

Before a Board of Inquiry
MacKays to Peka Peka Expressway Proposal

under: the Resource Management Act 1991

in the matter of: Notice of requirement for designation and resource consent applications by the NZ Transport Agency for the MacKays to Peka Peka Expressway Proposal

applicant: **NZ Transport Agency**
Requiring Authority

Statement of rebuttal evidence of **Vaughan Keesing** (Freshwater Ecology) for the NZ Transport Agency

Dated: 26 October 2012

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**STATEMENT OF REBUTTAL EVIDENCE OF VAUGHAN KEESING FOR
THE NZ TRANSPORT AGENCY**

- 1 My full name is Vaughan Francis Keesing.
- 2 I have the qualifications and experience set out at paragraphs 1-6 of my evidence in chief, dated 6th September 2012 (*EIC*).
- 3 I repeat the confirmation given in my EIC that I have read, and agree to comply with, the Code of Conduct for Expert Witnesses (Consolidated Practice Note 2011).
- 4 In this statement of rebuttal evidence, I respond to the relevant sections of evidence of the following:
 - 4.1 Expert witnesses on behalf of Greater Wellington Regional Council (*GWRC*) (#684):
 - (a) Dr Boothroyd (Freshwater);
 - (b) Mr Handyside (Sediment);
 - (c) Mr Perrie (Freshwater); and
 - (d) Mr Percy (Planning).
 - 4.2 Expert witnesses on behalf of Kapiti Coast District Council (*KCDC*) (#682):
 - (a) Dr Death (Freshwater);
 - (b) Ms Myers (Terrestrial / Mitigation);
 - (c) Mr van Bentum (Sediment); and
 - (d) Ms Thomson (Planning).
 - 4.3 Non Expert Submitters:
 - (a) Ms Higgot (#297);
 - (b) Ms Pomare (#309); and
 - (c) Dr & Mrs Dearden (#261).
- 5 The fact that this rebuttal statement does not respond to every freshwater issue raised in the evidence of submitter witnesses should not be taken as acceptance of the matters raised. Rather, I rely on my earlier technical report (Technical Report 30), my EIC and this rebuttal statement to set out my opinion on what I consider to be the key freshwater ecological matters for this hearing.
- 6 Consistent with my, EIC I have referred to the MacKays to Peka Peka Expressway Project as "the Project" in this rebuttal evidence. I

also note that in this evidence I refer to "submitters", "witnesses" and "experts", but where I use the term "submitters" this generally includes their technical expert(s).

EXECUTIVE SUMMARY

- 7 In response to a number of criticisms of my assessment of "aquatic ecological value", I note that the role of the "value" assessment was primarily to guide my advice to the engineers with regard to the location and the type of structures used to traverse waterways (i.e. whether they should be bridged or culverted). It also influenced decisions regarding the location of mitigation (i.e. focusing on best outcomes). However, mitigation has been provided for **all** stream loss or adverse effects to waterways, no matter the value or condition. The value ascribed to a particular waterway did not determine whether to mitigate an adverse effect or not. The method used for determining the extent of mitigation was Stream Ecological Valuation (*SEV*), as required by the GWRC.
- 8 The primary aquatic concern raised by submitters is earthwork-related sediment discharge. Primarily this is addressed by **Mr Graeme Ridley** and **Mr Graham Levy** who describe the methods that will be used to minimise sediment and contaminant discharge to the water bodies. I rely on their expertise in this regard. However, I note again that the condition of the potential receiving environments (ie. the water bodies) is not good. I also note that all of the waterways have long histories of frequently raised sediment loads and therefore have a flora and fauna tolerant of raised sediment loading.

Outline of evidence

- 9 I will first make some general comments in relation to the submitters' evidence. As there are a number of issues raised that are common between submitter witnesses, I will next address these under specific topic subheadings. I will then follow with responses to individual submitters/experts where the issues raised are unique to them.

GENERAL COMMENTS

- 10 In this section I note some key concerns which I have with many of the matters raised in some submitters' evidence.
- 11 As is often the case, a great number of studies and various collections methods and wider catchment studies and more time sampling could have been spent on evaluating and enumerating the freshwater systems involved with the Project (nutrients, algae, bryophytes etc). However, in my opinion sufficient sampling and analysis has been done to evaluate the condition, sensitivity, type and value of the affected waterways (perennial and intermittent), and to quantify loss and change. Those areas not sampled (such as

ephemeral paths) were not sampled after careful consideration of the effect to them and of their probable value.

- 12 It is important to note that none of the submitters or expert witnesses have acknowledged in their submissions or evidence that most of the waterways being described are not natural watercourses. They are drains formed to drain wetlands and pasture, and in some areas to protect residential areas from flooding. All submitters appear to be treating the waterbodies crossed by the proposed alignment as natural channels. That is not to say these waterways do not have values, but the values are limited by their history, current management, and form.
- 13 None of the submitters or expert witnesses have acknowledged in their submissions or evidence that on an annual or more frequent basis almost all of the watercourses affected by the Project are "managed" by Council or landowners. This management typically involves mowing of grass banks to maintain access, 'raking' and removing the aquatic weed growth to maintain flows, and excavating of the stream bed to maintain channel depth. This management is destructive and will be having significant ongoing effects on the ecological health of these streams and on the populations of fauna within them.
- 14 Few of the submitters have acknowledged that these streams are largely or entirely deforested, half are exposed to grazing and farm effluent, and most others are subject to urban discharges including treated sewerage and heavy metals.
- 15 For submitters to ignore the reality of the past and ongoing modifications to these streams and the effect of existing discharges to them, while making rather sweeping statements regarding the harm that this Project will cause to these waterways and the fauna that persist within them, is in my opinion both unreasonable and inconsistent.
- 16 The footprint of the proposed expressway affects a relatively narrow and unavoidable series of crossings with each waterway. Best endeavours have been made, in engineering terms, to minimise direct effects on waterways. Images and detailed descriptions of each affected waterway are provided in Annexure G of my EIC.
- 17 As noted earlier, the primary aquatic concern raised in submitters' evidence is earthwork-related sediment discharge. I understand from **Mr Ridley** and **Mr Levy** that industry best practice methods suited to the Project area will be employed to minimise sediment and contaminant discharge to the water bodies. I accept this, noting again that the potential receiving environments (Waikanae River aside) are not good condition water bodies and that all the waterways have long experience with raised frequent sediments and have a flora and fauna tolerant of raised sediment loading.

COMMON ISSUES RAISED BY SUBMITTERS

Fish Surveys

- 18 A number of submitters argue that it is preferable to sample for fish species using a variety of methods to provide a more complete assessment of the fish communities, and that we should have conducted more comprehensive fish surveys (including weighing and measuring individuals netting, and spotlighting), as well as whole catchment studies.¹
- 19 At paragraph 5.8, Dr Boothroyd states that information on the size and weight of fish captured would enable more informed description of the fish populations and fish recruitment at the site and within the catchment, and thus further inform the ecological value of the stream. I disagree that this information would have altered my assessment on value. While these statistics are sometimes presented in assessments of effects, it is usual that they are collected to infer population condition of a sample area (i.e. evidence of recruitment of young, evidence of adults). I have assumed for my assessment that fish passage was continuous, that the lower-middle reaches of each waterway provided corridors for all migratory species found within the wider catchment, and that lower-middle reaches only provided habitat for a limited number of the total fish found within the wider catchment. Furthermore, such a requirement (i.e. information on size and weight) is not prescribed in order to use the SEV model tool.
- 20 At paragraph 5.5, Dr Death raises concern regarding my reliance on electro-fishing (an opinion shared by Mr Perry)² to assess river and stream fish assemblages. He also states that electrofishing is inappropriate for some fish species (e.g., short jaw Kokopu, giant Kokopu).
- 21 In response I make the following points:
- 21.1 I agree that netting/trapping can return species not sampled by electric fishing, depending on the effort of electric fishing, and that a judgement call is required as to the sufficiency of the electric fishing upon completion based on the habitat sampled. Such a judgement was made in this case.
- 21.2 We (Boffa Miskell) chose to conduct electric fishing as the primary source of data collection because, of all the methods available, it is the one that is most readily able to act as a robust baseline for future studies, giving the best approximation to a quantitative assessment.

¹ For example, Dr Boothroyd evidence [paragraphs 5.7-5.8], Mr Perrie evidence [paragraphs 11-12] and Mr Percy evidence [paragraphs 81-82].

² At paragraphs 11-12 of his evidence.

- 21.3 At many of these streams spotlighting as a technique has limited value. With the exception of the Waikanae, Wharemauku, and Waimeha, the streams crossed by the Project alignment are so heavily stained by peats, by stock effluent, and/or are so heavily choked with aquatic weeds that spotlighting is not possible. For the Waikanae, Wharemauku and Waimeha, which have clearer water that would make spotlighting possible, the direct effects of the Project on the waterway are minimal as they are being bridged and so there will be little or no effect on fish.
- 21.4 At many of these streams netting is problematic. The eutrophication of many of these streams by cattle or human waste has resulted in significant eel populations. It is our experience that in streams so heavily populated by eel, the use of nets is likely to increase the risk of predation by eel of any residual populations of Kokopu.
- 21.5 The NIWA fish data base shows very limited recordings of either giant Kokopu or short jawed Kokopu, the former more typical of the lowest reaches and the latter in the upper reaches in native forest areas. These are uncommon taxa and, the short jaw Kokopu especially, are not likely to be found in the habitats available within the Project footprint.
- 21.6 While I agree that other methods are available to attempt to survey the widest array of fish species potentially present, I disagree with Dr Death's inference³ that I placed weight on those species found in the survey and that I excluded from my assessment of values for mitigation any species not found in the survey.
- 21.7 I have used the NIWA freshwater fish database limited to records within NZTopo260 map R26 as a base to assist in making assumptions about catchment wide fish species presence⁴. I do not think it a sensible (or necessary) use of time and money (or necessary) to undertake detailed multi-sampling method surveys of the entire length of all waterways within the 5 major catchments (inlet to headwater) to be able to inform the value of the location and the potential effects of the Project. This is especially so where passage is assumed to be required for all species and where discharges of contaminant are to be as minimal as the Project engineers can achieve and governed in timing by a condition of consent (to minimise risk to migrating fish)⁵.

³ Dr Death evidence [paragraph 5.5].

⁴ This map covers the coastal plains and lower hill country but only as far as the road end up the Waikanae River.

⁵ Refer to the new condition proposed at paragraph 234 of my EIC, and the text of WS.9 set out in Annexure E.

Catchment Wide Studies

- 22 A number of submitters argue that the Project's ecology team should have surveyed entire catchments (I assume for habitat, fish, macroinvertebrates, macrophyte, algae etc), and not just the extent of stream potentially affected by the development of the Project.⁶ They argue that sampling of the upper reaches would have better informed the application of the stream values (rather than relying on a discussion of database records) and that without knowledge of the entire catchment we cannot adequately determine potential effects, particularly on fish only present in catchment headwaters. I strongly disagree.
- 23 At paragraph 5.2, Dr Death states that Technical Report 30 fails to highlight the very high ecological values of many of these waterways further upstream in the foothills of the Tararua Ranges. He cites that this is of particular concern for freshwater fish.
- 24 In response I make the following points:
- 24.1 With the exception of the Waikanae River, all the streams crossed by the Project have their headwaters largely or entirely within the sand plains of the Kāpiti Coast or the coastal hill slopes immediately above the sand plains. They are therefore subject to similar influences of rural and urban contamination as were described within the study area. In my opinion, no benefit would have derived from extending our surveys into these headwaters and my assessment of effects remains germane and relevant to the area of effect. Importantly, passage for all native fish has been a consideration and is catered for by consent condition and requirements for inclusion in the Environmental Management Plan.⁷
- 24.2 Both the Waikanae and to a lesser extent the Wharemauku have their headwaters in forested hill country. However, as both will be bridged, issues of fish passage or loss of fish habitat are avoided. Again it is my opinion that no benefit would have derived from extending our surveys into these headwaters.

Impact of Sediment

- 25 Several submitters, but principally Dr Death, argue that we have underplayed the impact of sediments on indigenous fish species.⁸

⁶ Dr Boothroyd evidence [paragraphs 5.5, 5.9 & paragraph 7.2], Dr Death evidence [paragraphs 3.5, 8.2].

⁷ Proposed consent conditions WS.3A, WS.4, G11, G42(d) and G34(d)(xi) all require fish passage development and monitoring. The draft EMP at pages 36-40, under culverts and diversions and guidelines recognises the need, and methods to ensure fish passage.

⁸ Dr Death evidence [paragraphs 6.11, 7.1 & 8.6], Mr van Bentum evidence [paragraph 5.14]

- 26 The quantities of sediment predicted by modelling to enter the streams during the construction phase by the Project team's sediment and erosion management experts, is small and most importantly, will be largely of sands and organic silts.^{9 10}
- 27 Dr Death in particular includes a number of images in his evidence of fish struggling in thick sediments.¹¹ The locations of where these photographs were taken are not stated and I consider that these images are misleading as they show fish within thick slurries of clay. There are no clay soils within the Project alignment. The sand and silts that will be generated by this Project do not have the same effects on fish as clays.
- 28 Furthermore, all of the waterways (aside from the Waikanae and Wharemauku) already have deep soft bottoms with large amounts of sand and mud movement.

Quantum of Sediment Discharge

- 29 Several submitters argue that the volumes of sediment discharge have been underestimated and on this basis the effects will be significantly greater than I have assessed.¹²
- 30 Mr Handyside estimates this could result in a possible threefold increase in Project sediment yield during construction. **Mr Ridley's** rebuttal evidence addresses (and rebuts) this issue specifically and I comment on **Mr Ridley's** sediment recalculations later in this statement.
- 31 On page 8, Ms Higgot raises concern regarding the 'large amounts of added sediment in the affected water courses', including Te Harakeke/Kawakahia and Kawakahia wetlands, Waikanae Estuary and discharges from earthworks to the Paetawa, Ngarara, Kakariki and Ngarara Stream. Ms Higgot states that these areas are well known and nationally recognised for their ecological values and provide habitat for at risk or declining freshwater fish species including giant Kokopu, Inanga, red fin bully and long-finned eel.
- 32 In his rebuttal **Mr Ridley** has reviewed the figures provided by Mr Handyside in relation to the USLE and concluded that they were not representative. **Mr Ridley** supplies an updated USLE calculation of sediment yield using an updated K factor. Those estimates result in a slight reduction in the predicted percentage increase of sediment load for the five principal catchments of the works area. I was

⁹ Technical Report 26, Table 37, page 120.

¹⁰ My own sampling of sediment movement in the Kakariki and Paetawa streams, carried out as part of baseline studies in September-October 2012, suggests a 90-95% sand composition (particles > 63 micron) with a 20-30% organic matter content.

¹¹ Dr Death, evidence, pages 11 and 12.

¹² Mr Percy evidence [paragraphs 83 and 84], Mr Handyside evidence [paragraph 40], Mr Perrie evidence [paragraphs 16 to 17].

satisfied with the original predictions in terms of effects (remembering that the tonnage is relatively small), and so remain satisfied with the updated predictions in terms of their ability to manage adequately the potential adverse effects of those sediments.

- 33 My EIC (paragraphs 200-201) addresses the matter of earthworks within native fish migration periods raised in the KCDC submission. Dr Death agrees with the approach of avoiding critical migration periods,¹³ and I recommended a condition (WS.9) in my EIC. In addition he recommends additional trigger levels (20% above up stream controls) for turbidity and water clarity, for cessation of works at other times. I discuss this below.
- 34 In regard to avoiding peak migration times I consider this is adequately addressed by my proposed additional condition WS.9.¹⁴
- 35 In regard to trigger levels, I consider that appropriate trigger levels, to be set at both warning and adverse effect levels will be established through the baseline monitoring programme.¹⁵ This will enable a realistic set of triggers based on the fauna community actually present and which reflect the conditions in-situ and the background in-stream sediment levels. Dr Death does not state where his 20% trigger levels come from but they may or may not be applicable and their applicability would need to be determined with reference to baseline data (captured using continuous turbidity meters).

Stream Form

- 36 Several submitters comment that in my assessment it is not clear what criteria were used to classify waterways as perennial or ephemeral.¹⁶
- 37 My assessment used the following distinctions (which are in common use in New Zealand):¹⁷
- 37.1 *Perennial streams* are those that flow all year round and are within a well defined channel. For this Project, in the absence of continual records of each stream (only the Waikanae River, the Wharemauku and the Mazengarb have Regional Council data available), an assessment of permanent flow was

¹³ Dr Death evidence [paragraph 6.15(b)].

¹⁴ Refer to my EIC, Annexure E.

¹⁵ The trigger levels to be set out in the construction environment management programme, certified by GWRC in accordance with condition G.40.

¹⁶ For example, Dr Boothroyd evidence [paragraph 5.3], Mr Perrie evidence [paragraphs 22-23]

¹⁷ These distinctions are similar to those Dr Boothroyd and I agreed upon during witness conferencing in the Long Bay development case in 2008 heard by the Environment Court (*Long Bay-Okura Great Park Society Inc v North Shore City Council*, A78/08, 16 July 2008, Judge Jackson.).

required based on anecdotal knowledge and on the apparent condition of the waterway (the depth and width of the channel and water etc).

37.2 *Intermittent streams* are those that cease to flow for some parts of the year (although they are more typically with water than without) and are retained in a defined channel. For such streams the intermittency can be difficult to judge, and typically intermittency is a factor of the upper headwater reaches as opposed to a whole stream. Several of the smaller tributaries (such as Drain 7) are sometimes intermittent.

37.3 Along the alignment, intermittent streams were typically roadside drains that lie just east and west of State Highway 1, and shallow drains in farmland in the north of the site. These streams are not, in my estimation, valuable streams or seepages and are unlikely to provide habitat for rare and threatened fauna.

37.4 *Ephemeral waterways* are stormwater passages, which typically do not have a formed channel but reflect topographic low points that collect rain water. While these features do not typically have aquatic fauna, they can have quite specific semi-aquatic invertebrate fauna and flora. In the peat and sand country of the Kāpiti Coast, these flow paths are extremely short lived.

Regional Significance

- 38 A number of submitters argue that if I had applied Policy 22 of the proposed Wellington Regional Policy Statement (*proposed RPS*) to my assessment of stream values I would have properly acknowledged that they are all regionally significant¹⁸.
- 39 At paragraphs 6.9 and 6.10, Dr Boothroyd opines that the presence of a nationally threatened organism(s) (including fish species) meets the rarity category of Policy 22 and thus raises any stream classification to the category of significant value. As a result in paragraph 6.3, Dr Boothroyd states that he is not convinced that reworking the assessment of significance of streams in the manner that I have provides a better system than that listed in Policy 22 of the proposed RPS.
- 40 In the first instance, the criteria of Policy 22 are not specific or well tailored to aquatic systems, Dr Boothroyd acknowledges that there are no accepted methods for determining the ecological significance of streams, and I agree to that point¹⁹.

¹⁸ Mr Perrie evidence [paragraphs 14-15], Dr Boothroyd evidence [paragraphs 6.1-6.11].

¹⁹ Dr Boothroyd evidence [paragraph 6.2].

- 41 Policy 22 states that indigenous ecosystems and habitats with "significant biodiversity values" are those which meet one or more of five criteria: representativeness, rarity, diversity, ecological context, and tangata whenua values.
- 42 These in themselves are common assessment criteria, but it is how they are to be interpreted in the proposed RPS that is different from "normal" interpretation. I discuss each criteria below and in relation to my assessment (against the version of Policy 22 appended to Mr Porteous' evidence).²⁰
- 43 **Representative:** I would argue that the waterways of the Project study area, while often highly modified, are still common place and generally of a similar extent as historically (accepting wetlands as a different class of habitat). Interpretation of subsection (ii) of this criteria is difficult as riparian margins, esplanade reserves and Council riparian reserves are common place but it is not clear if these are "protected" areas for the purposes of the Policy.
- 44 If one was to accept waterways as incorporated in the LENZ analysis of representativeness, as discussed by **Mr Fuller** in his rebuttal evidence, then the unavoidable conclusion is that all waterways within the Wellington Region are "significant". I do not agree that that is the case.
- 45 **Rarity:** In regard to "rarity", the proposed RPS has determined that "rare" includes species that are "scarce" or "threatened" in a local, regional or national context." I assume that "threatened" refers to the classifications of Molley et al 2001 and Townsend et al 2008, and for freshwater fish Allibone et al 2010²¹. In that regard, I note that the threat classification is a classification developed in New Zealand to list species according to their threat of extinction, not their rarity, although there is obviously often a correlation.
- 46 For the waterways of the Project area both my own assessment and the NIWA freshwater fish data base, typically show that the "threatened" fish species present are long fin eel (see Table 21, Appendix 1 of my EIC). Long fin eel are considered to be "At Risk - Declining", but in my opinion they are not "rare" (or scarce) as they are commonly found in most waterways throughout New Zealand.
- 47 Of the 18 fish taxa we recorded in our surveys, longfin eel were the second most abundant fish, surveyed from 11 of 15 streams, and comprised 18% of the total abundance of fish caught. They are not "rare" in these waterways²².

²⁰ Appendix III.

²¹ The list of "threatened" fish species and their classification as to threat condition is provided in Alibone et.al, 2010.

²² See Table 21, Annexure B of my EIC.

- 48 Furthermore, the presence of a “rare” species in the headwaters of the Waikanae River (for example), does not, in my opinion, make the lower reaches of the waterbody within the Project area some 10 km downstream therefore “significant”, even if passage through that reach is required.
- 49 **Diversity:** In regard to “diversity”, my data shows that the streams other than the Waikanae River do not have a high or good natural (i.e. unmodified) diversity, being poor in terms of types of in-stream habitat diversity (i.e. grossly simplified by drainage, flood management, loss of riparian etc), low aquatic invertebrates and lower fish diversity.
- 50 **Context:** In regard to “ecological context”, the waterway as a continuum is again difficult, but I accept that migration passage requires use of much of the stream, and is a connectivity conduit. But while a waterway is a continuum, I do not think it appropriate to classify an entire river or stream as “significant” based on, for example, the presence of a particular fish in one location of that system (e.g. short jawed kokopu in the headwaters), when passage from the sea to (potentially) the headwaters is a requirement (and is maintained). I do not see the lower-middle reaches as buffers, or as seasonal or core habitat for threatened indigenous species (even considering longfin eel).

Overall comment on Policy 22

- 51 In my opinion, although all the waterways with a nationally threatened species within the Project’s study area would be regarded as “significant” in accordance with Policy 22, this does not provide for a realistic analysis of the ecological values and conditions actually present. Therefore I do not consider that it is appropriate to rely on the Policy 22 approach alone (as suggested by Dr Boothroyd²³). As noted by Dr Death²⁴, while the presence of one threatened species such as giant Kokopu represents a high value, it does not mean the stream has good ecological condition or that the entire waterway should therefore be considered significant habitat.
- 52 I therefore stand by my analysis of the stream values. As an ecologist, my assessment needs to consider the full range of ecological factors that describe a waterway. For me to simply declare that every waterway that contains longfin eel is significant would be pointless and a limitation of ecological investigations solely on the basis of the wording of a policy.
- 53 I would also note that Dr Boothroyd states he generally agrees with my application of habitat scoring protocols²⁵, although he is cautious

²³ Dr Boothroyd evidence [paragraph 6.10].

²⁴ Dr Death evidence [paragraph 4.1].

²⁵ Dr Boothroyd evidence [paragraph 5.10].

of their interpretation. Although Dr Boothroyd acknowledges the modified nature of many of the waterways, he advises caution when suggesting that the streams impacted by the Project have low quality because typically lowland soft-bottom streams retain low habitat scores.²⁶ I agree and believe I have taken this into account.

Biodiversity Values

- 54 A number of submitters argue that for one reason or another, my assessment undervalues the actual ecological and biodiversity values of the streams.²⁷
- 55 Ms Myers states that the assessment of environmental effects (*AEE*) has not adequately assessed the biodiversity values of any of the waterbodies, that the ecological significance of streams has been downplayed and that she does not agree with my assessment on the biodiversity value of the waterbodies potentially affected by the Project²⁸.
- 56 At paragraphs 11 and 12, Mr Porteous states his opinion that the criteria used to identify the area of significant indigenous vegetation, or habitat of threatened species, are inappropriate. He goes on to state his view that the use of inappropriate criteria has led to the applicant under-estimating the Project's impact on significant indigenous ecosystems and habitats.
- 57 I disagree with these submitters. I believe the use of an assessment system using regional comparisons, the fish IBI or the functional scores of the SEV, is entirely appropriate to assist in understanding these waterways. I do not agree that my assessment has undervalued the water bodies traversed.
- 58 I note that at paragraph 4.1, Dr Death concurs with my overall assessment, that the streams and drains (excluding the Waikanae River) in the area of the Expressway represent habitats potentially of low to moderate ecological condition. Dr Death notes that my assessment of value seems consistent with the Greater Wellington Regional Freshwater Plan descriptions of these waterways.²⁹
- 59 However, at paragraph 5.4, Dr Death suggests that low ecological condition does not mean that a waterway has low ecological value and states that a degraded ecosystem is not a license to degrade it further. I agree with that conclusion, but also note that condition and value are often strongly linked and that my evaluation was a weighing against other regional stream condition metrics making it a relative value, because "value" remains a subjective interpretation.

²⁶ Dr Boothroyd evidence [paragraph 5.10].

²⁷ For example, Ms Myers evidence [paragraph 6.45], Mr Porteous evidence [paragraphs 11-12], Mr Perrie evidence [paragraphs 13-15].

²⁸ Ms Myers evidence [paragraph 6.45].

²⁹ Dr Death evidence [paragraph 4.2].

Adequacy of Mitigation

- 60 A number of submitters argue that because I have undervalued the stream systems the mitigation proposed may not be sufficient.³⁰
- 61 At paragraph 6.49, while supporting the SEV approach for calculating the level of mitigation, Ms Myers states that because the ecological value of the streams has been undervalued in the AEE, the amount of mitigation does not currently reflect the ecological value of the streams affected by the proposed works. At paragraph 6.54, she also states that the amount of mitigation (including riparian restoration) required needs to be significantly increased to reflect the ecological value of the streams affected by the works. Further, Ms Myers states that the diversions and realignments required for Expressway construction should be rehabilitated separately to the SEV offset mitigation requirements for the Project – and that this needs to be specified in conditions.³¹
- 62 Dr Boothroyd also expresses an opinion that the package of mitigation (and or compensation) is unclear to him and that it may not be sufficient in quantity³².
- 63 I note that Dr Death makes the comment that stream diversions are an appropriate response³³ and that they offer a potential opportunity to improve ecological condition/value³⁴. He does not, however, offer an opinion as to the quantity of mitigation offered.
- 64 In response I make the following points:
- 64.1 GWRC require use of the SEV analysis for streams within the Wellington Region. The ecologists who undertook the SEV analysis for the Project have completed the SEV training required by GWRC and applied the SEV tool appropriately to the streams surveyed.
- 64.2 Some of the measures used by SEV are more subjective than others, and if another ecologist had carried out this survey, there would be some variation. But, my experience is that the variation is likely to be low and the overall results would not alter significantly.
- 64.3 Overall, the results generated by the SEV tool, confirmed my impressions of each stream which is that, with the exception of the Waikanae, all waterways are compromised in some way(s) and some are extremely polluted. These results match

³⁰ For example Dr Boothroyd evidence [paragraph 9.7], Mr Percy evidence [paragraph 79].

³¹ Ms Myers evidence [paragraph 6.54].

³² Dr Boothroyd evidence [paragraphs 8.1-8.4].

³³ Dr Death evidence [paragraph 6.2].

³⁴ Dr Death evidence [paragraph 6.1].

my observations on site and I am confident that the results accurately reflect the contamination and modifications of these waterways.

64.4 It may be that through expert conferencing the perceived difficulties with how the ECR and SEV model and tool have been used will become clearer (e.g. to Dr Boothroyd), but in essence it is only a model that, with a range of assumptions and predictive values, creates an estimate of required compensation. The test is still the common sense of the approach. In this case, roughly 3 km of stream are degraded, changed or lost, and 5 km of stream are restored, protected and enhanced. Given the underlying condition of the waterways, I remain convinced of the appropriateness of the extent of aquatic ecological mitigation proposed.

Pollution of streams and groundwater

- 65 At paragraphs 3.4 and 3.5, Mr van Bentum considers that the design approach and assumptions in the Contaminated Load Assessment³⁵ do not adequately take into account the way in which Expressway stormwater would be positively directed to major watercourses along the alignment. Most notably, Mr van Bentum considers that the approach does not adequately represent the potential for negative ecological effects if inadequately treated stormwater were to be discharged to these watercourses. Mr van Bentum goes on to recommend that the requirements for treatment be tightened and a more prescriptive approach be adopted for specifying treatment devices, particularly for discharges to high and moderate ecological value watercourses.
- 66 At paragraph 5.21, Mr van Bentum suggests that the potential impacts of inadequate treatment are more significant than with the current informal State Highway drainage system. Mr van Bentum therefore recommends that a two stage approach (use of swales and constructed treatment wetlands) be provided for discharges to all high or moderately high ecological value watercourses, namely the Waikanae River, Wharemauku Stream and Whareroa Tributary as well as the currently low ecological value Waimeha Stream, Ngarara Creek and Kakariki Stream.
- 67 In their rebuttal evidence **Mr Ridley** and **Mr Levy** have each addressed Mr van Bentum's concerns regarding a more prescriptive approach to stormwater treatment. In light of this, I am satisfied that sediment will be appropriately managed and the level of sediment will be acceptable for the waterways concerned.
- 68 Based on my own evaluation of the streams tolerance/sensitivity, I do not consider that the Waimeha Stream, Ngarara Creek and Kakariki Stream require the level of protection suggested by Mr van Bentum, although I am supportive of utilising the best protection

³⁵ Technical Report 25.

mechanisms feasible. The rebuttal of **Mr Ridley** states that the methodologies specified within the Erosion and Sediment Control Plan (*ESCP*) are robust and provide as a minimum, industry best practice with respect to design, implementation and maintenance. I consider those methods and the processes will be sufficient to enable construction with minimum and temporary adverse effects to any of the waterways.

69 **Mr Ridley** and **Mr Matiu Park** have addressed similar recommendations of Mr van Bentum in relation to additional erosion and sediment control for wetlands.

70 Ms Pomare states that pollution to groundwater and runoff to the Waikanae Rivers has not been adequately dealt with, and that 'pollution will be going out the sea by the tonne'³⁶.

71 Dr Christopher and Mrs Monica Dearden³⁷ similarly question whether eels will be able to survive in this water given the potential road contaminants, citing the decline in eels is a global issue.

72 In response I refer these submitters to Technical Report 25 (Contaminant Load Assessment) which shows that the new alignment will lead to a reduction in contamination derived from SH1³⁸.

73 Also with regard to eels, I note that the most populated stream in terms of eels within the study area was that reach of the Mazengarb Stream that receives treated sewerage from the wastewater treatment plant. As a result I am confident that eels, at any rate, will survive in the waterways and may thrive in the diversions and mitigation areas.

74 On this matter, I note that Mr van Bentum supports the general approach outlined to address potential significant negative impacts on wetland plants and watercourse aquatic species [paragraph 3.6].

SPECIFIC EXPERT WITNESS EVIDENCE

Dr Ian Boothroyd – freshwater ecology, SEV and mitigation (for GWRC)

75 It would appear from his evidence that Dr Boothroyd had not yet visited the site and waterways of the proposed alignment. In my opinion water inspections are crucial to form opinions as to the condition, value and susceptibility of these waterways and in considering appropriate mitigation.

³⁶ Ms Pomare evidence [paragraphs 53-54].

³⁷ Dr and Mrs Dearden evidence [paragraph 2.38].

³⁸ Technical Report 25, section 3.8, Tables 13-16, pages 26-29.

Assumptions made in the values assessment

- 76 Dr Boothroyd states that he has not been able to form a view on the appropriateness of several assumptions I made in regard to fish passage requirements and sediment discharge issues that cover off the presence of any of rare fish not recorded in the fish survey.³⁹ The assumptions I made were as follows:
- 76.1 Regardless of fish recorded in the area or in the headwaters, passage for all fish must not be impeded by the Project;
 - 76.2 Greater ecological values than those recorded at the site may (and typically do) exist upstream and downstream of the Project footprint; and
 - 76.3 Sediment discharges will be managed to as low a level as possible (regardless of the receiving environment), will be temporary and will be governed by consent conditions that include avoiding peak migration periods.

SEV Analysis

- 77 The SEV is a modelling tool and in my opinion too much is made of the ins and outs of this tool by Dr Boothroyd.⁴⁰ As I have commented previously in evidence (Transmission Gully hearing⁴¹), the SEV is a tool that requires judgements and predictions and a range of assumptions (along with a large quantum of field data) which as noted above, different ecologists will do differently. It nevertheless offers a good insight into comparative functioning and creates a system for calculating an environmental compensation ratio (the ECR).
- 78 Dr Boothroyd has a lot of questions in regard to the finer points of the SEV model⁴² some of which are inherent in the use of the model, some of which are likely because he was not involved in the calculation. The process is not a simple matter to layout, and so he understandably does not follow the process I followed in undertaking my analysis. Nevertheless, tables showing the various steps followed to estimate the potential impacted waterway values and the potential values of the mitigation streams were supplied in the appendices of Technical Report 26⁴³ and again in Annexure F of my EIC.

³⁹ Dr Boothroyd evidence [paragraph 5.7].

⁴⁰ Dr Boothroyd evidence [paragraphs 7.7-7.11].

⁴¹ Before the Board of Inquiry. Statement of evidence of Dr Vaughan Francis Keesing (Freshwater Ecology) for the NZ Transport Agency and Porirua City Council, 17 November 2011, [paragraphs 124-130].

⁴² Dr Boothroyd evidence [paragraphs 7.4-7.11].

⁴³ Technical Report 26, Appendix G.

Reference Streams

- 79 Dr Boothroyd's evidence comments⁴⁴ that he is concerned I was not able to use a reference stream value in my SEV analysis.
- 80 In reality, there are no 'pristine' streams that cross the sand country of the Kāpiti Coast that can be used as reference sites. In the absence of a suitable reference stream condition, there are no options when using SEV, as required by GWRC, except to develop a hypothetical reference stream, which we did.
- 81 At paragraphs 6.4 and 6.5, Dr Boothroyd states he found it difficult to understand how I reached my conclusions regarding stream value, noting I revised my assessment of ecological values in my EIC from that of Technical Reports 26 and 30. Most notably, Dr Boothroyd was unclear how the hypothetical reference condition or state has been ascertained (paragraph 6.5) – and the scores attributed to the ideal state. That information was presented in Technical Report 30 section 4.3.5:

All waterways within the study area are highly modified and none were suitable as a reference stream. After a review of potential reference sites on the Kāpiti Coast and discussions with DOC, GWRC and KCDC staff it was decided that the model reference sites provided with the SEV workbook were not sufficiently representative of the channels water bodies within the study area and could not be used. The decision was made to modify the SEV from the Kakariki Stream (which scored well in some metrics) to improve some of the scores particularly the riparian habitat.

Other aspects

- 82 Dr Boothroyd questions how, with restoration, the SEVi-P can be lower than the SEVi-I (paragraphs 7.9). He is correct in that the model seeks to develop a SEVi-P which is based on a restoration of the impacted stream. However, this is unrealistic as currently there are no plans to restore these waterways and their current future is therefore the status quo. Treating the existing waterways as though they will be restored will only cause the SEVi-P and SEVm-P to converge on the same restored value and therefore simply mean the ECR is the result of SEVi/SEVm.
- 83 In my opinion the appropriate consideration is the level the SEVi-P will reach under current permitted land use and management. We understand from KCDC that flood management in these waterways is of chief importance and so the "drain" clearance by digger and edge mowing and existing inputs of contaminants are the realistic potential for these waterways. Inflating their theoretical potential condition simply increases the amount of mitigation required and I disagree with that approach.
- 84 At paragraph 5.11, Dr Boothroyd suggests my interpretation of habitat scoring mechanisms ignores the potential for improvements

⁴⁴ Dr Boothroyd evidence [paragraph 5.14].

to the waterways, citing that a major factor in my assessment of the SEV scores for streams sampled is the absence of effective riparian margins. I disagree. I considered the potential for improvements to all of the streams post-construction, and settled on the mitigation (and / or compensation) which added greatest aquatic values. In determining the potential improvements, I considered the fact that many of the waterways (within and outside of the designation) are required to be managed in a way that would negate any significant restoration of enhancement actions (e.g. annual digger channel clearance).

- 85 I note that Dr Boothroyd later agrees with my strategy of focusing on larger areas (paragraph 8.15), rather than numerous small fragmented areas of stream. Dr Boothroyd states his opinion that the streams investigated for the application have scored quite low (e.g. the Whareroa Drain at SEV of 0.283). At paragraph 7.5, he goes on to note that streams with culverts or piped sections tend to result in a score around 0.18-0.20. I agree with Dr Boothroyd that the SEV scores for the waterways in the Project area are some of the lowest scores my colleagues and I have measured using the SEV assessment method. However, these scores are consistent with my visual observations and other biophysical parameters. I reiterate that the low SEV scores (in general) are a combination of a large number of factors of historic and current land use and in my experience it is possible to have waterways scoring below a culvert score. Case in point is the lower "Drain 7" site adjacent to the timber / storage yard which is extremely contaminated with minimal flow, eroding sides and soft bottom.
- 86 At paragraph 7.6, Dr Boothroyd questions how the ECRs have been calculated, noting particularly whether I incorporated 'stream area' in the application of the ECR.
- 87 In the first instance I did not use areas. Typically, where loss and mitigation are within the same waterway and reasonably near to each other, using a linear length is suitable. However, I did run a check on my ECR result during development of my proposed mitigation by calculating an average width of each stream assessed (based on in-stream measures) and multiplying the affected reach by that width to get an area affected. The result is that approximately 7,800 m² (0.78 ha) of stream is adversely affected. I then calculated the mitigation stream area (based on riparian restoration of 20m each side and an average stream width of 2.5m), which I developed after my Technical Report was finalised. This resulted in a proposed mitigation area of 1.3 ha of stream and (refined by the GIS maps of the riparian areas) 170,000 m² (17 ha) of riparian restoration. Under this process there is a ratio of 1.6:1 of in-stream mitigation and with the addition of the riparian areas a ratio of 23.5:1 benefit to loss that would be attained.
- 88 Dr Boothroyd could not find any discussion or rationale within Technical Report 26 regarding how the 'potential' SEV scores were

determined, citing a lack of tables of SEV data showing how the potential SEVi-P and SEVm-P were generated.⁴⁵ These tables were not included in Technical Report 26 due to their substantial size. However, further tables were included in my EIC (Appendix F) showing greater SEV calculation details.

- 89 Dr Boothroyd notes that no reference is made to the use of the more specific soft-bottomed Macroinvertebrate Community Index (sb-MCI)⁴⁶. I can confirm we used the correct, soft bottom stream MCI values and version of the SEV model.
- 90 Dr Boothroyd⁴⁷ also appears to be under the impression that the new waterways (some 2,000 linear meters) that will connect the stormwater treatment wetlands to adjacent streams form part of the aquatic mitigation I have proposed. I can assure the Board that while these waterways will be created following appropriate riparian planting, they do not contribute to the quantum of aquatic mitigation I calculated as being required. An apparent perceived exception to this may be the waterway connecting to a new mitigation wetland system at the sewage plant outlet reach of the tributary of the Mazengarb. However, this is not a stormwater connection, but a connection to an ecological wetland mitigation area. As I stated in my EIC, they are of additional benefit, but that 2,000 m does not form part of the required quantum of aquatic mitigation.

Riprap and culvert surfaces as improvements

- 91 Dr Boothroyd spends some time expressing his doubt as to the mitigation value of riprap and culvert surfaces⁴⁸.
- 92 His suggestion is that I have included riprap and culverts as a form of mitigation. In the first instance, while I do think that they do offer an increase in habitat opportunity in soft bottomed streams, I did not promote either as mitigation in my proposed mitigation plan. However, I make the observation that in soft bottomed streams with erodible banks of sand and a general absence of riparian vegetation, the introduction of some hard surfaces (such as riprap and culvert bottoms) typically does offer habitat opportunities.
- 93 There is growing research to this effect^{49,50,51,52} that rip-rap, at least when in poor and soft substrate/bank habitats, adds stability and

⁴⁵ Dr Boothroyd evidence [paragraph 7.7].

⁴⁶ Dr Boothroyd evidence [paragraph 5.12].

⁴⁷ Dr Boothroyd evidence [paragraphs 8.13-8.15].

⁴⁸ Dr Boothroyd evidence [paragraphs 8.6 – 8.12].

⁴⁹ Jude, D.J.; DeBoe, S.F. 1996. Possible impacts of gobies and other introduced species on habitat restoration efforts. Canadian journal of fisheries and aquatic sciences Vol. 53, no. Suppl. 1. Pgs 136-141. 1996.

⁵⁰ Schmude KL, Jennings MJ, Otis KJ, Piette R R 1998. Effects of habitat complexity on macroinvertebrate colonization of artificial substrates in North Temperate Lakes. Journal of the North American Benthological Society 1:73-80

variation and can add new taxa and is more beneficial than detrimental (scale dependent).

Conclusion

- 94 In essence Dr Boothroyd is largely concerned with the amount of mitigation and how it was calculated, noting issues with sufficient values attributed to the waterways and on the SEV process. Regardless of these issues, he agrees that well designed and implemented stream diversions can provide enhanced freshwater values and he is supportive of the adaptive management approach⁵³.
- 95 I am of the opinion that:
- 95.1 Much of the issue with the measure of value versus condition and the "significance" of the waterways is largely academic;
- 95.2 All possible avoidance options have been considered; and
- 95.3 The use of the SEV tool will always cause debate but that the results fit with my more detailed site knowledge of what will be affected and that the results make sound ecological sense to me.
- 96 I remain of the opinion that given the condition of the affected systems and their tolerance, sufficient mitigation has been proposed by the NZTA and sufficient conditions have been proposed to ensure that such mitigation occurs appropriately.
- Mr Handyside - sediment (for GWRC)**
- 97 At paragraph 52.4, Mr Handyside suggests that clarity monitoring should be incorporated into site monitoring to assess the treatment effectiveness of individual control measures. While clarity monitoring may provide an additional measure of treatment effectiveness, I do not consider that it is required in addition to monitoring for turbidity or TSS (total suspended solids), which I further discuss below. From an ecological perspective, turbidity and/or TSS levels are a more important determinant of instream ecological health than water clarity.
- 98 I note that a number of the streams within the Project footprint are never clear. The Kakariki, and Paetawa Streams and Drain 7 for example are tannin enriched and typically dark. Furthermore, in rain events most of the streams run murky.

⁵¹ Johnston, T. 2001. A thesis submitted in partial fulfilment of the requirements for the degree Of Master of Science in Biological Sciences by Toni Johnston at Waikato University (also published).

⁵² Quigley, J.T. and Harper, D.J. 2004. Streambank protection with rip-rap: an evaluation of the effects on fish and fish habitat. Can. Manuscr. Rep. Fish. Aquat. Sci. 2701:xiv + 76 p.

⁵³ Dr Boothroyd evidence [paragraph 8.16].

99 **Mr Ridley** further addresses the monitoring of water clarity in his rebuttal statement.

Mr Perrie – freshwater ecology (for GWRC)

- 100 Mr Perrie makes a number of comments (in addition to methodologies discussed above under fish methods) regarding monitoring and consent conditions, predominantly as they affect fish. Mr Perrie argues that I should re-survey all streams using a methodology approved by GWRC. He also recommends that all fish values for each site be based upon the opinions of an expert panel.
- 101 I disagree. While some fish species may not have been sampled as efficiently by electric fishing as others, overall the results of my team’s sampling, and the abundance and diversity of fish found to dominate these waterways, is robust and in my opinion clearly reflects the health and ecological quality of the stream reaches affected directly by the Project, and was entirely anticipated based on the habitat condition present.
- 102 I note that in his evidence at paragraph 24.2, Mr Perrie draws attention to a particular data card of the NZ freshwater fish database (card 1482) showing short jawed Kokopu, koaro and dwarf galaxias as present in the Waikanae River. He cites this as evidence of omissions in my data of threatened species. These data do not appear in my table (in Annexure B of my EIC) because I “asked” the database only for those records in NZ250 map R26 within the coastal flats and adjacent foothills.
- 103 Card 1482 relates to fish recorded 20.5 km inland from the coast in a forested headwaters of the Waikanae River. The site was a boulder, cobble, gravel stream, surrounded by native forest, in rapids, riffles and runs. I do not doubt that these species are resident within this headwater, but I maintain that they are highly unlikely to inhabit the lowland reaches of the Waikanae River. As I acknowledge, each species will continue to pass through the lower reaches during their migrations to the coast and back. However, as the Waikanae River will be bridged fish passage will not be affected.
- 104 I reiterate that the effects on fish within these streams due to construction of the Project will in my opinion be minor. The highest value streams and rivers will be bridged. The flat terrain means where streams and drains are culverted, fish passage can be readily provided, and the mitigation works proposed will provide lengths of stream which will have considerably higher ecological values than those that currently exist (Waikanae River being the exception).
- 105 Extensive additional sampling (as suggested by Mr Perrie and others) in order to add one or two additional species to the lists of those present in these waterbodies will not in my opinion change these matters of passage and disturbance. Nor would it change my assessment of effects, requirements for mitigation, or the locations and types of mitigation proposed.

- 106 Mr Perrie states that there is no provision for water quality monitoring in the draft Freshwater Monitoring Plan⁵⁴. This is correct. For this Project it is proposed that water quality monitoring be carried out by the sediment management team⁵⁵ and only aquatic sampling will be carried out by the ecologists. This is normal practice for a project of this type. **Mr Ridley** addresses Mr Perrie's concerns in his rebuttal statement.
- 107 Upon review of the ESCP and EMP, I agree with Mr Perrie that in relation to in-stream sediments it is not clear what will, and how, or when monitoring should occur. In my opinion, wherever there is a potential discharge from a sediment management device or extensive open earthworks areas adjacent to a perennial waterway, then an in-stream monitoring system is required. To that end I propose an additional consent condition which will cause constant measure of turbidity (or TSS) for the three most important streams (Waikanae River, Wharemaukau and Kakariki) and a process for monitoring other waterways related to monitored failure of sediment management systems (if such an event should occur).
- 108 In accordance with the previous paragraph, I recommend that the proposed conditions and/or the management plans be amended to provide for:
- 108.1 Monitoring of water quality associated with potential construction related discharges to perennial or intermittent waterways is required in addition to monitoring the control devices. In particular the monitoring of total suspended solids (TSS g/L) or turbidity (NTU) are parameters that require monitoring downstream of potential earthwork discharge areas.
- 108.2 Monitoring during open earthworks in each relevant catchment for the duration of the open earthworks even with the ESCP monitoring of management devices and processes. Continuous logger turbidity monitoring shall be used to establish a base line turbidity state in the Waikanae River, Wharemauku Stream, and Kakariki Stream.
- 108.3 Continuous monitoring by logger shall be continued in those waterways throughout the open earthworks periods in each of their catchments.
- 108.4 In regard to other waterways, where there is a trigger breach of the ESCP and a discharge from works, this will trigger, an event monitoring of suspended sediment within 2 hours.

⁵⁴ Mr Perrie evidence [paragraph 19].

⁵⁵ Condition E.8 requires erosion and sediment monitoring to be in accordance with the ESCP. The ESCP is found within lodged material at Volume 4, management plans, Appendix H, see page 21-section 5.3.1

- 109 I understand that **Mr Robert Schofield** will propose an amendment to the conditions in response to my recommendation above.
- 110 Mr Perrie supports the sediment and macro-invertebrate monitoring that we have proposed for key streams⁵⁶, but seeks this to be carried out in more sites. We chose the Kakariki and Waikanae because these waterbodies contained the highest fish values and lay upstream of ecologically sensitive wetlands and estuaries. I see no value in repeating this sampling in other lower value streams such as the Waimeha. This is primarily because the other waterbodies are managed by excavator on an annual basis and because the fauna are of such a type and condition that it is unlikely changes of any significance can be measured. This means that any effects of sediment discharge from the Project are likely to be masked by this (and other) current activity. Separating these temporal, but often major effects, by baseline surveys (to account for them) can be difficult.
- 111 Mr Perrie seeks consent conditions to ensure fish passage is provided⁵⁷. I agree and note that fish passage has been provided for in proposed conditions: G.40, G.42(d), G.11, G.34(d)(xi), WS.3A, and WS.4.
- 112 Mr Perrie identifies some errors in Technical Report 30. I believe I have addressed these as fully as required in my EIC (paragraphs 48, 58). Tables 10 11, and 21 have also been corrected (Annexure B of my EIC provides corrected fish data).⁵⁸

Dr Russell Death – freshwater ecology (for KCDC)
Invertebrate sampling

- 113 Dr Death is concerned that the invertebrate sampling and processing protocols undertaken (by my team and the Ryder Associates Laboratory) will not meet either of the goals stated in Technical Report 30 (at page 9) to “*Identify rare and threatened species within waterways*” and to “*Allow an evaluation of the conservation/regional significance (value) of the species/communities and habitat present*”. Dr Death goes on to state that the ‘C2’ / MCI approach used evaluates water quality based on biology and is not appropriate for the stated biodiversity assessment goals⁵⁹.
- 114 I disagree. While the sampling effort and analysis is not at the level of a detailed academic research programme, it is substantive in an informative season (summer) and involved a total of 45 samples

⁵⁶ Mr Perrie evidence [paragraph 20], referring to the draft EMP.

⁵⁷ Mr Perrie evidence [paragraph 21].

⁵⁸ I note that Mr Percy for GWRC makes a number of comments in relation to freshwater ecology. I do not propose to address those comments directly as I consider that they have been covered in my responses to the other witnesses for GWRC above.

⁵⁹ Dr Death evidence [paragraphs 5.7 – 5.11].

which were analysed by a certified laboratory (Ryder Consulting Laboratories) to standard levels of identification. 60 taxa were returned and included 14 caddisfly, 4 mayfly and 3 stonefly. Each sample was identified to the level required for the MCI indices and SEV modelling, which means that specific species level identification is not made for a range of groups such as midges, and crustacea.

- 115 While the approach used does result in the species richness being under reported, again the results are to inform an effects process under the RMA. Nevertheless, the laboratory process does have a focus on identifying rare and unusual species and these are specifically looked for in the sample examination process. It would be unusual over 45 samples (of similar habitat type) for the lab to miss or fail to recognise rare taxa present (if present). The data in terms of types of fauna present suggest (given the habitat conditions sampled, and accepting the Waikanae River as the stand out aquatic habitat) that we should not have expected rare taxa. I believe that the sampling and analysis of the invertebrate data is sufficient to inform the assessment as to value and effect.
- 116 Dr Death also suggests⁶⁰ that the data is not sufficient to inform the value judgement (Table 4 of my EIC). Again, I disagree. Rarity is sufficiently covered. Furthermore, the level of invertebrate biodiversity analysis is as it needs to be to allow the regional comparisons with the GWRC State of the Environment data collected and the MCI/QMCI indices comparisons. The regional comparisons⁶¹ are a second corner stone of assessing, in a regional context, the "value" of the aquatic communities in the affected waterways.
- 117 At paragraph 5.10, Dr Death suggests that my discussion of invertebrate species richness and composition of the streams and drains is not an appropriate way to assess biodiversity because only the juvenile stages of aquatic invertebrates were sampled. Dr Death states that I have not considered aquatic invertebrate biodiversity at all:

In my opinion, the lack of evaluation of invertebrate biodiversity is a major oversight given the large number of wetlands and seepages in the region. These habitats have been shown to have unique and often threatened taxa in other parts of New Zealand (Collier and Smith 2006, Suren and Kilroy 2007). Without this knowledge it is difficult to predict the effects on upstream communities.⁶²

- 118 I disagree. That is because the juveniles sampled in this modified landscape set of reaches, are distant and disconnected from upper, better, stream habitats (and that is a primary difference in the Mokihinui Dam case quoted by Dr Death) and strongly reflect the

⁶⁰ Dr Death evidence [paragraph [5.6].

⁶¹ Technical Report 30, section 5.3, pages 66-72.

⁶² Dr Death evidence [paragraph 5.11].

potential adult fauna. Given the lack of native riparian vegetation corridors to other “better” aquatic habitat, which would allow adults to colonise from the upper catchment, it is unlikely that adult sampling would have returned any different species.

- 119 I remain confident that the faunal analysis is robust and represents the invertebrate biodiversity in general (accepting more data can always be collected over wider areas and in time). I consider the analysis allows an appropriate assessment in regard to value, sensitivity and effect.
- 120 Dr Death is correct in regard to an absence in wetland fauna sampling⁶³. I did not sample wetland taxa or seepage taxa. I did not sample seepage taxa primarily because I generally found no seepages which I considered required sampling – the area being sand country and largely wet surfaces being a factor of varying groundwater rather than spring feed seepages. Nor did I consider that there were any indigenous “wet areas” that might contain indigenous seepage fauna of conservation interest.
- 121 In regard to wetlands, wetland ecology has been assessed by **Mr Park**, but I will make the following observation in regard to invertebrate fauna of wetlands. There are characteristic wetland aquatic fauna (Suren & Sorrell 2010⁶⁴) and these faunal communities typically reflect high sediment, high organic matter types and are not mayfly or stonefly habitats. **Mr Park** and I did not consider it necessary to sample wetland invertebrates (or fish) because there has been a large emphasis on avoiding any indigenous good quality wetland habitat through the Project shaping process. The wetland areas that are affected are those largely newly developed, largely exotic types that I do not expect to have fauna that are long term established, representative of a natural indigenous wetland system or of conservation value.
- 122 Consequently I do not consider there to be the “major oversight” stated by Dr Death at paragraph 5.11.

Sediment discharge

- 123 Dr Death states, at paragraph 6.6 that his “biggest concern”, is the potential for an increase in deposited sediment generated and discharged from earthworks during construction, and the effects that may have on downstream life and on migration patterns of fish. To an extent, sediment issues raised by Dr Death have been discussed in the rebuttal evidence of **Mr Ridley**. However, I will make the following notes on specific points raised by Dr Death.

⁶³ Dr Death evidence [paragraph 3.3, 5.11, 8.3].

⁶⁴ Suren, A.; Sorrell, B. 2010. Aquatic invertebrate communities of lowland wetlands of New Zealand.: Characterising spatial, temporal, and geographic distribution patterns. Science for Conservation 305. DOC, Wellington.

- 124 Firstly, the Muaupoko diversion should not be open to the Waikanae River during diversion. This would not be best practice. I note that the finalised diversion guidance document will specify that the Muaupoko diversion will not be open to the Waikanae River during diversion (Appendix M.E of the draft EMP). Furthermore, the heavy sandy and soft bed of the current Muaupoko Stream should not have an opportunity to sluice into the Waikanae River. The process for diversions is to work "off" line to create and stabilise the new bed (this will include substrate improvements), then close the old reach (blocking it from discharge to the Waikanae River) and opening the new channel. The process should involve very little discharge of fine sediment from the Muaupoko.
- 125 Secondly, as I have noted earlier, the principal substrate for most of the waterways (but not the Wharemauku and Waikanae) is sands with some muds, not clays. I anticipate that should any earthwork discharges escape the erosion and sediment control devices they will be either very fine and remain suspended until flushed to the sea, or sands which are of far less an issue to the biota and common in most of the affected waterways.
- 126 To understand sediment movement in the Project study area I, as part of the baseline monitoring, have been running sediment pit fall traps in the Kakariki Stream above and below the proposed Expressway since September 2012. These traps are 11 litres in volume and collect sediments moving along the bed to allow a measure of deposition and bed movement over time. In the Kakariki they currently show that the bed is highly mobile (being sand, muds and organic material) and after moderate rains upward of 11 litres of sand and mud in-filled the pit traps over night. That volume (having been analysed by the Hills and NIWA Laboratories) corresponds to 140 g sand (>63 micron particles), 4-5 grams of muds (<63 microns) and contains 20-30% organic matter. Repeat measures show that in the lower Kakariki, even without rain, the pit traps filled (11 litres) within 2-5 days. The Paetawa and upper Kakariki (in which I have also placed traps) had less movement without rain (0.02-0.75 litres), but also had volumes over 11 litres after modest rain events.
- 127 These results continue to support my assertion that the majority of the stream systems within the Project area have high bed loading of sands and muds and that the communities that are present live with a persistent relatively high level of "sediment".

Ms Shona Myers – terrestrial ecology (for KCDC)

- 128 Ms Myers discusses a number of matters relating to freshwater ecology in her evidence, including riparian planting and mechanisms required to avoid and mitigate effects on stream and wetland ecology.

Riparian Buffers

- 129 In paragraphs 6.47 to 6.49, Ms Myers cites a number of references on riparian buffers to reach her conclusion that a planted riparian buffer width of at least 10-20 metres on each side of a stream is needed to provide a sustainable ecosystem.
- 130 I agree with Ms Myers that 10-20 metres width is optimal for a good riparian buffer in all locations where riparian planting is proposed. I have recommended a riparian buffer width of 20 metres both sides of all mitigation waterways⁶⁵.
- 131 At paragraph 6.50, Ms Myers raises a concern that the SEV mitigation ratios are completely reliant on the proposed stream restoration and riparian planting being successful and achieving significant benefits to stream ecology. This is always the case with mitigation. There is always an assumption that it will be undertaken properly and have the results predicted. Ms Myers is concerned that there is no detail in the AEE to provide confidence that this outcome will be achieved. I disagree. There are proposed conditions of consent and draft plans of how aspects of the mitigation are to be achieved and requirement for more detail, and extent in conditions of consent (some proposed in my EIC), including a map of locations and extent.⁶⁶
- 132 I direct the Board to Ms Myers evidence (paragraph 5.19) where in reference to the loss of an area of riparian planting on the banks of the Waikanae River she states:
- the recently planted Waikanae River riparian forest has very important ecological values and provides riparian protection for the Waikanae River, and I assess it as being of at least moderate ecological significance.
- 133 The planting which Ms Myers is referring to, as I understand it, is within the Muaupoko Stream area and is only 5-7 years old. I agree that it appears to be well established and dense and appropriate riparian vegetation to the stream. Her view that in only 5-7 years this vegetation is now of at least moderate value, confirms my confidence that my required SEV ratios can be achieved in the Kāpiti District.
- 134 I also refer to:
- 134.1 Proposed Condition G.42(d) which ensures the planting of the 5,412 lineal meters of riparian planting (that required by my SEV calculation); and

⁶⁵ Refer to paragraph 119, and Annexure C of my EIC state that the proposed mitigation widths for streams are 20m either side.

⁶⁶ Consent conditions G.34, G.42 and G43 quantify the necessary mitigation and specify its form. Annexure C of my EIC provides maps of extent and location of recommended freshwater mitigation.

- 134.2 Proposed conditions G.34(d)(viii) and (ix) which ensure mitigation requirements are undertaken and monitored to make sure success is achieved and monitoring is carried out in a manner that confirms that mitigation meets objectives.
- 135 Ms Myers, at paragraph 6.51, raises a concern that the riparian planting proposed only addresses the sections of streams and diverted streams which lie within the Expressway designation. She states that it does not address the provision of wider ecological benefits and linking stream restoration to the high value condition of upstream reaches.
- 136 In response I note that I have used the SEV tool (as required by GWRC) to determine the quantum of restoration and re-vegetation required to mitigate adverse effects of the Project. By confining the stream mitigation to the Project designation, the responsibility for both carrying out the work and ensuring that it meets the mitigation goals resides clearly and unambiguously with the NZTA. To extend mitigation works outside the footprint to land owned by other parties would not provide this surety.
- 137 At paragraph 6.52, Ms Myers states that there is little detail provided in the AEE regarding how the restoration and creation of diverted streams will be undertaken. She cites my EIC that detailed design of the stream diversions and riparian planting has not yet been completed. Ms Myers suggests that proposed Condition WS.5 should require the development of Stream Rehabilitation Guidelines.
- 138 I agree with Ms Myers and with her suggestion that detailed stream restoration guidelines need to be developed to provide details of how natural stream profiles will be restored and constructed to incorporate natural stream channel characteristics, and to achieve the restoration of riparian habitats. The intention was, and remains, that these details will be provided during detailed design and guided by the Ecological Management Plan. If this is not clear, a minor addition to proposed Condition G.34 would confirm that point. I note that prior to Regional Council, certification, the final EMP is also supplied (under condition G.37) to KDCDC for comment and this ensures their input as well.
- 139 Ms Myers considers that the lack of proposed riparian planting associated with the Waikanae River is a significant gap in the proposed mitigation package for effects on streams⁶⁷. I disagree.
- 140 In response I note that GWRC has placed limitations on what can be planted in the flood plain due to its flood management and erosion control requirements for the Waikanae River. The areas of planting that is allowed by GWRC will be carried out by the landscape architects. All vegetation that is lost on the south bank will be replaced. Some modest native planting may be allowed on the north

⁶⁷ Ms Myers evidence [paragraph 6.53].

bank. However, overall this planting will provide relatively modest increased ecological value over what exists there now. As a result, I have not included it as ecological mitigation and instead I have focused on other sites which provide greater potential opportunities for aquatic mitigation.

- 141 In conclusion and in response to Ms Myers paragraph 7.8, I confirm the riparian mitigation will be 20m in width where it physically can be. That riparian planting will be in accordance with a Stream Rehabilitation Guideline and such a guideline will be completed as part of a final EMP. I agree also that stormwater wetlands are not considered to be part of the stream mitigation package. The rehabilitation areas are those identified in Annexure C to my EIC. For completeness, I note that due to flood management and erosion control requirements, freshwater riparian mitigation planting cannot be provided along the Waikanae River.

Mr Robert van Bentum – stormwater and sediment control (for KCDC)

- 142 Mr van Bentum states there is a lack of clarity regarding which new open channel drains and streams will be constructed to resemble natural streams with natural stream beds, riparian planting and refuges. At paragraphs 5.5 and 5.6, he recommends that works be undertaken to this standard in relation to all modified watercourses, including drains, to ensure every opportunity is taken to enhance the stream and drain environment for the benefit of aquatic species present. Mr van Bentum recommends that this requirement be captured by modification to or in addition to consent conditions WS.1 to WS.7, which would require that all new, relocated or renovated drains or streams are to be constructed to resemble natural streams with natural stream beds, riparian planting and refuges.
- 143 I disagree that the effects of the Project warrant this additional restoration work and consider that the scale, location and form of mitigation I have recommended fully mitigate for any adverse effects.
- 144 At paragraph 5.7, Mr van Bentum comments that the location of the final operational designation has yet to be confirmed, such that it is not clear that all off-set storage, ecological offsets and wetland treatment areas will be contained within the designation corridor. With the exception of the northern portion of the Kakariki Stream (which is proposed to be protected and maintained by conditions on title), I consider the areas required for ecological mitigation, including stream restoration will be sufficiently maintained to ensure the ecological mitigation works continue to function on an on-going basis. I understand **Mr Levy** has proposed a condition variation to this effect⁶⁸.

⁶⁸ Mr Levy EIC paragraph [159], and Annexure A.

Ms Emily Thomson – Planning (for KCDC)

- 145 At paragraph 9.25, in relation to stormwater, Ms Thomson recommends amendments to condition DC.54 (as recommended in the evidence of Mr van Bentum and Ms Myers) as follows:
- The final operational designation area shall fully incorporate the areas of offset storage, ecological offset and wetland treatment (with the exception of offset storage area 6A) to ensure that these treatment and mitigation works will continue to function and be able to be maintained on an on-going basis by the consent holder.
- 146 I am not clear how Ms Thompson proposes to change DC.54 with the amendment noted above as proposed condition DC.54 relates to the Landscape Management Plan. While I support the intention of the statement in terms of the aquatic ecological mitigation I do not consider that it is an appropriate amendment to DC.54.
- 147 At paragraph 9.27, Ms Thomson recommends a number of amendments to proposed Condition DC.54(a)(v) and (vi) in relation to the Landscape Management Plan (as recommended by Ms Williams and Ms Myers):
- v) The proposed maintenance of plantings, including the replacement of unsuccessful plantings to achieve for minimum canopy cover of 80% at the time of final completion plus a survival rate of 90% of the original density and species before works are handed over to NZTA to maintain; and
 - vi) Coordination of landscape works with ecology works, including those required for stream diversion and permanent stormwater control ponds and how proposed ecological planting and landscape planting will be differentiated and managed;
- 148 **Mr Park** has addressed the matter of the differentiation of ecological and landscape planting and I agree with his position on this. In respect of the proposed requirement to achieve minimum canopy cover and survival rate, I consider this is adequately addressed by proposed Condition G.34(d) and (e) which ensures that both mitigation requirements are undertaken and monitored to ensure success is achieved; and that monitoring is carried out in a manner that confirms that mitigation meets objectives.
- 149 I note that in regard to the streams, mitigation success is measured instream and the riparian condition contributes to, but is not the focus of, the mitigation success measures.
- 150 At paragraph 10.5, Ms Thomson recommends a number of amendments to proposed Condition G.27 in relation to the Erosion and Sediment Control Management Plan (on the recommendation of Mr van Bentum's, and Dr Death's evidence) as follows:
- (c) Ensuring construction and maintenance activities avoid, remedy or mitigate effects of soil erosion, sediment run-off and sediment deposition to achieve no greater than 20% change in visual clarity to any receiving waterbody during works and no greater than 20% increase in deposited sediment at the conclusion of all works.

- 151 As discussed above in response to Mr Handyside for GWRC, a number of the streams are never clear and most streams run murky during rain events. Also as noted above I consider that it would be more appropriate to monitor for turbidity (TSS). Therefore, I do not consider water clarity monitoring is required.
- 152 I also disagree with the use of a 20% increase (based on the current tolerance of the waterways, aside from the Waikanae) as a trigger for either visual clarity (should that be maintained) or levels of deposited sediment (or suspended sediments). In my opinion, use of a 20% trigger is too precautionary. For example if the baseline shows a turbidity of 2 NTU⁶⁹ and the experts agree that ecological effects will occur at sustained 20 NTU then a 20% change on top of 2 NTU is not a useful trigger as it would not result in any adverse ecological impact. I consider that it would be more appropriate to determine a trigger for each waterway based on the baseline data after it has been collected and analysed.
- 153 Similarly, at paragraph 10.11, Ms Thomson recommends an amendment to Condition G.34(d)(xiii) relating to the Ecological Management Plan (on the recommendation of Ms Myers' and Dr Death's evidence):
- xiii. Freshwater habitat monitoring during construction with continuous turbidity meters (water clarity) and quorer sampling (deposited sediment) upstream and downstream of any activities affecting waterbodies.
- 154 I agree with the use of continuous turbidity meters (noting turbidity is typically measured in terms of NTU or TSS and is not "clarity" which is a different but related measure) in the Waikane River, the Wharemakau, and the Kakariki. I disagree that quorer sampling is required. This methodology is designed for cobble-bottomed stream substrates (refer ClapCott et al 2011)⁷⁰ and is unlikely to produce any meaningful results within the predominantly sand and silt streams traversed by the Project. Even with the Waikanae River and Wharemauku (which are cobble bottomed), it is my experience that this method does not result in usable effects data. In addition, quorer sampling to the best of my knowledge has never been used for a construction project as a management trigger as envisaged by this condition.
- 155 **Mr Park** has addressed Ms Thomson's recommended amendments to require quarterly baseline, during construction and post-construction monitoring for freshwater and other ecosystems in proposed Condition G.38 (paragraph 10.13). I agree with **Mr Park** that the quarterly reporting proposed by KCDC does not relate to the key monitoring seasons for freshwater species. Moreover, I

⁶⁹ Nephelometric turbidity units.

⁷⁰ Clapcott, J.E., Young, R.G., Harding, J.S., Matthaei, C.D., Quinn, J.M. and Death, R.G. (2011) Sediment Assessment Methods: Protocols and guidelines for assessing the effects of deposited fine sediment on in-stream values. Cawthron Institute, Nelson, New Zealand.

consider any additional monitoring requirements excessive given the highly modified and low value nature of most of the waterbodies traversed.

- 156 I also agree with **Mr Park** that Ms Thomson's proposed amendments⁷¹ to proposed Condition G.39(c), to require all ecological monitoring required under the EMP to be independently peer reviewed, is excessive given the requirement that this monitoring be undertaken by a 'suitably qualified and experienced ecologist' (who will also be independent).
- 157 At paragraph 10.22, Ms Thomson recommends substantial amendments to proposed Condition WS.8 (formerly WS.5) relating to management of riparian areas (on the recommendation of Ms Myers as follows):

The consent holder shall prepare and implement a revegetation and mitigation strategy for the stream modifications and structures authorised by this consent. The strategy shall be submitted to the Manager for certification at least 15 working days prior to any Work commencing. The revegetation and mitigation strategy shall include, but not be limited to:

- a) The quantum in total of stream mitigation required (at least 5.25km), the target SEV scores of the final enhancements and a plan of the location and lengths of waterways to be enhanced. Ensuring that construction stream diversions and realignments, flood storage areas, stormwater treatment wetlands will be rehabilitated separately to the SEV offset mitigation requirements;
- b) The development of Stream Rehabilitation Guidelines to detail the methods to restore of riparian habitats and reinstate the natural characteristics of streams;
- c) Riparian buffers with an average width of at least 20m.

- 158 I have already addressed the above amendments to sub-paragraphs (a)-(c) as raised by Ms Myers, and I agree with the intent of the changes proposed above. In particular, I support the amendment to (a) noting that the matters described by Ms Thomson are not considered to be part of the proposed freshwater mitigation. However, I do not consider that it is necessary that the strategy be certified by the Manager.⁷²

- 159 In relation to stormwater quality, at paragraph 10.24, Ms Thomson recommends an amendment to proposed Condition SW.1(a) (as recommended by Mr van Bentum):

Operational stormwater discharge from the Expressway shall meet the following performance criteria:

- a) All Expressway stormwater to be discharged to the following high quality water courses: Waikanae River, Waimeha Stream, Ngarara Creek and Kakariki Stream; shall be treated before discharge to the receiving environment by way of a two train system comprising swales followed by a constructed wetland. For all other catchments, treatment shall be provided via either wetland swales (holding

⁷¹ Ms Thomson evidence [paragraph 10.15].

⁷² Any further changes to conditions which I agree with or propose will be contained in Mr Schofield's rebuttal evidence.

water all year round) or grass swales followed by constructed wetlands).

The design and construction requirements for the treatment devices shall be as set out in ~~in accordance with~~ the NZTA publication Stormwater Treatment Standard for State Highway infrastructure, 2010, or equivalent industry standard methods.

160 I note in the first instance that my evaluation of the waterways does not conclude that the Waimeha Stream, Ngarara Creek and Kakariki Stream are "high value" waterways, only the Waikanae River is of such quality. Otherwise **Mr Levy** has addressed these proposed amendments in his rebuttal statement.

161 Finally, Ms Thomson recommends an additional condition at paragraph 10.28 following SW.2 (on the recommendation of Mr van Bentum) as follows:

All new, relocated or renovated open channel drains shall be constructed to resemble natural streams within natural stream beds, riparian planting and refuges.

162 I disagree with this additional condition where those features are not part of the ecological mitigation requirements. I am of the opinion that the NZTA's efforts regarding ecological improvements should be focused on areas where ecological values present (i.e. the mitigation areas I have recommended) and not in areas of drains, stormwater treatment areas, flood storage or non-ecological diversions and other poor value aquatic systems.

CONCLUSION

163 I appreciate a number of submitters and witnesses have located errors in Technical Report 30 and that they have a range of suggestions for different measures and alternative sampling regimes. I also appreciate that they have different opinions as to evaluating ecological value. However, the detailed data I and my colleagues have collected and the significant analysis I have undertaken is sufficient to allow the recognition of the aquatic values affected, to contextualise these within the region and to develop appropriate avoidance (bridging), minimisation and mitigation proposals.

164 A primary conclusion of particular note in regard to a number of criticisms of my assessment of "aquatic ecological value" is that the "value" assessment's role was primarily to guide my response to the engineers with regard to the location and the type of structures used to traverse waterways (i.e. bridging, culverting). It also influenced decisions regarding the location of mitigation (i.e. focusing on best outcomes). However, and this is an important point, all stream loss or adverse effect to a waterway, no matter the value or condition, has been mitigated for. The value did not determine whether to mitigate an adverse effect or not. The method used for determining the extent of mitigation was that required by the GWRC (i.e. the SEV system).

- 165 While I accept that a number of good points have been raised by submitters, none are of crucial moment or of sufficient concern that I have changed my mind or now consider my conclusions to be at fault. Based on my extensive knowledge and understanding of these waterways, I remain of the opinion that avoidances relative to values have been achieved, that effects to the waterways have been minimised as far as feasible, and that the conditions in those affected areas are such that the proposed mitigation / compensation are more than sufficient to result in a neutral if not net aquatic gain across the waterway systems.
- 166 For freshwater, a primary consideration remains the effectiveness of the construction earthworks sediment management programme. Other than the Waikanae River, there is a generally tolerant aquatic community present creating minimal risk of significant adverse effects.



Dr Vaughan Keesing
26 October 2012