A total of 101 SFD sites have been identified (9 gullies, 39 shoulders, 53 blankets). The locations, type, and storage volumes of each SFD are shown on Riley Drawings (Annexure A). Gully fills are only proposed for Matariki Forest. For the nine identified gully SFD sites a permanent rock lined channel will be implemented to divert the clean water flow around the perimeter of the fill site.

107. The exact location and number of SFD sites will be confirmed as part of detailed design, and the criteria/constraints listed above are required to be included in the EMP through proposed condition CM3(d) to ensure that significant sediment release into downstream watercourses is avoided.

108. Experience with other wind farms indicates that any effects on stream habitat as a result of construction are temporary. The EMP / ESCP and SSMPs will further manage the risk of sediment runoff including during fill disposal, using industry best practice.

Water takes

109. In March 2023, Riley established water level loggers at the locations of the proposed water takes (i.e. sites M1 and M2). The water level has been recorded at these locations continuously since. Four stream flow gaugings have also been undertaken in order to establish rating curves at each site, so that the water level data can be converted to stream flow data.

110. Analysis of the calculated stream flow data at sites M1 and M2 over the two years of data record (March 2023 – March 2025) provides the following summary information (Riley 2025):

Location	Catchment Area (km^2)	Mean flow (L/s)	Median flow (L/s)	95th percentile flow (L/s)
M1	4.6	153	115	65
M2	12.4	377	269	92

111. Given the water requirements of the wind farm construction (i.e., up to 500 m^3/day), the stream hydrology at sites M1 and M2, and the rules as stipulated in Appendix K of the SWLP, Contact proposes a water take of a maximum of 5 L/sec at M1 and M2, but restricted when stream flows are Q95 (or lower), at which point water take shall comply with the permitted activity limits set in Rule 49(a) or 49(ab) (whichever is applicable) in the SWLP. Based on this concept and the calculated Q95 flows, the water take would never exceed 8% of the stream flow at M1 and 6% of the stream flow at M2.

112. A water take of 5 L/sec would provide 432 m^3/day, which is close to the anticipated maximum demand of 500 m^3/day. However, water taken will be significantly restricted when flows are Q95 or lower. This means that water take will be significantly restricted for 5% of the time, or approximately 18 days a year.

113. To address the issue of not having enough water to meet construction demands during these periods of low stream flow (i.e., Q95 or lower), water storage tanks or ponds are proposed in order to store water during periods of low demand and draw down the storage when periods of high demand coincide with periods of low stream flow.

114. Water would be pumped from either M1 or M2 (or potentially both) to preliminary water tanks located close to the site of abstraction and then pumped again to water storage ponds (which would have a maximum capacity 10,000 m^3) located within a ‘water storage and concrete batching facility’ area. The exact location of the storage ponds (and concrete batching plant facilities) will be determined during detailed design.

115. Potential adverse effects of water extraction on freshwater communities include construction effects (e.g., increased sediment inputs), downstream flow reductions (e.g., reduced habitat, increased water temperatures), and if appropriate intake screening is not installed, fish may also be drawn into intakes.

116. An ESCP will be adopted during water take construction, which includes the requirement for water quality monitoring. Implementation of the management plan will ensure that the SWLP 'Rule 55A – General conditions for activities in river and lake beds' are complied with, including that any activity in the water and bed disturbance is to be minimised to avoid water discolouration.

117. Water intake pipes will be screened to prevent fish from entering the pipe. This is a requirement of SWLP 'Rule 58 – Cables, wires and pipes', and is to be in accordance with SWLP 'Appendix R – Fish Screen Standards and Guidelines'.

118. To protect freshwater ecology values from downstream flow reductions, restrictions on the amount of water that can be taken from watercourses have been set by Environment Southland in the SWLP. The SWLP allows for a maximum permitted abstraction per land holding of 2000 L/day, plus 250 L/hectare/day at a maximum rate of 2 L/sec (Rule 49(a)). The Project's proposed rate of take (5 L/sec) therefore exceeds the permitted activity maximum rate of take, and thus a consent is required for the water take.

119. Environment Southland staff have commented that, in terms of the effects management hierarchy, taking 5 L/sec is not avoidance but rather minimisation[34]. Notwithstanding the hierarchy, the proposed minimum flow limit effectively provides levels of instream habitat maintenance that are conservative, are supported by past assessments of habitat protection in New Zealand[35] and Southland[36] streams, and will be sufficient to maintain existing stream ecosystem values.

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[34] Email from Darin Sutherland (Environmental Scientist, Environment Southland) to Brigid Buckley (Resource Management – Senior Specialist, Contact Energy) dated 15 December 2023.
[35] MfE 2008. *Draft Guidelines for the Selection of Methods to Determine Ecological Flows.* Ministry for the Environment, March 2008.
[36] Jowett, I.G. and Hayes, J.W. 2004. *Review of methods for setting water quantity conditions in the Environment Southland draft Regional Water Plan.* NIWA Client Report: HAM2004-018. 86p.

120. Based on the Q95 flows established to date, a take of 5 L/sec will reduce the flow at Site M1 from 65 L/sec to 60 L/sec – a reduction of 7.7% of the stream flow. At Site M2, the stream flow at Q95 will reduce from 92 L/sec to 87 L/sec – a reduction of 5.4% of the stream flow. Water takes at these periods of low flow would represent the highest reduction in water volume in the streams, however even then the change in flow would be barely detectable by flow gauging and would result in only small changes in water depth and velocity.[37]

121. As the water supply will only be required during the construction phase of the wind farm (estimated to take 24-30 months), the potential effects of downstream flow reductions are not long-term.

122. Intake pipes will be screened to prevent fish from entering the pipe. This is a requirement of Rule 58 (Cables, wires and pipes) of the SWLP, and will be in accordance with Appendix R (Fish Screen Standards and Guidelines) of the SWLP.

123. The proposed restrictions on abstraction rates and daily volumes, and appropriate fish screening of intake pipes, will ensure that the existing freshwater ecology values of the Mimihau Stream South Branch are protected while water is taken for the construction of the wind farm.

124. To summarise, the development and implementation of the ESCP (including water quality monitoring), fish screening, and restrictions on the amount of water that is taken, will ensure that the existing freshwater ecology values of the Mimihau Stream South Branch are protected while water is taken for the construction of the Project.

Stream crossings

125. Where possible, roads will follow ridgelines and therefore avoid watercourses. Of the nine 'notable' stream crossings, eight will be as culverts, and one as a bridge (NSC2).

126. The freshwater ecology values at the nine proposed 'notable' stream crossing sites include the presence of migratory and non-migratory

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[37] Jowett, I.G. 2018. *Review of Minimum Flows and Water Allocation in Taranaki.* Prepared for Taranaki Regional Council. Client Report: IJ1702.

fish species, depending on the site. Further watercourse crossings, at higher elevation locations, are likely to be in areas where only non-migratory fish species are present (largely Gollum galaxias).

127. Replacement of the existing ford crossings in the Port Blakely Forest and in Jedburgh Station with culvert crossings will provide localised positive benefits through the removal of the existing, ongoing disturbance associated with vehicles driving over the stream bed.

128. Potential adverse effects of watercourse crossings on freshwater communities include construction effects (e.g., increased sediment inputs), habitat loss, and if watercourse crossings are not designed and installed appropriately, disruptions to fish passage.

129. The proposed conditions of consent and the ESCP will require water quality monitoring and the recovery and translocation of any fish and/or kōura that are disturbed by earthworks. Implementation of the ESCP will ensure that the SWLP 'Rule 55A – General conditions for activities in river and lake beds' are complied with, including that any activity in the water and bed disturbance is to be minimised to avoid water discolouration.

130. SWLP Rule 55A also requires that fish passage is not impeded as a result of the activity. The SWLP includes some design conditions to ensure that fish passage is provided (e.g., Rule 59 – Culverts), with more design guidance provided within the New Zealand Fish Passage Guidelines (Franklin *et al.* 2024[38]).

131. Although the SWLP requires that fish passage is not impeded by bridge and culvert construction, the NPS-FM includes Clause 3.26 relating to fish passage. Part (1) of this clause states:

> *Every regional council must include the following fish passage objective (or words to the same effect) in its regional plan:*
>
> *"The passage of fish is maintained, or is improved, by instream structures, except where it is desirable to prevent the passage of some fish species in order to protect desired fish species, their life stages, or their habitats."*

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[38] Franklin, P., Baker, C., Gee, E., Bowie, S., Melchior, M., Egan, E., Aghazadegan, L., and Vodjansky, E. 2024. *New Zealand Fish Passage Guidelines Version 2.0*. NIWA Client Report No. 2024157HN.

132. Clause 3.26 (1) is applicable to the watercourse crossings that will be constructed at NSC3 within Jedburgh Station (near turbine JED-18) and NSC1 within the Port Blakely Forest. These are the most downstream crossings of these catchments, and fyke net trapping (and eDNA sampling in respect of site NSC3) have confirmed the presence of Gollum galaxias at these locations. Therefore, we consider the culverts to be constructed at these two locations should be designed to prevent the passage of trout upstream in order to protect the threatened Gollum galaxias population. The culverts should be constructed to maintain passage for climbing indigenous species that require it, noting however that to prevent trout passage, upstream passage for the non-migratory Gollum galaxias does not need to be maintained.

133. One other culvert is also recommended to be designed to prevent the passage of trout. This is culvert NSC6, which is where the Port Blakely Forest road crosses a tributary of the Kaiwera Stream East Branch. Tributaries of Kaiwera Stream within the vicinity of culvert NSC6 are known to contain the threatened Clutha flathead galaxiid. Despite no galaxiids being found by Wildlands during their December 2022 survey at ‘Site 7’ (downstream of NSC6) we cannot rule out the possibility that Clutha flathead galaxiids are present within the tributary upon which NSC6 is to be located. As such, and taking a precautionary approach, we recommend that the culvert at NSC6 is designed to prevent trout passage.

134. The installation of a new watercourse crossing will result in some local habitat disturbance, through an open channel being modified by the installation of a bridge or culvert. As noted above, where possible, roads will follow ridgelines and therefore avoid watercourses. Where watercourse crossings are required, where practicable, the tracks have been aligned perpendicular to the stream, and embankment heights minimised, to minimise the disturbance area and culvert lengths within stream (Riley 2025). The location of all watercourse crossings is yet to be determined, but the total length of notable stream crossings required has been estimated at approximately 160 m (17 m of which is existing culvert crossings).

135. To offset the unavoidable habitat disturbance associated with installation of these crossings it is proposed that a similar length of

watercourse will be enhanced. The length of enhancement required can be determined using the Stream Ecological Valuation (**SEV**) methodology (Storey *et al.* 2011[39]). This offsetting proposal is discussed later in this report.

136. To summarise, the development and implementation of an ESCP (including water quality monitoring), fish and crayfish recovery, and consideration of the requirement for fish passage, will ensure that the existing freshwater ecology values of watercourses are protected during watercourse crossing construction for the Project. Additionally, riparian fencing and planting will be undertaken along a similar length of watercourse to that affected to offset for residual habitat disturbance effects.

Other potential effects associated with construction

137. The CEMP will ensure that the risk of contaminant and pest introduction to watercourses is minimised, and will require, for example:

(a) That contaminants (e.g., diesel, lubricants) stored on site are to be bunded, and refuelling of machinery are to take place away from watercourses.

(b) To prevent runoff from concrete batching plants entering watercourses, runoff is to be isolated and captured and pass through buffer strips before discharging to land.

(c) Waste from ablution facilities will be removed from the site or treated using an appropriate method, to ensure that untreated wastewater cannot enter watercourses.

(d) All machinery brought onto the site will be thoroughly cleaned, to avoid the risk of introducing weed species.

Operational

138. No potential adverse effects on freshwater ecology values are anticipated with ongoing operation of the Project. Maintenance of access roads and the turbines will be required, however these are

[39] Storey, R.G., Neale, M.W., Rowe, D.K., Collier, K.J., Hatton, C., Joy, M.K., Maxted, J.R., Moore, S., Parkyn, S.M., Phillips, N. and Quinn, J.M. 2011. *Stream Ecological Valuation (SEV): a method for assessing the ecological function of Auckland streams.* Auckland Council Technical Report 2011/009.

highly unlikely to affect the freshwater ecology values within or downstream of the wind farm as long as appropriate management approaches are developed and implemented (e.g., for earthworks, stormwater control).

139. The potential effects on stream habitat and freshwater ecology during the operation of the wind farm will almost certainly be less than is the case at present (before the wind farm has been constructed). The reasons for this are:

(a) The main Port Blakely forestry road (which is to be upgraded and used as the wind farm construction access track) currently crosses the Mimihau Stream North Branch as a ford and also crosses a number of smaller tributaries as fords. As part of the wind farm construction, culverts will replace the fords, meaning that, not only will the wind farm-related traffic completely avoid driving through these streams, but so will all of the existing forestry traffic. This can be regarded as a positive change.

(b) Similarly, there are fords across a tributary to the Mimihau Stream South Branch near turbine JED-18 (NSC3) and near JED-19 (NSC4) which farm vehicles and stock currently use to cross through the stream. Culverts will replace these fords resulting in a long-term reduction in the impact on this stream with the reduction in farm related vehicles driving over the stream bed. While this will result in some habitat loss, offsetting for this habitat loss is discussed below.

(c) All other locations where the Project roads coincide with existing forestry or farm roads that currently utilise fords to gain access across streams will be upgraded to being well-formed roads and utilise culverts for stream crossings instead of fords.

(d) Existing culverts will be replaced with new culverts, where required, and will be upgraded to meet current fish passage guidelines, where this is deemed appropriate.

140. In addition, there will be no water taken from streams on site during wind farm operation (all water used at the Operations &

Maintenance facility will be via rainfall-fed tanks), so there will be no change relative to the present situation.

141. Overall, there should be a positive outcome on local freshwater ecology, relative to the present situation, during the wind farm operational phase.

Cultural Impact Assessment

142. The Cultural Impact Assessment (**CIA**) prepared by Te Ao Mārama Incorporated for the Covid Fast-track consenting process identified key values, rights and interests that Waihōpai rūnanga are seeking to protect.

143. Concern was expressed that water quality needs to be protected to a standard that allows for mahinga kai to be diverse, abundant, and safe to eat. To that extent, the CIA identified the potential effects on water quality and, subsequently the habitat, quality, and abundance of mahinga kai species from the following activities:

(a) earthworks, including infilling and recontouring of land;

(b) road and access construction;

(c) the crossing of streams; and

(d) the taking of water for making concrete and construction-related activities such as dust suppression.

144. All of these potential effects have been addressed in general terms.

145. To add to that analysis, we note that the fisheries of the wider Mimihau, Mokoreta and Kaiwera Stream catchments are relatively diverse. However, there is limited diversity within the waterways impacted by the Project footprint. Introduced brown trout were observed/caught at just one site (Site 7), on the Kaiwera Stream downstream of the proposed switching station and also downstream of NSC6 and NSC8. A longfin eel was also observed/caught at this site. This site is well downstream of where earthworks would be undertaken. A longfin eel was also observed/caught at Site 8, where the Port Blakely Forestry road crosses the Mimihau Stream North Branch. One of the more prevalent species throughout the Project

Site is a non-migratory galaxiid, Gollum galaxias, as discussed in Paragraph 68.

146. Notwithstanding the apparent lack of fish diversity within the wind farm footprint, waterways impacted by the Project footprint are valued for the habitat they provide for the Gollum galaxias (and potentially other fish species) and kōura (freshwater crayfish), mahinga kai, and their contribution to the water quality of the Mimihau, Mokoreta and Kaiwera Stream catchments.

147. There are several measures and approaches proposed within the application to avoid, mitigate and offset the potential effects of civil works on the values identified above, particularly as they relate to mahinga kai values, and key ones are discussed below.

148. For completeness, we note our understanding that since the CIA was prepared, Contact has reached an agreement with Ngāi Tahu ki Murihiku, Te Ao Marama Inc, and Te Rūnanga o Ngāi Tahu in respect of the Project, including that the proposed conditions of consent will appropriately address cultural and te taiao effects.

MEASURES TO ADDRESS ACTUAL OR POTENTIAL ADVERSE EFFECTS

149. Mitigation measures are discussed above when addressing effects. Below we summarise those measures, including by reference to the proposed conditions of consent. We then discuss the proposed offsetting for the loss of stream habitat associated with stream crossings.

Key mitigation measures

150. The measures proposed to avoid and / or mitigate effects on freshwater ecology values are provided in more detail in the conditions.

151. Stormwater management, sedimentation and run off, will be managed with sediment retention devices, appropriate timing of works, effective stabilisation of exposed areas, and diversion of clean stormwater runoff with diversion bunds. This is dealt with in conditions CM5A – CM7, along with CM(1)(a) and CM(1)(b).

152. Dust can also have an effect on sediment levels and the ecology of the site. There are conditions (CM19, 20 and 21) requiring careful management of dust discharge, such as by staging earthworks, providing wheel wash facilities at the entrance to the site, and avoiding locating stockpiles within 10 m of any stream.

153. To further prevent erosion, which can contribute to sedimentation, the ESCP will include maintenance, monitoring and reporting for erosion and sediment control measures, mitigations to control discharges to prevent scouring, and an Emergency Response Plan should an incident occur (CM3A).

154. In order to protect the ecology of watercourses, wind farm infrastructure such as the transmission line pylons, wind turbines and the switching station will not be located in watercourses, and regular water quality monitoring will be undertaken (refer CM7(e)). This monitoring will need to meet 'Mataura 3' and 'Lowland Soft Bed' receiving water standards, so will require, among others, that temperatures in watercourses do not increase more than 1-3°C of any discharge, pH remains between 6 to 9, aquatic life is not destroyed by concentration of any toxic substance, and there is no more than a 20% change in colour or clarity at the edge of the reasonable mixing zone (refer CM7A and CM7B). Water takes will also be managed to ensure that daily water does not exceed 432 m^3 per day from Sites M1 and M2 (CM17).

155. Fish communities will be maintained on the site with the conditions requiring recovery and translocation of any fish or kōura disturbed by earthworks (CM13), screening water intake pipes (CM17(f)), and providing for fish passage (CM15). This is further supported by CM13, which sets out that when work is required in the beds of streams, fish passage is not impeded for more than 24 hours at a time, discolouration of streams is avoided beyond a reasonable mixing zone, and contaminants are prevented from entering the water.

156. Where there is excess fill, fill disposal will be managed by avoiding areas of high ecological value, wetlands, watercourses, as well as very steep slopes and erosion prone land (CM3(d)).

157. Finally, the CEMP will ensure that machinery cleaning and refuelling is appropriately managed, waste from ablution facilities is removed from site or treated, and runoff goes through buffer strips before discharging to land (CM2).

158. As a result of the interweaving of all the different conditions within various management plans, effects on freshwater ecology are sufficiently mitigated and minimised without a specific management plan for freshwater ecology alone.

Offsetting stream habitat loss

159. The Project proposes to offset the unavoidable habitat disturbance associated with installation of stream crossings. This is the only effect requiring offsetting as part of the Project, as the other effects can be avoided, minimised and mitigated, as outlined above.

160. As a minimum, at least a similar length of watercourse will be enhanced through fencing and planting to prevent stock access, restore stream shade, and reduce sediment and nutrients inputs via surface run-off. The actual length of enhancement required can be calculated using the Stream Ecological Valuation (**SEV**) methodology[40]. This method calculates the Ecological Compensation Ratio (**ECR**) for offsetting the adverse effects of piping or modifications of streams, in terms of the length / area of existing streams in the vicinity of the Project site that will be restored via riparian fencing and planting. This approach is required by proposed Conditions EC43A – EC46, which require the details to be set out in a Riparian Offsetting Management Plan. The ECR has the underlying principle of "no net loss" and is based upon "no net loss of area-weight stream function." The formula to calculate the ECR for a stream is:

$$ECR = \frac{Predicted\ loss\ of\ function}{Predicted\ gain\ through\ restoration}\ x\ 1.5\ delay\ factor^{41}$$

161. In cases where a stream can be restored in a short period of time, a theoretical ECR close to 1:1 may be appropriate. However, where

[40] Storey, R.G., Neale, M.W., Rowe, D.K., Collier, K.J., Hatton, C., Joy, M.K., Maxted, J.R., Moore, S., Parkyn, S.M., Phillips, N. and Quinn, J.M. 2011. *Stream Ecological Valuation (SEV): a method for assessing the ecological function of Auckland streams.* Auckland Council Technical Report 2011/009.
[41] A factor of 1.5 is applied to allow for time delays before benefits of rehabilitation are realised.

the stream reach to be restored is lower in overall ecological value than the stream reach being degraded, the ECR will need to be set at a higher level[42], and could be 3 times or more the area of actual loss through civil works.

162. Mr Ussher, peer reviewer of the original report during the previous Covid Fast-track consenting process for the Project, agreed that the SEV method is appropriate to use, and including a robust analysis of the potential future state of the impacted streams as per the standard SEV methodology.[43]

163. Each affected site (and proposed restoration sites) will require detailed survey work applying the SEV assessment methods before the size of the ECR can be determined. This is set out (refer EC43) in the Riparian Offsetting Management Plan.

164. Dr Ryder assessed the watercourses in April 2024, and found that there were a number of tributaries of the Mimihau Stream South Branch that were potentially suitable for enhancement and could be considered by Contact for offsetting purposes. Most of the tributaries observed were currently open to stock access, and showed obvious signs of bank erosion, pugging and a general lack of riparian cover.

165. An estimation of stream length impacted by earthworks has been undertaken by Roaring40s Wind Power Ltd. The calculation has been undertaken using the NZ Rivers 1:50k topographic river network database.

166. This stream network database has some inaccuracies, which are particularly evident when viewed at small scale, whereby the identified stream channels do not always follow the actual stream channel that is visible in aerial photography. As such, before any analysis was undertaken, the alignment of the stream channels in the vicinity of the civil design was checked and stream channel alignments adjusted where necessary. This was done using a combination of Google Earth, 2014 orthorectified aerial imagery, and

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[42] Storey, R.G., Neale, M.W., Rowe, D.K., Collier, K.J., Hatton, C., Joy, M.K., Maxted, J.R., Moore, S., Parkyn, S.M., Phillips, N. and Quinn, J.M. 2011. *Stream Ecological Valuation (SEV): a method for assessing the ecological function of Auckland streams.* Auckland Council Technical Report 2011/009.
[43] JWS on Offsetting / Compensation, 5 November 2024, at [66].

contours generated from the DEM for the site (based on highly accurate LIDAR data).

167. Following the edits made to the steam channel database, the Intersection Geoprocessing Tool in QGIS was used on the stream channel file and the civil works design file (as produced by Riley) to identify and extract the sections of the streams that are intersected by the civil works design. The estimate of total stream length potentially impacted by civil works using this method is 769 m.

168. A portion of this estimated length range that would be impacted by construction activities is already culverted (13 culverts in total, with 7 of these being located on the existing road through the Port Blakey Forest). These culverts will need to be replaced and probably extended in length, however, the actual impact of stream length due to the wind farm civil construction works will be lower than the estimated range above, potentially by as much as 200 m.

169. While detailed SEV calculations are yet to be carried out, it is considered that there is sufficient stream area available locally for offsetting purposes to address the effects of stream loss as a result construction activities associated with watercourses. Based on the quality of the stream length affected (i.e., much less than 1 km), and likely state of the streams to be restored, something in the order of 1-2 km of stream length will likely need to be restored in order as an offset, and there appears to be sufficient stream length available to meet that. It may well be that the Jedburgh Station site itself contains sufficient stream length for the riparian offset, and we understand that Contact has had initial discussions with the owner of Jedburgh Station about the use of streams onsite for riparian offsetting.

170. We note that the key principles (1-6) of aquatic offsetting, as set out in clause 3.24 and Appendix 6 of the NPS-FM are relevant in terms of the appropriate approach to offsetting for stream habitat loss. The principles include 'additionality': principle 4 in Appendix 6 of the NPS-FM is that:

> *An aquatic offset achieves gains in extent or values above and beyond gains that would have occurred in the absence of the offset, such as gains that are additional to any minimisation and*

remediation undertaken in relation to the adverse effects of the activity.

171. In respect of additionality, we understand that broadly speaking, Rule 70 in the Proposed Southland Water and Land Plan:

(a) Requires a landowner to obtain resource consent to be able to continue to allow stock to access the beds of rivers and wetlands; and

(b) Includes an exemption for sheep, if certain conditions are met, and also an exemption for moving stock through waterways.

172. The SEV and the ECR calculations can readily be adjusted to account for any situation where riparian fencing is already required under regional planning instruments. As far as we are aware, no regional planning instruments require riparian planting (or the temporary pest control over the planted areas proposed for the Project). Therefore, any adjustment in calculations to ensure the additionality principle is met would discount (to some extent and depending on what the regional planning instruments actually require) the fencing / stock exclusion element of the restoration.

173. The proposed conditions of consent require the offset scheme to be put in place, the necessary rights to the relevant land secured, and for the planting to be monitored and assessed against performance standards. The conditions in turn require a Riparian Offset Management Plan (**ROMP**) to be developed and certified to that end. We have prepared a draft ROMP, which is included with the application.

Ruth Johanna Goldsmith

Gregory Ian Ryder

APPENDIX 1

Table 1: Five-year median water quality data for Environment Southland's Mimihau Stream South Branch (2018 – 2023), Mimihau Stream at Wyndham (2016 – 2021[44]) and Mokoreta River sites (2018 – 2023). Ten-year trends (2011 – 2021 and 2013 – 2023) are also reported as indicating 'improving', 'indeterminate', or 'degrading' water quality. Where appropriate, the relevant NOF bands are also reported ('A', 'B', and 'C' indicates that water quality is considered suitable for designated use, and 'D' and 'E' indicates water quality is not considered suitable for the designated use). Data and interpretation sources from LAWA.

Parameter		Value	Mimihau Stream South Branch tributary at Venlaw Road	Mimihau Stream at Wyndham	Mokoreta River at Wyndham River Road
Phosphorus	Total phosphorus (g/m^3)	5-year median	0.0215	0.036	0.028
		10-year trend	Very likely degrading	Indeterminate	Likely degrading
	Dissolved reactive phosphorus (g/m^3)	5-year median	0.012	0.010	0.008
		10-year trend	Indeterminate	Very likely improving	Likely improving
		NOF band	C	B	B
Nitrogen	Nitrate nitrogen (g/m^3)	5-year median	0.166	0.910	1.090
		10-year trend	Very likely degrading	-	Very likely improving
		NOF band	A	A	B
	Ammoniacal nitrogen (g/m^3)	5-year median	0.005	0.005	0.005
		10-year trend	-	-	Very likely degrading
		NOF band	A	A	A
Clarity	Black disc (m)	5-year median	1.4	0.8	1.2
		10-year trend	Very likely degrading	Very likely improving	Likely improving
	Turbidity (NTU)	5-year median	1.9	5.2	2.7
		10-year trend	Very likely degrading	Very likely improving	Very likely improving

[44] Environment Southland ceased water quality monitoring at the Mimihau Stream at Wyndham site in 2021.

Parameter		Value	Mimihau Stream South Branch tributary at Venlaw Road	Mimihau Stream at Wyndham	Mokoreta River at Wyndham River Road
Bacteria	*E. coli* (per 100 mL)	5-year median	40	265	190
		10-year trend	Very likely degrading	Very likely improving	Likely improving
		NOF band	B	E	D

Table 2: Five-year median benthic macroinvertebrate data for Environment Southland's Mimihau Stream and Mokoreta River sites (2018 – 2023). Ten-year trends (2013 – 2023) are also reported as either indicating 'improving' or 'degrading' community health. Where appropriate, the relevant NOF Bands are also reported ('B' and 'C' indicates that the community is mild to moderately impacted, and 'D' indicates the community is severely impacted). Data and interpretation sources from LAWA.

Parameter	Value	Mimihau Stream South Branch tributary at Venlaw Road	Mimihau Stream at Wyndham	Mokoreta River at Wyndham River Road
Taxonomic richness[45]	5-year median	31	25	24
Percent EPT[46] richness	5-year median	48	40	39
Macroinvertebrate community index score[47] (MCI)	5-year median	118.7	93.8	86.4
	10-year trend	Likely degrading	Likely degrading	Very likely degrading
	NOF band	B	C	D
Quantitative MCI score[48] (QMCI)	5-year median	5.57	5.07	4.22
	10-year trend	Very likely degrading	Indeterminate	Likely degrading
	NOF band	B	C	D
Average score per metric[49] (ASPM)	5-year median	0.494	0.393	0.361
	10-year trend	Likely degrading	Likely degrading	Likely degrading
	NOF band	B	C	C

[45] Taxa richness is considered a very coarse indicator of stream health, which is measured by counting the number of different species of invertebrates present in a sample. The benthic invertebrate community typical of pristine conditions has a high variety of species or "taxa". In general, high taxa richness is considered good, although mildly impacted (nutrient-enriched) rivers can have higher taxa richness than pristine streams and rivers.
[46] EPT stands for Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) which are macroinvertebrates that are sensitive to water pollution. Because these species are generally found in streams with good water quality, their abundance can give us an idea about how healthy a stream is. The percentage of EPT-taxa (or %EPT) is most commonly calculated by counting the total number of mayfly, stonefly and caddisfly taxa in a sample, then dividing that number by the taxa richness and multiplying by 100. A high percentage of EPT taxa indicates good stream health. However, in some New Zealand streams there are naturally few mayflies, stoneflies, or caddisflies present.
[47] MCI stands for Macroinvertebrate Community Index which is used as an indicator of stream ecological health. Higher MCI scores indicate better stream conditions.
[48] QMCI stands for Quantitative Macroinvertebrate Community Index which is used as an indicator of stream ecological health. Higher QMCI scores indicate better stream conditions.
[49] ASPM stands for Macroinvertebrate Average Score Per Metric (ASPM) which is used as an indicator of stream ecological health.

Table 3: Wildland Consultants (2023) assessment of benthic macroinvertebrates communities at sites within the proposed Project area. Sites 1-7 were sampled in December 2022 and site 8 in April 2023.

Wildlands site ID	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**Site 5**	**Site 6**	**Site 7**	**Site 8**
Grid reference (NZTM)	**1294798 4862691**	**1296911 4863747**	**1298329 4864166**	**1299473 4864593**	**1300363 4866039**	**1304083 4866549**	**1301575 4873490**	**1301489 4868524**
Location	**Mimihau Stream South Branch tributary**	**Mimihau Stream South Branch tributary**	**Mimihau Stream South Branch tributary**	**Mimihau Stream South Branch tributary**	**Mimihau Stream South Branch mainstem**	**Mimihau Stream North Branch tributary**	**Kaiwera Stream East Branch**	**Mimihau Stream North Branch mainstem**
Elevation (m asl)	**360**	**180**	**230**	**300**	**300**	**370**	**220**	**270**
Total number of individuals	274	684	888	134	201	639	2016	1280
Taxonomic richness	12	15	16	12	12	16	12	12
Percent EPT richness	42	52	56	42	58	56	42	42
%EPT of the total number of invertebrates	83	56	66	66	49	69	63	81
MCI score and interpretation	128 excellent	125 excellent	116 good	120 excellent	123 excellent	135 excellent	104 good	93 fair
SQMCI score and interpretation	7.0 excellent	6.5 excellent	6.5 excellent	7.3 excellent	6.3 excellent	6.3 excellent	6.8 excellent	7.1 excellent

Table 4: Ryder Consulting (2009) assessment of benthic macroinvertebrates communities at five sites within the proposed Project area. All sites were sampled in February 2008.

Ryder site ID	**Site A**	**Site B**	**Site C**	**Site D**	**Site E**
Grid reference (NZTM)	**1297780 4859555**	**1298125 4861235**	**1296623 4860278**	**1296680 4859290**	**1297408 4858107**
Location	**Mimihau Stream South Branch tributary**	**Mimihau Stream South Branch tributary**	**Mimihau Stream South Branch tributary**	**Mokoreta River, Redan Stream tributary**	**Mokoreta River, Redan Stream tributary**
Elevation (m asl)	**580**	**540**	**550**	**570**	**560**
Total number of individuals (average)	165	143	511	99	48
Taxonomic richness (average)	13	8	5	10	11
Percent EPT richness (average)	46	31	40	45	36
%EPT of the total number of invertebrates (average)	51	48	4	22	32
MCI score and interpretation (average)	109 good	98 fair	123 excellent	93 fair	103 good
SQMCI score and interpretation (average)	4.6 fair	4.3 fair	5.1 good	2.8 poor	4.5 fair

Table 5: Freshwater crayfish (kōura) records in the Mimihau Stream, Mokoreta River and Kaiwera Stream catchments from the NZFFD, accessed 1 June 2025.

Common name	**Species**	**Migratory**	**DOC threat classification (Grainger *et al.* 2018)**	**Mimihau Stream catchment**	**Mokoreta River catchment**	**Kaiwera Stream catchment**
Freshwater crayfish	*Paranephrops zealandicus*	No	At risk – declining	Yes	Yes	Yes

Table 6: Fish species recorded in the Mimihau Stream, Mokoreta River and Kaiwera Stream catchments from the NZFFD, accessed 1 June 2025.

Common name	**Species**	**Migratory**	**DOC threat classification (Dunn *et al.* 2018)**	**Mimihau Stream catchment**	**Mokoreta River catchment**	**Kaiwera Stream catchment**
Shortfin eel	*Anguilla australis*	Yes	Not threatened	Yes		
Longfin eel	*Anguilla dieffenbachii*	Yes	At risk - Declining	Yes	Yes	Yes
Giant kokopu	*Galaxias argenteus*	Yes	At risk - Declining		Yes	
Gollum galaxias	*Galaxias gollumoides*	No	Threatened – Nationally vulnerable	Yes	Yes	
Clutha flathead galaxias	*Galaxias* species D	No	Threatened – Nationally critical			Yes
Southern flathead galaxias	*Galaxias* species S	No	Threatened – Nationally vulnerable		Yes	
Lamprey	*Geotria australis*	Yes	Threatened – Nationally vulnerable		Yes	
Upland bully	*Gobiomorphus breviceps*	No	Not threatened		Yes	Yes
Common bully	*Gobiomorphus cotidianus*	Yes	Not threatened		Yes	
Redfin bully	*Gobiomorphus huttoni*	Yes	Not threatened		Yes	
Brown trout	*Salmo trutta*	Yes	Introduced and naturalised	Yes	Yes	Yes

Table 7: Location of unidentified galaxiids at five sites within the proposed Project area, February 2008 (Ryder Consulting 2009).

Ryder site ID	Site A	Site B	Site C	Site D	Site E
Grid reference (NZTM)	**1297780 4859555**	**1298125 4861235**	**1296623 4860278**	**1296680 4859290**	**1297408 4858107**
Location	**Mimihau Stream South Branch tributary**	**Mimihau Stream South Branch tributary**	**Mimihau Stream South Branch tributary**	**Mokoreta River, Redan Stream tributary**	**Mokoreta River, Redan Stream tributary**
Number of fish (length range, mm)	1 (88)	1 (78)	observed	3 (25-51)	1 (30)

Table 8: Wildland Consultants (2023) assessment of freshwater ecology values at Sites 1, 5 and 8.

Site ID	Wildlands Site 1	Wildlands Site 5	Wildlands Site 8
Location	**Mimihau Stream South Branch tributary**	**Mimihau Stream South Branch mainstem**	**Mimihau Stream North Branch mainstem**
Strahler stream order	3	4	4
Catchment Area (km^2)	4.6	12.9	17.5
Mean flow, L/s (Riley 2025)	115	377	487
Q95, L/s (Riley 2025)	65	92	79
Rapid habitat assessment overall score	86	74	68
Macroinvertebrate community index score (MCI) and interpretation	128 excellent	123 excellent	93 fair
Semi-quantitative MCI score (SQMCI) and interpretation	7.0 excellent	6.3 excellent	7.1 excellent
Fish species captured (number caught)	Gollum galaxias (4)	Gollum galaxias (11)	Gollum galaxias (7) Longfin eel (1)

APPENDIX 2

Plate 1: Monkey Musk (Erythranthe guttata) choking a headwater tributary of the Kaiwera Stream. (photo: G. Ryder, 18 April 2024).

Plate 2: Gollum galaxias (Galaxias gollumoides).

Plate 3: Galaxiid (likely Gollum galaxias) habitat in the proposed Project area, February 2008 (from Ryder Consulting 2009).

Top left: Site B, Mimihau Stream South Branch tributary. Top right: Site C, Mimihau Stream South Branch tributary. Bottom left: Site D, Redan Stream tributary. Bottom right: Site E, Redan Stream tributary.

Plate 4: Mimihau Stream South Branch unnamed tributary in the vicinity of proposed water take M1, December 2022. Wildlands Site 1 (photos from Wildland Consultants 2023).

Plate 5: Mimihau Stream South Branch mainstem in the vicinity of proposed water take M2, December 2022. Wildlands Site 5 (photo from Wildland Consultants 2023).