

**ENVIRONMENT COURT OF NEW ZEALAND  
WELLINGTON REGISTRY**

**I MUA I TE KOOTI TAIAO O AOTEAROA  
TE WHANGANUI-A-TARA**

**ENV-2023-WLG-000005**

**Under** the Resource Management Act 1991

**In the matter of** the direct referral of applications for resource consent and notices of requirement under sections 87G and 198E of the Act for the Ōtaki to North of Levin Project

**By** Waka Kotahi NZ Transport Agency

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**STATEMENT OF REBUTTAL EVIDENCE OF JOHN (JACK) ALLEN  
MCCONCHIE ON BEHALF OF WAKA KOTAHI NZ TRANSPORT AGENCY**

Dated 10 October 2023

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## TABLE OF CONTENTS

INTRODUCTION.....	1
HYDROGEOLOGY AND GROUNDWATER.....	2
ABSTRACTION OF CONSTRUCTION WATER.....	5
HYDROLOGY AND FLOODING.....	11
RESPONSES TO MR KINLEY AND MR MCARTHUR.....	18
RESPONSES TO 'PROUSE TRUST PARTNERSHIP'.....	23
CONCLUSION.....	24

## INTRODUCTION

1. My full name is **Dr John (Jack) Allen McConchie**.
2. I prepared a statement of evidence (**Evidence**) regarding hydrology and flooding, hydrogeology and groundwater, and water abstraction effects of the proposed Ōtaki to North of Levin Project (**Ō2NL Project** or **Project**), dated 4 July 2023.
3. My qualifications and experience are set out in my Evidence.
4. In this rebuttal evidence I use the same defined terms as in my Evidence.
5. I repeat the confirmation given in my Evidence that I have read the 'Code of Conduct' for expert witnesses and that my evidence has been prepared in compliance with that Code.
6. This rebuttal evidence responds to points made in evidence by:
  - (a) Mr Jonathan Williamson on behalf of Manawatū-Whanganui Regional Council (**Horizons**) and Greater Wellington Regional Council (**GWRC**), regarding the effects of the Project on hydrogeology and groundwater;
  - (b) Mr Michael Thompson on behalf of Greater Wellington Regional Council (**GWRC**), regarding the effects of the Project caused by the abstraction of water for construction;
  - (c) Ms Michaela Stout behalf of Manawatū-Whanganui Regional Council (**Horizons**), regarding the effects of the Project caused by the abstraction of water for construction;
  - (d) Mr Phil Jaggard on behalf of Kāinga Ora – Homes and Communities (**Kāinga Ora**), regarding the effects of the Project on the potential flooding of three properties;
  - (e) Mr Peter Kinley, on behalf of Manawatū-Whanganui Regional Council (**Horizons**) and Greater Wellington Regional Council (**GWRC**), regarding the effects of the Project on flooding;
  - (f) Mr John McArthur, on behalf of Horowhenua District Council (**HDC**) and Kapiti Coast District Council (**KCDC**), regarding the effects of the Project on flooding; and

- (g) Ms Anna Carter and Mrs Karen Prouse, the Prouse Trust Partnership, and Mr Stephen and Mrs Karen Prouse regarding the effects of the Project on flooding on their property.
7. I attended expert conferencing on '*hydrogeology and groundwater*' on 26 July 2023 with:
- (a) Mr Williamson.
8. I attended expert conferencing on '*water abstraction*' on 26 July 2023 with:
- (a) Mr Thompson;
  - (b) Ms Stout;
  - (c) Ms Karaitiana;
  - (d) Mr Tamihana, and
  - (e) Mr Brown.
9. I attended expert conferencing on '*hydrology and flooding*' on 9 August 2023 with:
- (a) Mr Kinley;
  - (b) Mr McArthur; and
  - (c) Mr Jaggard.
10. I attended expert conferencing on '*water abstraction during periods of low flow in Koputaroa Stream*' on 24 August 2023 with:
- (a) Ms Stout'
  - (b) Mr Watson; and
  - (c) Mr Brown.

## **HYDROGEOLOGY AND GROUNDWATER**

### **Mr Jonathan Williamson**

11. Following various discussions, including expert conferencing, there is now a high level of agreement regarding the potential effects of the Ō2NL Project on hydrogeology and groundwater, how these will be avoided, and where this is not possible, how any residual effects will be mitigated or offset.

12. Despite the high level of agreement, there would appear to be three areas where Mr Williamson would still prefer greater clarity. These include:
  - (a) stormwater management devices;
  - (b) material supply sites, and
  - (c) groundwater monitoring.

Mr Williamson is seeking small changes to three conditions proposed by Waka Kotahi to provide greater clarity in these three areas because of the current stage of the design of the Ō2NL Project.

#### *Stormwater management devices*

13. Mr Williamson's concern relates to the lack of site-specific hydrogeological information to confirm the appropriateness of the soakage device design, and the potential for groundwater mounding and consequent flooding of adjacent properties.
14. Mr Williamson notes correctly that in the Hydrogeology and Groundwater Joint Witness Statement (**JWS**) he and I agreed that consent condition RSW1 should be amended to require stormwater management devices to be designed, located, and operated in a manner that will not cause or exacerbate groundwater related flooding.
15. Below I provide additional context in respect of these devices and the risk of groundwater mounding and flooding.
16. Stormwater treatment and discharge to ground, which has the potential to affect groundwater levels, has only been proposed on the 'Ohau fan', i.e., from the north bank of the Ohau River to approximately Queen Street East. In this area there are few streams, and the generally coarse gravel allows effective soakage. These characteristics, and the monitoring undertaken to support the design of the Project, indicate that the groundwater is a considerable distance below the ground surface. Soakage is the preferred means of stormwater treatment and management in this area to maintain, and potentially enhance, groundwater flow to Punahau / Lake Horowhenua.
17. Comprehensive modelling of the risk of groundwater mounding from stormwater treatment devices in this area is provided in Appendix G.1.I and paragraphs 194 through 208 of my Evidence. The conclusion of that

modelling is that any effects of the Project on groundwater mounding, and the potential to exacerbate flooding, can be considered 'less than minor'.

#### *Material supply sites*

18. When the application for resource consents was lodged, there was limited information regarding groundwater conditions at the potential material supply sites which are required to satisfy the cut-and-fill balance of the Project.
19. Consequently, I understand that Waka Kotahi is happy for work associated with the material supply sites to be managed by the current suite of conditions. These conditions manage effects on groundwater and require ground water levels to be monitored. The design of the material supply sites and proposed remediation will be provided via the outline plan process. I understand from the rebuttal evidence of Ms McLeod that this matter has been considered and as the conditions (specifically RGW1, 2 and 3 relate to all activities (and include specific reference to material supply sites) that no specific additional changes to conditions are actually required. I agree with the argument provided in Ms McLeod's evidence. Nevertheless, I consider that a condition that requires the effects of material supply sites on ground water be confirmed once the design of the proposed material site excavation and follow on rehabilitation of the material supply is known. This will only be able to be done once the material supply requirements of the Project are known. I believe that this approach resolves Mr Williamson's concerns as this will confirm that the effects of the material supply sites on groundwater are in general accordance with my assessment.

#### *Groundwater monitoring*

20. Earlier concerns raised by Mr Williamson regarding monitoring to identify unacceptable groundwater effects have now been addressed by condition RGW3(b)(i).
21. Discussion of the need for additional monitoring in the JWS related to two activities: the formation of material supply sites for which little information is currently available; and the potential installation of culverts which, depending on ground conditions at the time of installation, may intersect groundwater. As discussed in my Evidence, it is anticipated that any culverts will be installed during summer/autumn when the level of the groundwater is below any works needed for their installation. Consequently, there will be no effects on groundwater.

22. However, if installation will interact with groundwater, then monitoring will be required to ensure that there are no unanticipated adverse effects. This was agreed in the JWS.
23. Given the above, I think that condition RGW3(b)(i) is currently too broad. This is because it could be interpreted to potentially include passive dewatering in areas where offsets have already been provided e.g., some wetlands. Therefore, for clarity and to better reflect the discussion during expert conferencing, I would suggest the following slightly amended wording *“at least one piezometer within 100 metres of any material supply sites or site where active dewatering using pumping is occurring.”*
24. I have no issue with the exact location of the piezometer being agreed in advance with the regional council. However, Ms McLeod has advised me that it is not possible to have a condition that includes the requirement for ‘agreement’. Consequently, Ms McLeod has drafted an alternative condition which I believe provides for council input regarding the location of these piezometers and meets Mr Williamson’s suggestion.

#### **ABSTRACTION OF CONSTRUCTION WATER**

25. Both the need for water to support construction of the Project, and an overall strategy for managing the supply and use of water, are discussed in my Evidence in paragraphs 258 through 267 and in the CEDF.<sup>1</sup>
26. Construction of the Project will require an average of 2,350m<sup>3</sup> of water a day, with a maximum of 3,900m<sup>3</sup>/day. To place this in context, it represents between 0.46% and 0.76% of the combined median daily flow of the five rivers and streams crossed by the Project and from which water will be abstracted. This water is also equivalent to that required to irrigate only 47ha of pasture, at the generally accepted ‘*efficient rate*’ of 5mm/day.
27. It is also important to recognise the distinct difference between the abstraction of water to support construction and the abstraction of water for the irrigation of pasture or crops.
28. Construction water is needed for a specific range of purposes, but predominantly for dust suppression. Consequently, there is an optimum amount of water that needs to be applied. Applying too much water is problematic and since both the abstraction and use of water is expensive it

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<sup>1</sup> Cultural and Environmental Design Framework (Appendix Three to Volume II of the application).

adds to the cost of the Project. Therefore, there is considerable motivation to minimise the use of water for construction. This is distinctly different to the use of water for irrigation, where excess water drains through the soil profile and the use of water increases income rather than just increasing costs as it does when used in construction.

29. With respect to any effects on the various rivers and streams, the Project seeks to abstract a maximum of only 10% of the flow available under specific conditions, up to the limits specified in the consent. The strategy is to abstract water at very low rates, to avoid environmental effects, and store this water in repurposed stormwater detention ponds for use later during construction.
30. Both the National Environmental Monitoring Standards for *Open Channel Flow Measurement* and *Rating Curves* highlight the uncertainty of any flow measurement within a natural stream or river channel.<sup>2</sup> Even following industry best practice, and under ideal situations, only 95% of rated flows will be within  $\pm 8\%$  of the measurement flow.
31. I have undertaken numerous compliance checks against Meridian Energy's resource consents for operating both the Waitaki and Manapouri Power Schemes. During these compliance checks, because of the uncertainty in flow measurements, both the Canterbury and Southland Regional Councils have accepted that any flow within  $\pm 10\%$  of the consented value is considered compliant. I have undertaken similar compliance checks for Mercury and this level of uncertainty is also recognised by Waikato Regional Council.
32. This argument regarding the uncertainty of open channel flow measurement was also presented in the technical report provided to support the abstraction of construction water from the Manawatū River for the Te Ahu a Turanga Project.
33. If the same criterion was adopted during the Ō2NL Project, which in my professional opinion would be reasonable, and consistent with industry practice, then the abstraction of water at the rate proposed is within the margin of error or uncertainty of flow measurements in the various rivers and streams.

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<sup>2</sup> Open Channel Flow Measurement » National Environmental Monitoring Standards (NEMS); Rating Curves » National Environmental Monitoring Standards (NEMS)



34. Further, it is my opinion that if the difference in flow in a river or stream cannot be measured, then any effects from the small reduction in flow must be negligible and also unable to be quantified.
35. Any effects of the abstraction of water to support the Project are further minimised by ceasing abstraction at the relevant minimum flow, set in the various regional plans. It should be noted that the minimum flow is when the abstraction of water must cease. It is not the minimum flow that will be reached in the river, or even the point at which adverse effects might start to be experienced. Flow in a river or stream will continue to decrease naturally below the minimum flow if there is no rainfall. The minimum flow is solely a management metric, set to maintain instream values.
36. For example, the minimum flow for the Waitohu Stream is ~140L/s. At the minimum flow, continuous flow is maintained throughout the entire downstream reach of the stream to the coast. Although the reach of the Waitohu Stream near Taylors Road does go dry, this does not occur until a flow of less than 100L/s at the monitoring site is maintained for a period of time. That is, the flow must drop below the minimum flow by about 29% before there is a risk of the stream going dry over this reach. In my opinion, the abstraction of a maximum of 14L/s (i.e., 10% of the minimum flow and therefore the 'worst case scenario'), leaving 126L/s in the stream would have negligible and unmeasurable hydrological effects.
37. In the absence of detailed hydrometric data for analysis, it is likely that similar hydrological behaviour might also be observed in the other rivers and streams within the designation that occasionally go dry under extreme climatic conditions.

**Ms Michaela Stout**

38. Following various discussions, including two expert conferences, there is now a high level of agreement with Horizons regarding avoiding and managing any effects of the abstraction of water to support construction from various rivers and streams.
39. Ms Stout, however, has raised four matters for further consideration. These include:
  - (a) standard water measurement and reporting conditions;
  - (b) the expiry date of any consent;

- (c) use of the flow data from Horizon's new hydrometric site on Koputaroa Stream at Tavistock Road to manage abstraction; and
- (d) a revised minimum flow when abstraction must cease from Waikawa Stream.

*Water measurement and reporting conditions*

- 40. I do not intend to discuss how best to provide the required level of measurement and reporting of the abstraction of water to support construction of the Project. That is a matter for the Project Planners and is discussed in the evidence of Mr Eccles and Ms McLeod.
- 41. However, it must be noted that to implement the strategy proposed for the Project, discussed in my Evidence, comprehensive, real-time monitoring and reporting will be required. This is necessary to ensure compliance with both the site-specific rates and volumes sought, and the total abstraction across all water takes. Consequently, the consents proposed by Waka Kotahi will require monitoring and reporting in the manner and to the level required by the Regional Councils. In my opinion therefore, any additional conditions will be redundant.

*Expiry date*

- 42. Ms Stout has suggested that the consent to abstract construction water should expire after either 10-years or the actual construction period whichever is the shortest.
- 43. In my opinion, such a condition would be excessive given the scale of abstraction and negligible level of effects.
- 44. Also, while the bulk of the water sought will be used for dust suppression and earthworks, it is likely that some may be required to support the establishment of plantings associated with the Project. It may therefore be necessary that the Project has access to water beyond the duration of the physical works. I refer to Mr Dalzell's evidence which sets out post construction activities that require water.
- 45. In my opinion, the potential adverse effects of not having access to this small volume of water far outweigh any potential benefit of reducing the duration of the consent.

46. To avoid any perception of 'water banking', the Project has only sought a maximum of two-thirds of the water currently available from the core allocation of each catchment. Consequently, in each of the catchments from which water will be abstracted there will remain a considerable volume of water for other parties.

*Koputaroa at Tavistock Road hydrometric site*

47. Ms Stout advises that Horizons' Environmental Data Team has recently installed a hydrometric site in the Koputaroa catchment at Tavistock Road.
48. I welcome this news and support the adoption of the hydrometric data and other information from this site by the Project. The earlier disestablishment of this site by Horizons, prior to the One Plan, has been problematic when undertaking hydrological analyses for both the Ō2NL Project and a number of recent developments within the catchment e.g., stormwater discharge from NE Levin, Tara-Ika etc.
49. Given the consenting and contractual timeframes for the Ō2NL Project, I do not think that it is necessary to have a condition preventing abstraction prior to the start of 2024. Any issues this restriction might cause are only for the Project. There are no adverse environmental effects to consider.

*Waikawa Stream cease-take flow*

50. Ms Stout's proposal to redefine the minimum flow for abstraction from Waikawa Stream is problematic, not the least because in my opinion it is contrary to the intent and provisions of the One Plan.
51. To recognise the loss of surface flow to groundwater over a reach of Waikawa Stream, the JWS relating to water abstraction recommended that the Project would only abstract 9% of any flow above the minimum flow, and not the 10% adopted for some other rivers and streams.
52. It would appear that the Freshwater Ecology JWS, and Ms Stout who was a signatory to the Water Abstraction JWS, now wish to also raise the minimum flow by 10% to allow for these some losses to groundwater i.e., they are requesting that the same very small effects be mitigated twice.
53. As discussed previously, the abstraction of up to 9% of the flow from a natural channel cannot be measured within the channel. Consequently, in my opinion any potential environmental effects must also be negligible.

54. The management of abstractions from the core allocation within the One Plan is that all abstractions cease at the 'gazetted' minimum flow. For example, Horizons monitor the flow in Waikawa Stream and if it reaches the minimum flow all consent holders are told to cease abstraction. I believe that this approach applies to all consent holders irrespective of the consented volume and location within the catchment. As such, the system is simple, treats all consent holders in a consistent manner, and compliance is easily assessed.
55. What has been suggested is a site-specific minimum flow, I believe the only one within the Horizons region. In my opinion, it would also add a number of issues relating to compliance monitoring both for the Project and for Horizons.
56. Consequently, there are two possible approaches to address the uncertainty of instream flow caused by the 'losing reach' of Waikawa Stream. One is to adopt the current minimum flow, as with all other consent holders, and to reduce the potential abstraction from 10% to 9%. This is what is proposed in the JWS and Waka Kotahi's draft conditions. In my opinion, it is the simplest, best, and most pragmatic solution.
57. The other approach is to raise the minimum flow by 10% and establish a unique minimum flow cut-off for Waka Kotahi. As explained, in my opinion, such an approach is complicated and problematic. However, to avoid effectively addressing any small environmental effects twice when regulating Waka Kotahi, once by the raised minimum flow and again by the reduced rate of abstraction, the potential abstraction by Waka Kotahi would then need to increase from the proposed 9% to 10% of the flow.
58. When deciding the 'best approach', it is important to consider the relatively small volume of water involved, the fact that its 'loss' from the stream cannot be measured and therefore any effects are negligible, and the short duration of the consent. A unique way of managing this abstraction, as proposed by Ms Stout and the Freshwater Ecology JWS, is in my opinion not warranted.

**Mr Michael Thompson**

59. Following various discussions, including two expert conferences, there is now a high level of agreement with Greater Wellington regarding avoiding and managing any effects of the abstraction of water to support construction of the Project from Waitohu Stream.

60. Mr Thompson has raised three matters for further consideration. These include:

- (a) Standard water measurement and reporting conditions,
- (b) Expiry date of any consent, and
- (c) Efficiency of water use.

*Water measurement and reporting conditions*

61. Mr Thompson raises the same matter as Ms Stout which was discussed in detail above. For conciseness, I do not propose to restate my opinion on this matter. That is a matter largely for the Project Planners.

*Expiry date*

62. Mr Thompson raises the same matter as Ms Stout which was discussed in detail above. For conciseness, I do not propose to restate my opinion on this matter.

*Efficiency of allocation*

63. Mr Thompson considers that the outcomes from the expert conferencing, and a reduction in the maximum instantaneous rate of take from Waitohu Stream from 37.5L/s to 26L/s, have clarified that the approach suggested by the Ō2NL Project will maximise water allocation efficiency.

64. When Mr Thompson's opinion is considered with the Project's water abstraction strategy, there is now general agreement that Project's proposal ensures efficient and effective use of water in a manner consistent with both the CEDF<sup>3</sup> and the GWRC Proposed Natural Resources Plan.

**HYDROLOGY AND FLOODING**

65. Before discussing the evidence of Mr Jaggard, Mr Kinley, and Mr McArthur it is useful to provide some context when considering the effect of the Project on flooding and *vice versa*.

66. The approach when considering the potential effects of the Ō2NL Project on flooding is the same as adopted for the PP2Ō Expressway and Te Ahu a Turanga: Manawatū–Taranua Highway. These projects are to the south and

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<sup>3</sup> Cultural and environmental design framework (Appendix Three to Volume II of the application).

north of the current project respectively. These highways are also in the Greater Wellington and Whanganui-Manawatu regions respectively.

67. With respect to the Te Ahu a Turanga: Manawatū Tararua Highway Project, the approach adopted was endorsed by Horizons' technical expert.
68. I provided expert technical advice on hydrology and flooding to the Board of Inquiry / Environment Court during the design and consenting of each of these projects.
69. The goal in each of those projects, as with the Ō2NL Project, was to maintain hydraulic neutrality. Where this was not possible, any effects were kept away from existing habitable structures and largely to areas that are already flood prone. These areas are generally in river corridors or under pasture.
70. While the consenting of these two new highways does not provide a formal precedent for the consenting of the Ō2NL Project, it does indicate that the approach adopted has been considered reasonable given the scale and scope of the projects and the magnitude of potential effects.
71. The fact that this rebuttal statement does not respond to every matter raised in the evidence of submitter witnesses in the areas of hydrology and flooding should not be taken as acceptance of the matters raised. Rather, I rely on my Evidence, Technical Assessment F: Hydrology and Flooding, and the rebuttal evidence provided by Mr Craig on behalf of Waka Kotahi to address these matters.
72. The preliminary design of the Project, and the assessment of potential effects on flooding, has been informed by the development of a computational hydraulic model and comparison of 'before' and 'after' scenarios. The JWS confirms that all experts agree that this approach is valid and consistent with current industry best practice.
73. It must be recognised, however, that any computational hydraulic model represents conditions only at a point in time and is based on various assumptions. Consequently, any computational hydraulic model contains residual uncertainty in the model setup and therefore the results. No computational hydraulic model is perfect. This is why, when considering the effects of both the PP2Ō Expressway and the Te Ahu a Turanga: Manawatū–Tararua Highway on flooding, a level of uncertainty of  $\pm 100\text{mm}$  was suggested. Again, while not setting a precedent, this tolerance appears to

have been accepted by the relevant Board of Inquiry and Environment Court hearing panel.

74. To inform the design and assessment of potential effects of the Ō2NL Project, a very large and rare design event was modelled. As explained in my Evidence, the design event considered is likely to be at least 25% larger than that required by Horizons' One Plan. While this was a decision of Waka Kotahi, both the preliminary design of the Project, and assessment of potential effects, are likely to be more conservative i.e., higher, than required by the Regional Plan. This is discussed in the planning evidence of Mr Eccles.
75. The few areas along the 24km length of the proposed Ō2NL highway where there may be effects on flooding outside of the designation are generally overflow channels across either the wider aggradation surface or the contemporary floodplains of rivers and streams. In most cases, these areas already have an existing flood hazard.
76. In my evidence I explain my opinion that given the scale of the Project, the environment, and the extent, magnitude and duration of any increased flooding, these effects are reasonable and acceptable. I conclude that at the Project scale, I consider these effects to be less than minor.
77. Contrary to what is claimed by Mr Kinley and Mr McArthur, I do not argue that in each situation the effects of the Project on flooding are 'less than minor'. However, in the context of the Project I believe that the effects are reasonable for the reasons discussed and that overall the effects on flooding will be 'less than minor'.
78. Mr Jaggard, Mr Kinley, and Mr McArthur consider that the effects of the Project on flooding at watercourse crossings are more than minor because of an increase in water level relative to the existing situation. Their metric for assessing whether a change in flooding is 'acceptable' is simply that it meets a certain numerical threshold for a particular land use 'zone'. In my opinion, this is too simplistic as it attempts to reduce both the effects of the Project and the environment to a single arbitrary number.
79. It should be noted that while it is suggested by Mr Kinley, and Mr McArthur that the Project should not exacerbate flooding of the overflow channels, there is nothing in the relevant district plans to prevent a landowner from undertaking works that dam, divert or otherwise alter the flow regime and

flood hazard of these channels; beyond limits on the scale of earthworks. Generally, the threshold for requiring a land use consent for earthworks would far exceed that required to block or alter the overflow channels. In my opinion therefore, the small changes in flooding in these areas is permitted currently. I can see no justification for these effects, which are permitted by current landowners, to be managed by the Ō2NL Project.

80. It is my opinion that the effects of the Project, irrespective of their magnitude, must be considered in the context of their environmental, human, and economic effects.
81. I therefore take a wider view of the potential effects of the Project on flooding than Mr Jaggard, Mr Kinley, and Mr McArthur. I consider that, as with the PP2Ō Expressway and Te Ahu a Turanga: Manawatū–Taranua Highway, the very infrequent nature, the very short duration, and the limited area of any change to the extent and depth of flood inundation outweigh the likelihood of increased flood levels when assessing the overall significance of the flooding effects. Also important is that fact that these areas are generally in pasture which does not tend to be affected adversely by short-duration, infrequent flooding.
82. As noted in the evidence of Mr Craig, there are only a few locations where the current design of the Ō2NL Project may have a small adverse effect on flooding. Mr Craig also shows clearly that generally these effects can be reduced, although not always to the level suggested by Mr Jaggard, Mr Kinley and Mr McArthur, during final detailed design of the Project. I conclude that any effects of the Project on flooding are minor and acceptable given the scale and benefits from the Project. To reduce any effects to the levels suggested by Mr Jaggard, Mr Kinley, and Mr McArthur would result in, in my opinion, unreasonable costs and have a range of other potential adverse environmental effects e.g., visual, noise etc.
83. It is also important to acknowledge that the Project's design lessens or improves flooding effects in a number of areas.
84. Waka Kotahi has proposed a condition, relating to the flood effects reported in Technical Assessment F, that is intended as a performance standard to be achieved through the detailed design of the Project. The condition requires that the Project's final design limit flood inundation (during a modelled 1% AEP design event including the effects of climate change to 2130) to the areas shown in Technical Assessment F. I support this condition and believe



that it provides an efficient and effective means of managing any residual small effects of the Project on flooding.

85. I also support the condition provided in the evidence of Ms McLeod relating to avoiding any increased flooding of existing habitable floor levels. This condition will ensure that, in my opinion, any effects of the Project on flooding, when considered in context, can be considered less than minor.
86. The conclusion in my Evidence that the flooding effects of the Project are minor and acceptable remains unchanged after considering Councils' evidence. This is based on the very infrequent nature, the short duration, and limited extent of flood inundation effects.

**Mr Jaggard**

87. Mr Jaggard (on behalf of Kāinga Ora) expresses a particular interest in the potential effect of the Project on the flood hazard to three properties:
  - (a) 242 Muhunua East Road; and
  - (b) 96 and 98 Arapaepae Road.
88. The potential effect of the Project on these properties is discussed below.

242 Muhunoa East Road (Figure 1)

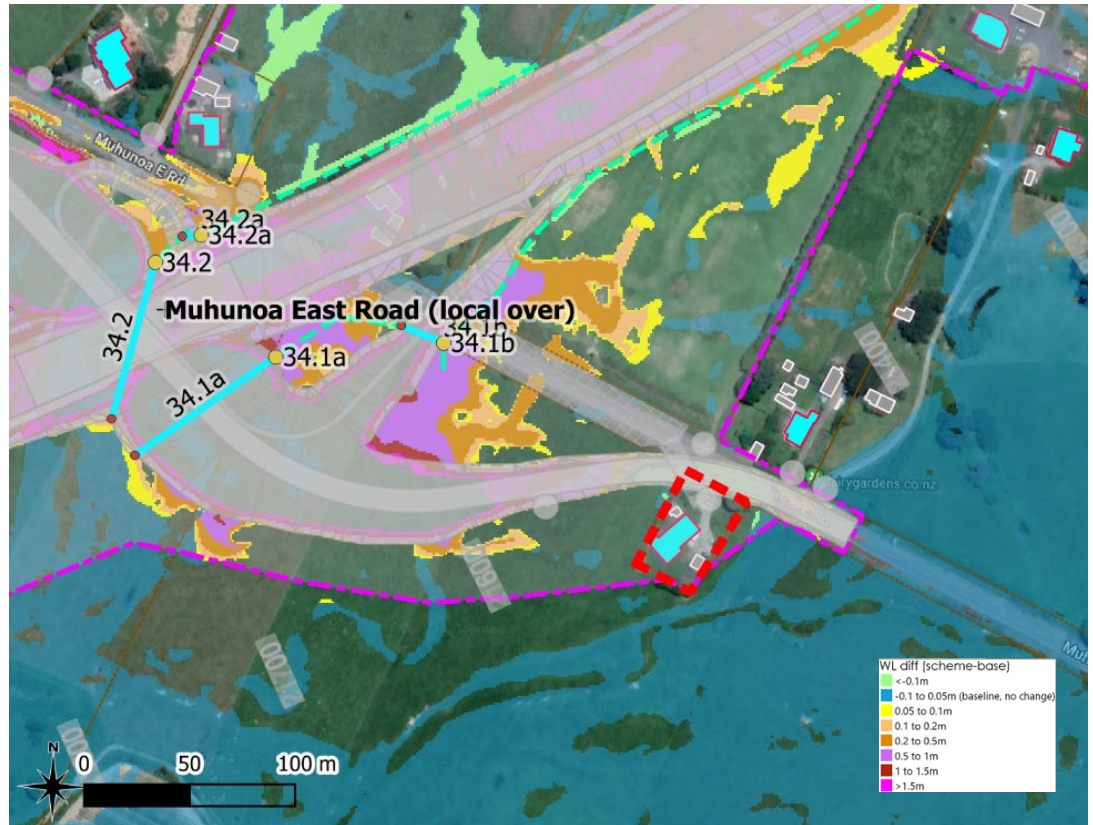
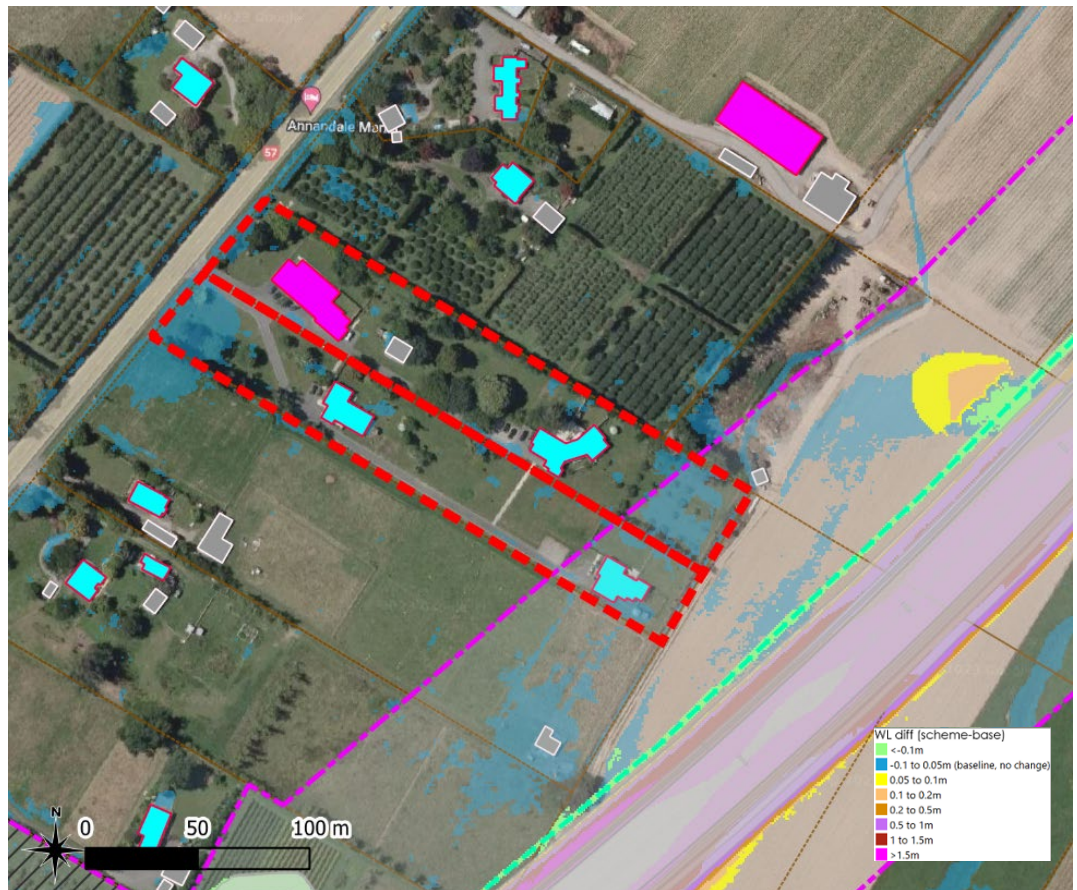


Figure 1: Effect of the Project on flooding at 242 Muhunoa East Road.

89. This property is entirely within the proposed designation and Waka Kotahi are in the process of acquiring the entire property. Waka Kotahi consider that the buildings will likely need to be removed as part of the construction of Project. Since the property will lie within the proposed designation, any effect of the Project on flooding does not need to be considered.
90. Despite the comment above, **Figure 1** shows that the Ō2NL Project will have no effect on flooding of the property. The only change will be to access caused by the new flyover embankment. Any stormwater design matters can be resolved easily, if necessary, during detailed design.

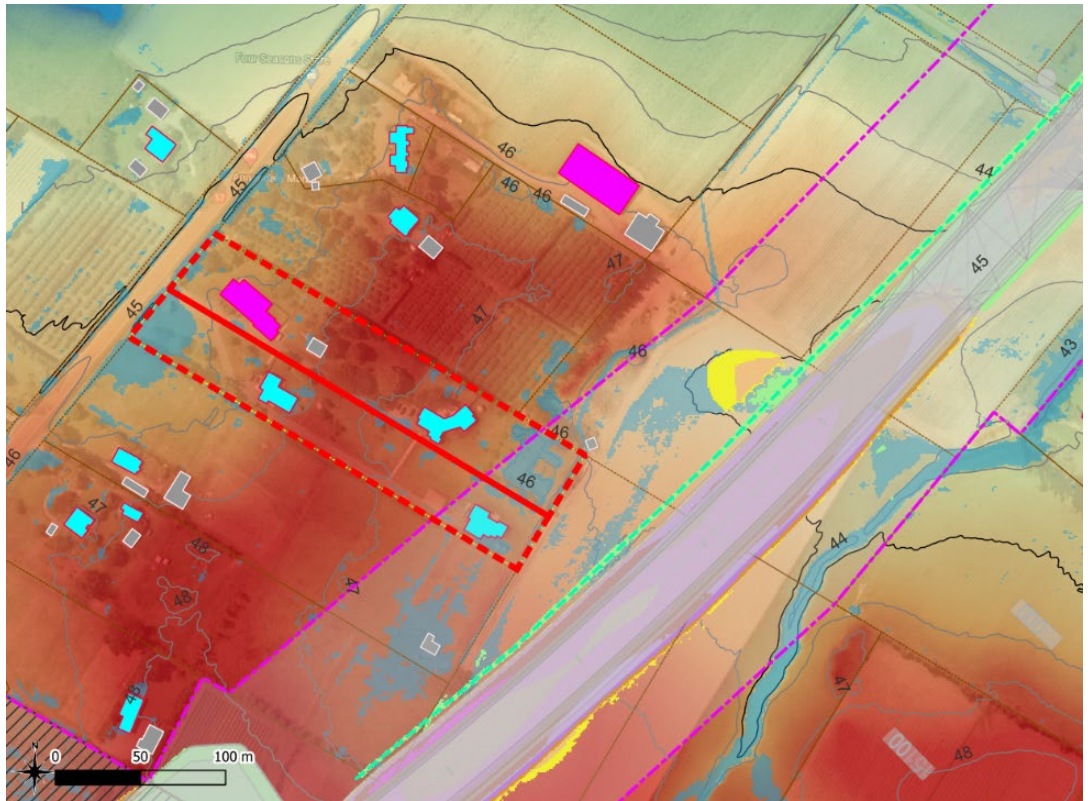
96 and 98 Arapaepae Road (Figure 2)

91. **Figure 2** shows that the Ō2NL Project will have no effect on the flood hazard to either 96 or 98 Arapaepae Road. While there is an existing flood hazard, with shallow inundation immediately upstream of Arapaepae Road, this does not change as a result of the Project. This is probably caused by impeded flow under/across Arapaepae Road, although it could also be an artefact of the hydraulic model and the inclusion of culverts and drains across topographic barriers.



**Figure 2: Effect of the Project on flooding at 96 and 98 Arapaepae Road.**

92. There is also an existing flood hazard caused by shallow inundation towards the eastern extent of both properties. This does not change as a result of the Project.
93. The reason for the low flood hazard to these properties is that they lie on a low ridge that forms a slight topographic high (**Figure 3**). Consequently, any runoff is away from and 'around' the properties rather than through them.



**Figure 3: Location of 96 and 98 Arapaepae Road on a low ridge that forms a slight topographic high preventing flooding.**

94. Given the proximity of these properties to a proposed stormwater management device, Mr Jaggard supports Mr Williamson’s suggestion regarding a condition to ensure that any stormwater device involving soakage does not cause or exacerbate flooding.
95. Since this matter is discussed in my response to Mr Williamson in this rebuttal, I will not address it again here.

### **RESPONSES TO MR KINLEY AND MR MCARTHUR**

96. As discussed above, Mr Jaggard, Mr Kinley, and Mr McArthur consider that the effects of the Project on flooding at watercourse crossings are more than minor because of an increase in water level relative to the existing situation. Their metric for assessing whether a change in flooding is ‘acceptable’ is simply that it meets a certain numerical threshold for a particular land use ‘zone’.
97. It is important to note that Mr Jaggard, Mr Kinley, and Mr McArthur provide no evidence to support the thresholds they recommend, and particularly the abrupt change from the Project having ‘acceptable’ to ‘unacceptable’ effects. The thresholds proposed take no account of the environmental context in which the change in water level occurs.

98. It is my opinion that a change in water level of say >100mm in an area that has never flooded and is a significant distance from a flood prone area, has much greater significance than the same change in water level in an area already prone to flooding.
99. It is also my opinion, as expressed previously, that the effects of the Project, irrespective of their magnitude, must be considered in the context of their environmental, human, and economic effect.
100. Mr Jaggard, Mr Kinley, and Mr McArthur propose a number of thresholds for an 'acceptable' change in water level depending on the land use zone. In my opinion, such an approach is problematic for a number of reasons:
- (a) It assumes that the same change in water level has the same effect at all locations within a particular land use zone. It also assumes that at some level there is an '*unacceptable effect*' while the effect of a water level change 1mm lower is '*acceptable*'.
  - (b) Having a threshold, below which any change in flooding is '*acceptable*', would also allow the Project to inundate large areas which are currently not exposed to a flood hazard. In my opinion, this would be a perverse outcome of such a zonal threshold approach.
  - (c) This approach also does not recognise the difference in effect of a change in water level or velocity upstream or downstream of the Project. The assessment process described by Mr Craig in Technical Assessment F and summarised in my Evidence considers these two different situations.
  - (d) It has also been argued that a change in the flood hazard (defined as product of water depth and velocity) of 10% should be adopted as a threshold for the Project having a significant effect. Again, a 10% change in the flood hazard does not have the same effect at every location and throughout each risk class. A 10% change at the bottom end of the Low-Risk Class, while highly likely to occur or be exceeded simply as an artefact of computational hydraulic modelling because of the very small numbers involved, has no actual effect on how the flood hazard should be managed. For example, a 1mm change in water depth, when the initial depth was only 5mm would be a change of 20%, but would have no real effect on the flood hazard. Likewise, a change

in velocity from 0.01m/s to 0.02m/s (a 100% change) would also have no real effect on the flood hazard.

Assuming that such a condition is recommended, and I do not believe that it is necessary, it would be more appropriate to reference a positive change in the flood hazard category, as defined for example in the *Floodplain Development Manual* (2005).<sup>4</sup>

101. Mr Kinley and Mr McArthur propose a threshold for an 'acceptable effect' of the Project on rural zoned land of 100mm outside of the designation. However, they provide no evidence for this threshold or the change in effects above and below the threshold apart from water level. As outlined above, I do not accept that such an approach is appropriate as it does not consider the environmental context or potential impact of any effects. It is also permissive in that it would allow the inundation of large areas which currently have no flood hazard.
102. The approach taken by Mr Craig when assessing the potential effects of the Project on flooding was to carefully assess the environmental context of each location where there is the potential for a change in water level outside of the designation. That is, Mr Craig undertook detailed site-specific assessments rather than just considering an arbitrary threshold. In my opinion, this is a more robust and balanced approach. It is also consistent with the approach taken on both the PP2Ō Expressway and Te Ahu a Turanga: Manawatū–Taranui Highway projects, to the south and north of the Ō2NL Project respectively.
103. The approach adopted by Mr Craig also allows consideration of site-specific interventions to reduce any change in flooding and inundation that might result from the Project. This would not be facilitated as readily with the proposal from Mr Kinley and Mr McArthur.
104. Similar comments to those provided above with regard to the proposed threshold (100mm) for 'acceptable flooding' of rural land also apply to the proposed 50mm threshold for 'urban zoned' land.
105. To provide additional context to the unreasonableness of a 50mm threshold for urban land, it must be recognised that large portions of the Levin urban

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<sup>4</sup> Floodplain development manual – the management of flood liable land. Department of Infrastructure, Planning and Natural Resources, New South Wales, Australia.

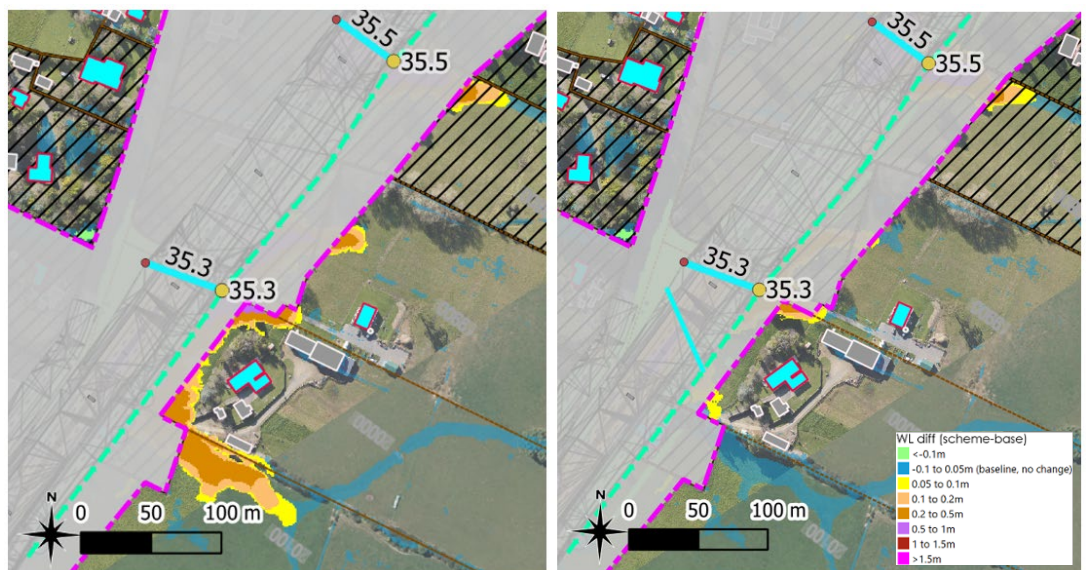
area are already flood prone. These areas are inundated during the design event modelled even without the Project.

106. It is argued by Mr Kinley and Mr McArthur that it is possible to design the Project to meet the various thresholds that they have proposed. However, they provide no evidence to support either this contention or its reasonableness.
107. It might be theoretically possible to design the Project to meet the proposed thresholds, however, in my professional opinion such a requirement is unreasonable. It would come at considerable cost, in both economic and environmental terms.
108. For example, rather than building the road 'at grade' as recommended in the CEDF,<sup>5</sup> various sections could be constructed on bridges or elevated carriageways. Despite being extremely expensive, such structures would have adverse visual and noise effects and probably require more land from local landowners. Given the low level of risk from any small increase in flooding, the investment required to meet the thresholds suggested by the Councils and Kāinga Ora would, in my opinion, be better spent to achieve a range of road safety or other outcomes for the community.
109. Finally, Mr Kinley and Mr McArthur suggest a threshold relating to any potential change to the water level affecting current habitable structures. I believe that such a condition is both reasonable and appropriate and it is being recommended by Waka Kotahi. This is discussed in the evidence of Mr McLeod and is included in the draft suite of consent conditions. It is important, however, that the wording of such a condition is clear, concise, and unambiguous. This is a matter to be resolved by the Project planners.
110. Waka Kotahi have proposed a consent condition that sets the maximum water levels modelled using a conceptual design for the Project as the consented baseline for effects on flooding.
111. As stated in my Evidence, the computational hydraulic modelling has been used to confirm that 'a Project' can be designed under the umbrella of effects identified. It is also my contention that these effects are reasonable and acceptable given the scale of the Project and the environment that it traverses.

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<sup>5</sup> Cultural and environmental design framework (Appendix Three to Volume II of the application).

112. Despite setting an umbrella of effects, the Project is committed to reducing any potential effects outside of the designation to a level that is both reasonable and practical.
113. Although discussed in detail in the rebuttal evidence of Mr Craig, I provide the following example of how any effects on flooding can be potentially reduced, although still not to the level suggested by Mr Kinley, Mr McArthur, and Mr Jaggard.
114. The area where the effects of the Project on the existing flood hazard appear greatest in the modelling provided with the consent application is shown in **Figure 4**.



**Figure 4:** Example of how the final design might reduce the flood hazard shown on the maps provided with the application. The image on the left shows the change in flooding caused by the initial conceptual design. The image on the right shows the effect of increasing the size of Culvert 35.3 and adding an additional culvert.

115. In the initial model run, culvert 35.3 was undersized. The size of this culvert was therefore increased, and an extra culvert was added as shown in Figure 4. These relatively small changes to the ‘conceptual design’ reduced both the extent and depth of potential changes to flooding dramatically. Some increase in flooding still occurs outside of the designation. While most of this increase in depth is less than 0.1m, there are very small areas where the increase may be up to 0.2m.
116. Both the results shown are for the 1% AEP design event including the effects of climate change to 2130. It should be remembered that this design event, and therefore the potential effects modelled, is significantly larger than that required by Horizons’ One Plan.



117. It should be noted that, despite the potential effects of these changes to the design, flooding outside of the designation would still not meet the criterion suggested by Mr Kinley, Mr McArthur, and Mr Jaggard.
118. It appears that Mr Kinley and Mr McArthur are concerned that setting a maximum baseline of effects will reduce any motivation by the ultimate designers to minimise the already small scale of effects on flooding. However, I believe that this theoretical risk can be avoided by a condition that requires the final design to confirm that the water levels are less than or equal to those on the preliminary flood water level maps provided with the application. This could be done simply by subtracting the water levels of the two models and showing that there are no 'positive' increases. This would ensure that the final design for the Project will have effects on flooding that are no worse than shown in by Mr Craig in Technical Assessment F.

#### **RESPONSES TO 'PROUSE TRUST PARTNERSHIP'**

119. Where the conceptual design of the Project interacts with Queen Street East there are a number of drainage and flooding challenges. These are caused by the Project interacting with the existing flood hazard in this area. This interaction is the result of the Project crossing a number of secondary flow paths that flow east to west across the proposed highway that runs south to north.
120. The results of computational hydraulic modelling of the conceptual design of Project submitted with the application for resource consents identified flooding outside of the proposed designation in this area. This flooding affects the existing flood hazard to property owned by the Prouse Trust Partnership.
121. Ms Carter and Mrs Prouse, the Prouse Trust Partnership, and Mr Stephen and Mrs Karen Prouse have all provided evidence regarding the effects of the Project on flooding of their property.
122. Since the production of the concept design drawings and Technical Assessment F, Mr Craig has tested various refinements to the design to reduce the extent of flooding on the Prouse property. The additional hydraulic modelling and the effect of the various refinements are discussed in the evidence of Mr Craig. The revised modelling indicates that a substantial reduction in flood level can be achieved when compared to the original concept results in Technical Assessment F. While the design will be refined

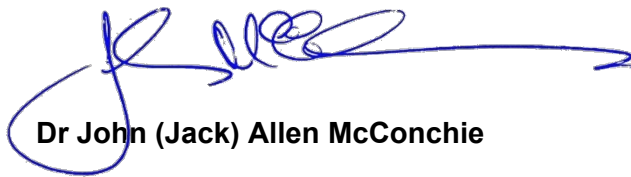
further through detailed design process, this modelling indicates the sort of performance that is likely to be achieved.

123. I do not propose to repeat the information provided by Mr Craig, however, it confirms my assertion that the final design of the Project will reduce the already small effect on flooding further. Despite these refinements, and reasonable endeavours to further minimise any increases in flood level, there are still likely to be some residual effects of the Project on flooding in this area. It must be recognised, however, that flooding in this area occurs under the existing environment and without the Project. It must also be recognised that the Project is only one element of this dynamic environment.
124. As stated above, it is my opinion that the effects of the Project must be considered in the context of their environmental, human, and economic effects. I consider that, as with the PP2Ō Expressway and Te Ahu a Turanga: Manawatū Tararua Highway Project, the very infrequent nature, the very short duration, and the limited area of any change to the extent and depth of flood inundation outweigh the likelihood of increased flood levels when assessing the overall significance of the flooding effects. Also important is that fact that these areas are generally in pasture which does not tend to be affected adversely by short-duration, infrequent flooding. No buildings or habitable floor levels are adversely affected on the property owned by the Prouse Trust Partnership.

## **CONCLUSION**

125. Following consideration of submitter evidence, I believe that the conclusions in my Evidence remain valid. These include that:
- (a) any residual effects of the Project on groundwater will be avoided or mitigated by the conditions proposed;
  - (b) the effects of the abstraction of water from various rivers and streams to support construction of the Project will be managed by the conditions proposed to a level where they can be considered negligible and less than minor; and

- (c) the effects of the Project on flooding are minor and acceptable remain unchanged after considering submitter and Council evidence. This is based on the very infrequent nature, the short duration, and limited extent of any flood inundation effects, and the environmental context in which these need to be considered.



**Dr John (Jack) Allen McConchie**

**10 October 2023**