Waterview Connection Project Board of Inquiry

Freshwater Ecology Review Appendix to the Section 42A Report

Prepared by Dr Gregory Ian Ryder

1. INTRODUCTION

1.1 The New Zealand Transport Agency (**NZTA**) has lodged applications with the Environmental Protection Authority (**EPA**) for the proposed Waterview Connection Project (the '**Project**'). The project will involve the completion of the Western Ring Route around Auckland by extending State Highway 20 (SH20) to the North-western Motorway (SH16) at Great North Road, Waterview and widening SH16 from St Lukes to Te Atatu.

1.2 The Board on the Project has requested that a freshwater ecologist assist the Board's planning adviser as required with the preparation of a planning report pursuant to Section 42A (a s42A report) of the Resource Management Act 1991 on NZTA's applications for resource consents to build and operate the Project.

1.3 This report has been prepared as an addendum to the section 42A report prepared for the Board.

2. AUTHOR'S QUALIFICATIONS AND EXPERIENCE

2.1 My full name is Gregory Ian Ryder. I am a water quality scientist and aquatic ecologist and hold BSc. (1st Class Honours) (1984) and PhD. (1989) degrees in Zoology from the University of Otago.

2.2 I am a member of the following professional societies:

- New Zealand Freshwater Society;
- New Zealand Water and Wastes Association;
- North American Benthological Society; and
- Royal Society of New Zealand.

2.3 I am a Director of Ryder Consulting Limited, an environmental consulting business with offices in Tauranga, Levin, Christchurch and Dunedin. Prior to this, I held positions at the Otago Regional Council and the University of Otago.

2.4 For approximately 24 years, I have conducted a wide variety of studies on freshwater ecology and water quality throughout New Zealand. I have been project manager for major studies on New Zealand river ecosystems. Regional councils and government departments have engaged me to

peer review environmental studies and resource consent applications, and I have held the position of an independent commissioner on a number of major resource consent hearings associated with marine farms, surface and groundwater abstractions, hydro power development and wastewater discharges.

2.5 In 1993, I acted as a technical editor for the Ministry of the Environment in the preparation of its 1994 publication, "*Water Quality Guidelines No. 2: Guidelines for the Management of Water Colour and Clarity*". In 1995 I designed, and for a number of years ran, Environment Southland's State of the Environment Freshwater Monitoring Programme and I am currently engaged to analyse the data generated by this programme since monitoring commenced in the mid 1990s. I have assisted both Environment Southland and Otago Regional Council in developing their respective regional water plans, and was the principal author in developing water quality standards for Southland's Draft Regional Water Plan (Ryder 2004), which received relatively few challenges in the submission process. My PhD thesis examined the effects of sediment discharges on stream biota and I regularly undertake assessments of freshwater communities that are subject to actual and potential activities that disturb instream habitat and discharge sediment-laden water.

3. REPORTING APPROACH

3.1 My assessment is based primarily on reviews I have undertaken of the applicant's assessment of effects (AEE) documents, proffered draft resource consent conditions and submissions received by the EPA through the Board of Inquiry process.

3.2 I undertook a site visit on 28th October 2010 and key points of interest were inspected and discussed on site with other members of the s42A reporting team, along with Kim Morgan (EPA), and applicant representatives.

3.3 I have not attempted to describe in detail the freshwater receiving environments and the various issues that the Project brings to bear on those environments. Rather, I have provided an overview of the environment in terms of their scale and ecological values, presented the likely key effects of the Project on those values, assessed the appropriateness of any mitigation proposed by the applicant, and similarly assessed the appropriateness of any monitoring proposed by the applicant. I have also commented on the adequacy of the applicant's investigations and interpretation of the findings of these investigations. I have examined and commented on the draft resource consent conditions proffered by the applicant. Finally, I have read key submissions relating to freshwater environments and, where relevant, commented on the nature of their concern relative to that of the applicant's experts and my own opinions.

3.4 The applicant has provided a series of reports relating to freshwater habitats that lie within the project footprint. The primary resource document is Technical Report G.6 titled *Assessment of*

Freshwater Ecological Effects[1], which also includes a number of important appendices relating to mitigation, monitoring, and realignment and rehabilitation guidelines[2].

3.5 This document makes reference to several other important documents containing technical assessments and proposed management plans the contents of which have been relied upon to assist in the assessment of effects on freshwater ecology. These documents are:

(a) Technical Report G.15. Tonkin and Taylor. (2010). *Assessment of Stormwater and Streamworks Effects*. Prepared for New Zealand Transport Agency.

(b) Technical Report G.21. BECA. (2010). *Construction Environmental Management Plan*. Prepared for New Zealand Transport Agency. This reports contains important appendices:

- Appendix G: Temporary Stormwater Management Plan (TSMP)
- Appendix H: Ecological Management Plan (ECOMP)[3]
- Appendix I: Groundwater Management Plan (GWMP)
- Appendix J: Settlement Effects Management Plan (SEMP)

(c) Technical Report G.22. Ridley Dunphy Environmental. (2010). *Erosion and Sediment Control Plan (ESCP)*. Prepared for New Zealand Transport Agency.

(d) Technical Report G.27. Tonkin and Taylor. (2010*). Stormwater and Streamworks Design Philosophy Statement Report*. Prepared for New Zealand Transport Agency.

4. SUMMARY OF REVIEW

4.1 After the viewing the applicant's documentation and submissions relevant to freshwater ecology, it is my opinion that any significant adverse effects on freshwater ecology resulting from construction and operational phases of the proposed Project can be mitigated to appropriate levels such that the overall ecological effects on freshwater ecosystems will be minor or less than minor. In saying this, some adverse effects will be unavoidable, but the more significant of these will be of a temporary nature only, with no significant long term effects. There is also some potential benefit that can be derived from the Project through the establishment of stormwater treatment facilities that would not only treat motorway runoff associated with newly constructed road and road-related infrastructure, but also treat runoff from roads that currently do not receive treatment before discharging to freshwater (and marine) environments. Further, there is opportunity to enhance existing stream environments particularly in Oakley Creek. However, it is

[1] Technical Report G.6. Sides, E. (2010). *Assessment of Freshwater Ecological Effects*. Document Reference No. 20.1.11.3-R-N-1007-A.
[2] Appendix C to Technical Report G.6. *WRR – Maioro Street Interchange and Waterview Connection: Oakley Creek Realignment and Rehabilitation Guidelines.*
[3] Also appended to the Technical Report G.6 as Appendix D.

important that, if the Project is granted consents, consent conditions are structured to ensure that the quality and quantity of proposed mitigation and environmental compensation is retained and enforced.

5. EXISTING ENVIRONMENT

5.1 General

5.2 The layout of the Project will be familiar to you by now and I have not described this in any detail. The Project has been split into 9 'sectors' and not all of these impinge on freshwater environments. In simple terms, the Project footprint impacts on four urban streams contained within three catchments. These are:

- Pixie Stream (Sector 1, SH16, Te Atatu Interchange);
- Meola Creek (Section 6, SH16, Great North Road to St. Lukes Interchange)
- Oakley Creek (Sectors 5, 7, 8 and 9, SH16 and SH20);
- Stoddard Road tributary of Oakley Stream (Sector 9, SH20).

5.3 These streams and their catchments are identified in Figure 1, which is redrawn Figure 2 from the Technical Report G.6.

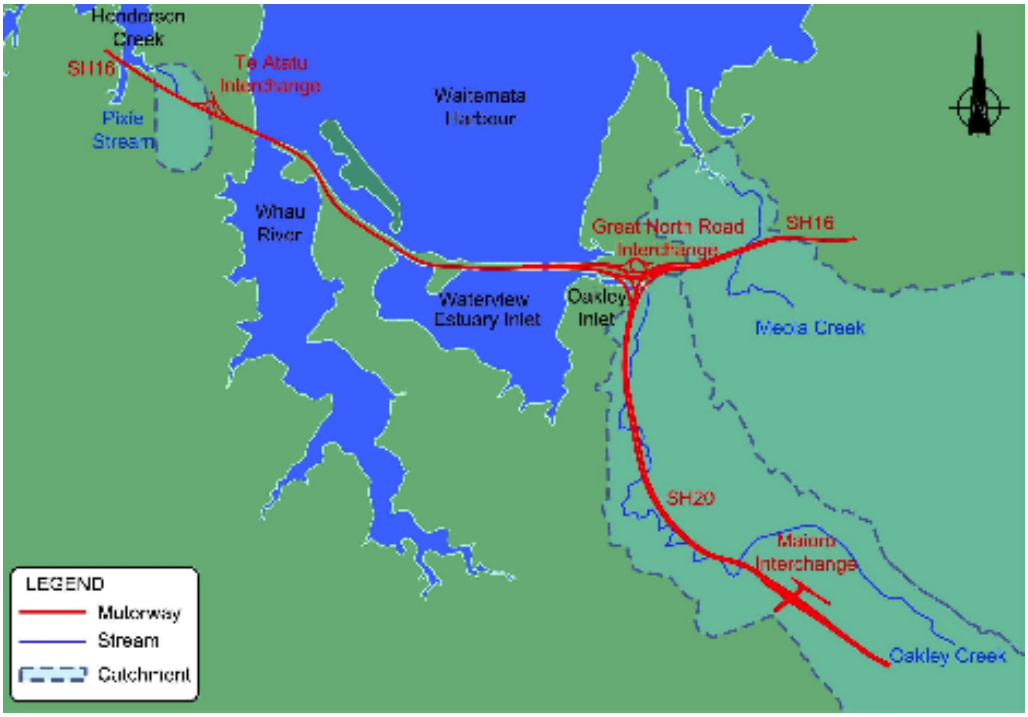

Figure 1. Freshwater streams and their catchments in the Project Area (redrawn from Technical Report G.6).

5.4 I have set out my review in a geographical context, starting with the Pixie Stream catchment in the north-western part of the Project area, working across to Meola Creek and then the sectors that fall within the Oakley Creek catchment and its Stoddard Road tributary. While I have referred to specific Project sectors where necessary, working within stream catchment boundaries is a sensible approach for ecological assessments as activities within one part of a watershed have potential to impact on other parts through the conveyance of water and water-borne contaminants.

5.5 Ecological emphasis for these streams has centred mainly around existing and potential effects on physical habitat, water quality and quantity, aquatic plants (macrophytes), benthic macroinvertebrates and fish. These areas of interest are appropriate for assessing the potential freshwater ecological effects of both the construction and operational phases of the Project.

5.6 In terms of stream biology, particular emphasis has been placed on the benthic macroinvertebrate[4] and fish communities, as they fill important trophic levels in stream ecosystems and have biodiversity value. Macroinvertebrates act as an indicator of general water and habitat quality, and provide an important source of food for freshwater fish. Fish are probably the most identifiable living component of stream ecosystems, having biodiversity, commercial, cultural, and recreational values. The New Zealand freshwater fish fauna is regarded as having low diversity. A national survey[5] found an average of 5 species per survey site compared with 3 per site found in the NZFFD[6] which is considered very low compared to numbers found in continental rivers. Without appropriate habitat and water quality conditions, neither 'healthy' fish or macroinvertebrate communities will be remain.

5.7 Survey and Assessment Techniques

5.8 As already noted, surveys have primarily assessed freshwater fish and macroinvertebrate communities, but other physical and other biological features (e.g., riparian character, aquatic plants and water quality) have also been assessed. Such attributes influence the biological character of stream ecosystems.

5.9 In my opinion, the survey and assessment techniques used by the applicant's advisors have been appropriate and conducted to an acceptable level of inquiry. Previous survey data has been sourced and appraised together with more recent surveys tailored specifically for the Project. Some detail on water quality is lacking for Pixie Stream and Meola Creek, but in my opinion there

[4] Benthic macroinvertebrates are small invertebrates that live on the bed of streams and rivers, and include crustaceans (e.g., amphipods), insects (e.g., beetles, caddisflies, mayflies and stoneflies), snails and worms.

[5] Jowett, I. G., Richardson, J. 2003. Fish communities in New Zealand rivers and their relationship to environmental variables. New Zealand Journal of Marine and Freshwater Research 37(2): 347-366.

[6] The NZFFD is a database managed by the National Institute of Water and Atmospheric Research (NIWA). It contains information on the distribution of New Zealand freshwater fishes. Data is contributed by the likes of consultants, government departments, crown research institutes, research agencies, Fish and Game councils, and universities.

is sufficient information on adjacent or similar Auckland urban catchments to develop a sufficient understanding of local water quality.

5.10 One criticism is the lack of stream flow data presented in the freshwater ecology report. Stream ecology is strongly influenced by flow patterns, and knowledge of flow history can help understand fish and macroinvertebrate community composition. As noted further on in this report, information on baseflow conditions in Oakley Creek would have been useful to include in the freshwater ecology report as baseflow has potential to be compromised by drainage of tunnel sections of the Project that pass near the stream.

5.11 In the Auckland region, a classification method[7] has been developed to determine the integrity of a stream's ecological functions. The method is known as Stream Ecological Valuation (SEV). It can also be used to quantify existing and post disturbance stream values and to calculate ecosystem and habitat loss, and then to determine an appropriate amount of environmental compensation (expressed as an Environmental Compensation Ratio, or ECR), for example when performing works in a stream which will create adverse effects that cannot be mitigated within that reach.

5.12 The AEE uses the above classification method to provide context for assessments of the values of these freshwater environments to aid in evaluating the effects of the Project. Section 3 of the AEE (Appendix G.6 Technical Report) outlines the Auckland Regional Council stream classifications for Oakley Creek, Meola Creek and Pixie Stream.

5.13 Stream Character

5.14 Having viewed sections of these streams and read the background information which provides detail on their ecological attributes, it is clear to me that they are highly modified aquatic environments. Their physical character has been altered over time through various practices such as channelisation, realignment, bridge culverting, piping, lining the channel with artificial material such as concrete, removal or alteration of riparian vegetation, piping of tributaries, wide-spread alteration of their watershed land use for urban development, and associated changes in the hydrological and water quality character of the water they receive and convey to the coast.

5.15 Not surprisingly, these wide spread modifications have resulted in changes to the ecology of these streams over time. Degraded water quality combined with an altered physical environment has meant the stream biota is now dominated by taxa[8] more tolerant of pollutants and modified physical environments with less diversity of habitat.

5.16 Notwithstanding the above observations, these environments still retain some ecological value (in addition to other likely values, such as aesthetic appeal and cultural significance, which are

[7] Rowe *et al*. (2008). *Stream Ecological Valuation (SEV): a method for scoring the ecological performance of Auckland streams and for quantifying environmental compensation – 2nd edition*. Auckland Regional Council Technical Publication No.302. 85p.

[8] A taxonomic group or entity, such as a family, genus, or species. In the context of stream environments, it could be a type of algae, fish, plant or macroinvertebrate.

not considered in this report). Consequently, stream values have been assessed by the applicant (and others) in an urban context and this has been used to assess the level of potential adverse effects from construction and operation of the Project and the measures required to avoid, remedy or mitigate significant adverse effects.

5.17 While not wishing to repeat the descriptions of these environments as detailed in the AEE documents, I think it is useful to provide some brief summaries of their general physical and biological character.

5.18 **Pixie Stream** is a small stream, (approximately 320 metres long) that drains a small, narrow catchment. It discharges to the Henderson Creek inlet. Most of its catchment area is piped, and the stream's only open channel being confined to reaches below the existing SH16 carriageway.

5.19 Pixie Stream has a poor macroinvertebrate community with no sensitive taxa. It has abundant macrophytes (aquatic plants) in its lower reaches, particularly the widespread introduced species *Elodea* (oxygen weed). The fish community is typical of that found in small coastal streams and is dominated by native species that have a migration stage between freshwater and marine water.

5.20 Water quality information for this creek is sparse and limited to some basic water quality indicators. It has been considered that low water quality is expected to occur in this creek, in association with rainfall events, and I agree with this assessment given the urban nature of the catchment.

5.21 **Meola Creek** is approximately 2.6 kilometres long with its headwaters entirely piped. The lower open reaches are described as swiftly flowing, very clear and quite deep (up to 0.8m in places). It is well vegetated for most of its length below Great North Road, sparsely vegetated within Chamberlain Park, and better vegetated (although this is somewhat patchy) upstream to its piped headwaters.

5.22 As for Pixie Stream, Meola Creek contains thick growths of introduced plants. It is reported that the nationally endangered aquatic moss *Fissidens berteroi* is present in the vicinity of the Great North Road culvert which is situated downstream of Project footprint.

5.23 The creek has a poor macroinvertebrate community with no sensitive taxa. The fish fauna includes longfin eel, shortfin eel, banded kokopu, inanga, torrentfish and common bully (all native species). Overall, this creek has been described in the AEE as being of moderate ecological value and I agree with this assessment given the urban nature of the catchment.

5.24 **Oakley Creek** is the largest stream in central Auckland, with an approximate length of 12 kilometres. It flows from Hillsborough to the Waitemata Harbour at Waterview and discharges into the Motu Manawa (Pollen Island) Marine Reserve. Its catchment consists of approximately

1400 hectares of gently rolling, mixed use, predominantly urban landscape. It is an open stream in a corridor of public land for the majority of its main stem.

5.25 The creek contains introduced plant species that have flourished in its enriched water, although some native species are still present. It has relatively low macroinvertebrate diversity and the community is dominated by pollution-tolerant taxa typical of those found in highly modified urban streams with relatively poor water quality. Macroinvertebrate community health indices confirm this assessment with low scores for most sites and no sensitive taxa.

5.26 The fish community found in Oakley Creek is also rather unremarkable in its makeup although diversity in the lower reach is quite good for such an urbanised environment. A 6 metre high waterfall situated approximately 900 metres up from the mouth appears to restrict the upstream distribution of some native fish species that are poor climbers.

5.27 Water quality in Oakley Creek has been relatively well characterised through a number of studies. Not surprisingly the water quality is compromised by urban stormwater and ANZECC[9] guideline levels for 95% protection of aquatic life are frequently exceeded for nutrients, some dissolved heavy metals and faecal indictor bacteria.

5.28 Overall Finding on Stream Character

In my opinion, the combination of historic and Project-specific surveys provide a sufficient level of survey information to characterise the biological, physical and water quality attributes of potentially affected stream environments. These streams are defined by the urban environments which envelop them. The modifications that their physical character and their catchment land use have undergone since the commencement of urban development essentially dictate their current biological and overall ecological make-up. A degree of riparian and channel protection, particularly in the lower reaches of Oakley Stream, has helped maintained some degree of 'naturalness' to the physical character of the stream, but this positive effect is probably compromised by relatively poor water quality as a result of contaminated urban runoff.

6. PROJECT EFFECTS

6.1 The Project affects these freshwater environments at both the construction phase and the operational phase. The assessment of effects on freshwater environments is based on the assumption that various measures will be undertaken to minimise the likes of contaminants in stormwater and seepage water (in tunnel sections) and the amount of stream bed and bank disturbed during the construction phase (i.e., the various mitigation measures described in the AEE).

[9] Australian and New Zealand Environment and Conservation Council (ANZECC), 2000. *Australian and New Zealand guidelines for fresh and marine water quality*. Volume 2, Aquatic Ecosystems. These guidelines are used extensively by regional authorities in assessing receiving water environments.

6.2 While the potential effects on freshwater ecology are broadly similar across the Project, their scale varies within and between the catchments. A brief summary of how the Project influences the three stream catchments is presented below.

6.3 Pixie Stream

6.4 The Construction Phase for Pixie Stream will result in:

- Discharge of treated stormwater from Temporary Sediment Retention Pond (SRP) 1C into Pixie Stream at Sector 1.
- Disturbance of the stream bed to extend an existing culvert under SH16 carriageway resulting in a loss of 23m of stream habitat (note that upstream of SH16 stream is already piped).

6.5 The Operational Phase will result in:

- Discharge of treated stormwater from the Jack Colvin Park Pond into the CMA downstream of the mouth of Pixie Stream at Sector 1.
- Stormwater treatment will be provided by a wetland and two treatment swales.

6.6 Meola Creek

6.7 The Construction Phase for Meola Creek will result in:

- Discharge of treated stormwater into Meola Creek at Sector 6 via a constructed wetland.
- Erosion and sediment discharge control measures will remain in place throughout construction.
- [Note that no instream works are required.]

6.8 The Operational Phase will result in:

- Discharge of treated stormwater into Meola Creek.
- Stormwater treatment and extended detention will be provided by the constructed wetland.

6.9 Oakley Creek

6.10 The Construction Phase for Oakley Creek will result in:

- Earthworks in vicinity of Oakley Creek mouth (Sector 5).
- Discharge of treated tunnel water through temporary stormwater systems (Sector 7 & 8).

- Discharge of stormwater from motorway and construction yards by temporary wetlands and wet ponds (Sector 9).
- Streamworks in Sector 9 will include areas of earthworks for stream realignment, instream works in areas of channel and habitat rehabilitation, and the bridging of SH20 over the stream.

6.11 The Operational Phase will result in:

- Discharge of stormwater via wetlands, a treatment swale, three cartridge filters and two lengths of bio-filter strips (Sector 5).
- Discharge of groundwater from tunnels via conveyance, storage and pumping systems. Depending on the level of water contamination, the flows may be discharged to either the northern portal wetland (normal levels of stormwater pollutants in water), or tanker trucks for offsite treatment and disposal (highly contaminated water) (Sectors 7 & 8).
- Discharge of treated stormwater via constructed wetlands (Sector 9).

6.12 Construction Phase - Effects

6.13 In the **Construction Phase t**he Project as proposed will directly disturb stream physical habitat (i.e., 'streamworks' effects) in Pixie Stream, Oakley Creek and the Stoddard Road tributary of Oakley Creek as well as affect the character of water quality primarily through potential discharges of sediment-laden water resulting from stream bed and bank excavation, or, for all three catchments, from land excavation and general disturbance which mobilise sediments and other contaminants that find their way into stormwater runoff (i.e., stormwater effects).

6.14 Channel altering activities will result in the loss of existing habitat through diversion and re-contouring of stream bed and banks, particularly in the Oakley Creek catchment, resulting in the temporary or permanent loss of habitat. Complete loss of stream habitat can be minimised by reducing the foot print of the Project or by avoiding areas all together and this has been taken into consideration by the applicant. However, at the end of the day, the alignment of the road and associated infrastructure is constrained by the location of the existing roading infrastructure and by existing commercial and residential development. Therefore for the Project to proceed, the loss or modification of habitat is almost inevitable and can only be mitigated through enhancement, rehabilitation and environment compensation as proposed by the applicant, and as discussed further on in this report.

6.15 For those areas that will be disturbed, the key to minimising construction effects is to restrict the entry of mobilised sediment to watercourses and there is heavy emphasis on this strategy in the application documents. The primary techniques proposed are:

- the use of sediment detention ponds;
- use of flocculants to settle out sediments in stormwater detention devices;
- use of silt fences;
- decanting earth bunds;
- progressive stabilisation of exposed areas;
- minimise foot print.

6.16 These techniques have been designed to accommodate treatment devices that meet the requirements of ARC technical specifications relating to earthworks and stormwater[10]. It is proposed that the effects of stormwater discharges from the Project during the construction phase will also be mitigated by treatment devices designed using the BPO (Best Practical Option) approach.

6.17 The stormwater generated from impervious construction areas and the pavement for the proposed motorway will carry pollutants dominated by suspended solids. The types of impervious surfaces expected during construction and the treatment approaches include the following:

- Construction yards will be established early in the construction process and runoff will be treated with construction treatment devices (for example wet ponds). The construction yards will be removed at the end of construction.
- Prior to use new sections of motorway (SH20) will be treated by a construction treatment devices, and ultimately by operational phase treatment devices.
- Widening for SH16 will get stormwater treatment once the lanes become live.
- For causeway sections of SH16, where the pavements will be constructed in stages, a series of construction treatment devices for the different stages of construction are proposed.
- For the Great North Road Interchange ramps, it is assumed proposed permanent stormwater treatment devices and reticulation will be constructed simultaneous with the works, and will therefore service these areas once they become live to public traffic. Therefore no separate devices for the construction phase are proposed.

6.18 Note that AEE Technical Report No G.22 *Erosion and Sediment Control Plan* provides details of erosion and sediment discharge control measures to be employed during the construction phase. The AEE documents state that by providing stormwater treatment during the construction phase the effects from stormwater discharges on receiving environments will be minimised.

[10] e.g., ARC's Technical Publication 10 – *Stormwater Management Devices: Design Guidelines Manual* (TP10)(2003).

6.19 In my opinion, these represent appropriate measures which appear consistent with regional plan policies.

6.20 Estimates of sediment discharges to each of the three streams have been prepared by NIWA using a modelling approach to compare existing sediment loads with expected loads generated during the construction and operational phases of the Project. For example, it has been estimated that the Project would generate 16.8 tonnes of sediment per year from Sectors 7 – 9 during construction, which will discharge to Oakley Creek, and that this represents 4.7% of current background sediment levels. The AEE's freshwater ecology report concludes that, overall, the increase in background sediment loads are expected to be minor and targeting high-risk areas with specific sediment controls is expected to further reduce the load.

6.21 Stream realignments proposed for Oakley Creek will help avoid the need for any new culverts (which would result in significant loss of stream habitat value) and minimise loss of stream length. Designs have taken into consideration the maintenance of fish passage and enhancement of instream habitat quality (e.g., by allowing for variations in stream width, water depth and velocity, and by planting riparian vegetation). In my opinion these measures are appropriate.

6.22 With respect to actual effects on stream biota, I agree with the AEE assessment that the biological communities in Oakley Creek are characterised by "*common, pollution-tolerant macroinvertebrate taxa and low fish diversity above the waterfall*" and that these communities will generally have a "*low sensitivity*" to the predicted increases in suspended sediment.

6.23 I also agree that the existing biological communities in the creek are adapted to varying flows and water quality, and probably have a high resilience or capacity to recover from increases in suspended sediment. No significant decreases in taxonomic richness or changes in the character of the fauna within Oakley Creek are anticipated and I agree with this conclusion given the nature of the existing biota and the proposed measures to mitigate sediment discharges.

6.24 The freshwater ecology report notes that monitoring of Oakley Creek since 2004 associated with the SH20 Mount Roskill Extension Project has shown that even when sediment deposition increased significantly at monitoring sites there were "*very little corresponding adverse effects on the bio-metrics of the instream community*".

6.25 Operational Phase – Effects

6.26 In the **Operational Phase** the effects on freshwater environments are largely to do with the effects of stormwater discharges on water quality character and, in the case of Oakley Creek, some ongoing effect on stream hydrology resulting from alterations to the groundwater profile associated with road cuts and tunnels.

(a) Stormwater

6.27 The effects of stormwater discharges to streams need to be couched in the context of the degree of stormwater treatment that is proposed as an ongoing commitment. Stormwater detention and treatment techniques have been designed to meet the requirements of the Auckland Regional Council Proposed Auckland Regional Plan: Air, Land and Water (PARP:ALW) using the BPO approach, and designed using the ARC's Technical Publication 10 – *Stormwater Management Devices: Design Guidelines Manual* (TP10)(2003) as a basis. The proposed treatment devices address both stormwater quality and quantity. The devices include a combination of wetlands, bio-filter strips, swales and proprietary cartridge filters.

6.28 The PARP:ALW requires, and ARC TP10 targets, removal of 75% of total suspended solids (TSS) content in stormwater on a long term average basis. However, for this Project, treatment of stormwater runoff to remove more than 75% TSS has been identified as a way of mitigating for coastal reclamation work required as part of the Project, and the associated loss of biological habitat. For this reason the stormwater treatment devices for the Project that discharge to the CMA (Sectors 1-5) have been designed for removal of 80% TSS on a long term average basis. Dr Stewart in his marine report[11] provides further comment on this matter.

6.29 The AEE documents state there will be 23.31 hectares of additional impervious surfaces resulting in an approximate total impervious area of 56.83 hectares across the Project area. Water quality treatment will be provided for 99.4 % of the additional impervious areas. Of the 33.52 hectares of existing impervious motorway surfaces within the Project area water quality treatment is currently provided for only 3.30 hectares (9.8 % by area). The proposed treatment devices for the Project will significantly increase the area of existing motorway treatment to 30.40 hectares (90.7% by area), achieving 80% treatment efficiency over the majority of this area. Water quantity treatment will be provided for all motorway areas with stormwater discharges to Oakley Creek to avoid flooding effects.

6.30 By providing stormwater treatment to meet the requirements of the PARP:ALW for all of the new motorway areas, the effects from stormwater discharge on the receiving environment have been minimised. In addition, improved environmental outcomes will be achieved by the stormwater treatment of existing motorway areas that currently only have minimal treatment. A higher than usual level of treatment of 80% TSS removal is proposed for areas of the Project that discharge to the CMA and stream environments.

6.31 In terms of actual predicted effects of stormwater on freshwater ecology, motorway stormwater in the Pixie Stream catchment will discharge into the coastal marine area rather than the stream itself, so any effects on Pixie Stream from the operation of the Project will be largely avoided. Treated stormwater could potentially enter the stream on an in-coming tide, but the proposed

[11] Stewart, B.G. 2010. *Review of the Assessment of Marine Ecological Effects and Submissions with Relevance to Marine Ecology*. Prepared for the EPA Board of Inquiry into the Waterview Connection Project.

treatment levels are such that measurable ecological effects are unlikely given existing stormwater from this part of SH16 is untreated.

6.32 Freshwater communities of Meola Creek have been classed as pollution-tolerant with relatively low sensitivity, and I agree with this description. The Project will increase the amount of impervious area in the catchment by a small amount. Stormwater from this area will be treated together with currently untreated motorway runoff. Consequently there are unlikely to be measurable adverse effects to the Meola Creek freshwater community.

6.33 All discharges to Oakley Creek will be treated and there is a predicted minor increase in contaminant concentrations as a result of the Operational phase of the Project. These are not expected to significantly affect water quality in Oakley Creek, and consequently significant adverse effects on biological communities are not predicted to occur. Ecological communities both above and below the waterfall are considered to be already tolerant of a wide range of water quality conditions, which currently vary periodically between moderate to very poor, and I agree with this assessment.

(b) Loss of instream habitat

6.34 Pixie Stream will be shortened by 7% as a result of the Project. Stream Ecological Valuation and Environmental Compensation Ratios were undertaken to determine the rehabilitation length required to compensate for the ecological functions lost as a result of this culvert extension. The SEV assessment and ECR calculations determined that a linear length of 207m of riparian stream-side revegetation would be required, but the AEE noted that because Pixie Stream has been the recipient of recent rehabilitation under the Twin Streams project, there is unlikely to be any scope for additional riparian revegetation at this location. Rehabilitation outside of the Pixie Stream catchment has been recommended, but no location has been put forward by the applicant as yet, citing a need to work on this with the Council.

6.35 Approximately 217m of the Stoddard Road tributary of Oakley Creek and 790m of Oakley Creek will be realigned resulting in a final stream length that is shorter than the existing watercourses by approximately 137m. The realignments are to be designed to ensure that the new channels provide better instream habitat opportunities than are currently present within the existing channels. Establishment of aquatic communities in these realigned sections will take time to occur, but I expect that improvements to these environments are possible provided the recommended mitigation measures and rehabilitation plans[12] are adhered to.

6.36 The AEE notes that poor fish passage in Oakley Creek is a natural phenomena created by the waterfall in the lower section of the creek, and that this impediment and generally poor urban water quality will continue to limit the potential of the fish community. It does not appear that the

[12] Technical Report G.6, Appendix C. *WRR – Maioro Street Interchange and Waterview Connection : Oakley Creek Realignment and Rehabilitation Guidelines.*

applicant has given consideration to improving native fish access over the waterfall as a part of the mitigation package for shortening the length of the stream and the associated realignment works. It is also possible that this could be used as off-site mitigation for the shortening of Pixie Stream.

(c) Oakley Creek Hydrology

6.37 The AEE states that the drawdown of groundwater in the vicinity of Oakley Creek to facilitate tunnel and portal construction might alter the contribution of groundwater that naturally flows towards Oakley Creek, and that this may result in changes to base flows in Oakley Creek. It might also increase the volume of water that naturally discharges through the floor of the creek to recharge the underlying groundwater system. It is reported in the AEE freshwater ecology report that modelling[13] indicates that stream base flow could be reduced by up to 21% due to long term leakage into the tunnels and consequent groundwater lowering. I agree with the AEE freshwater report that this would represent a significant reduction in base flows with likely significant adverse effects on stream ecology.

6.38 A number of excavation construction strategies to minimise the extent of predicted groundwater drawdown and changes in base flows to Oakley Creek have been recommended. In terms of the long term steady state, it has been recommended that the northern portals and approaches be undrained, that the tunnels be sealed, and that a permanent drain be placed in the basalt at the southern portals (to relieve pressure on the retaining walls here). The AEE concludes that with adoption of these recommendations the potential effects of dewatering will be less than minor. I would expect any reductions in base flow of 5% or less to be less than minor.

6.39 Flow meters or continuous flow monitoring of Oakley Creek at key localities is recommended in the technical reports and is contained within the *Construction Environmental Management Plan* (CEMP) (Technical Report G.21). I consider such monitoring is essential to assessing effects.

(d) Tunnel Settlement Effects on Oakley Creek

6.40 It has been estimated that drawdown of groundwater at the proposed tunnels will result in a cone of depression of the groundwater table that extends outwards from the tunnels causing settlement of the ground and affecting the bed of Oakley Creek where the tunnels pass in close proximity beneath it.

6.41 Changes to the bed gradient of the stream could potentially alter water velocity and in doing so alter instream habitat for fish and macroinvertebrates.

6.42 Modelling of Oakley Creek water velocity predicts that the change in average velocity will be less than 0.1m/s. I agree with AEE that this is a relatively minor change within the context of natural

[13] Beca. (2010). Technical Report G.7. Western Ring Route : Waterview Connection - Assessment of Groundwater Effects.

variation in water velocity within a stream section, particularly in upper Oakley Creek which does not appear to contain fish species with high velocity requirements.

7. MITIGATION AND ENVIRONMENTAL COMPENSATION

7.1 The primary mitigation methods proffered by the applicant relate to the minimisation of the Project's foot print, various sediment retention and treatment devices, minimising groundwater drawdown in tunnel and cut areas adjacent to Oakley Creek, the restoration and rehabilitation of channel alignment sections of Oakley Creek, and a further 343m of riparian rehabilitation, proposed to be undertaken within Alan Wood Reserve, Hendon Park and the Goldstar Block. These mitigation methods have come about through the development of Design Principles for the Project, which are:

- The design will incorporate the total stormwater management system (collection and conveyance network; treatment devices; stormwater cross drainage; Oakley Creek culverts and diversions).
- The objective of the stormwater management system is to provide a best practicable option (BPO) to avoid, remedy or mitigate adverse environmental effects, determined through a robust evaluation of options.
- The design should include full consideration of stormwater operational implications throughout the design life.
- The design should best practicably mimic the existing hydrologic regime and setting, to deliver outcome objectives that remedy or mitigate adverse environmental effects. The design should also consider any measures to improve current flood issues in the catchment.

7.2 As already stated, I consider the mitigation options recommended in the AEE with respect to effects on freshwater environments to be robust and appropriate. The construction of the Project will result in a number of unavoidable adverse effects in relation to Oakley Creek and one of its tributary streams. In particular these effects refer to the permanent loss of functional stream habitat. Stream rehabilitation within Alan Wood Reserve and Hendon Park is intended to provide the necessary environmental compensation for these adverse effects.

7.3 It has been noted in the AEE that additional rehabilitation works within Oakley Creek are already required of NZTA, through resource consent conditions associated with a related, but separate (and already consented) project, the SH20 Maioro Street Interchange Project. These rehabilitation works are also intended to be undertaken within Alan Wood Reserve, Hendon Park and the Goldstar Block. Provided that these separate rehabilitation works do not overlap, I consider that these two enhancement packages to be a sensible approach.

7.4 While the AEE has tended to dismiss the Oakley Creek waterfall, which is an impediment to upstream passage for some fish species present in the lower reach of the stream, as something beyond the Project's scope, I suggest that consideration be given to enhancing the upstream fish community as part of the mitigation package for effects on Oakley Creek itself and also for Pixie Stream, for which no stream enhancement has been proposed by the applicant at this stage. As stated by Collier *et al.* (2009[14]), "*although some native fish species appear to be resilient to urban development, it is difficult to restore the natural structure of fish communities at urban sites because of the varied combination of local and downstream factors that regulate fish distribution and abundance. Thus, rather than striving for natural fish community structure, a more attainable goal may be to enhance the distribution and abundance of iconic native species (e.g. large galaxiids) by identifying the specific aspects of their habitat and biology that constrain populations*". Enhancement through the passage transfer of fish upstream (e.g., banded and giant kokopu) could achieve such a goal by increasing the area of freshwater habitat available to native fish species.

8. MANAGEMENT PLANS AND MONITORING

8.1 Understandably, there has been a heavy emphasis on the use of management plans to identify issues and coordinate responses. An example of this is Figure 2 below which demonstrates how mitigation of construction effects are to dealt with through various management plans.

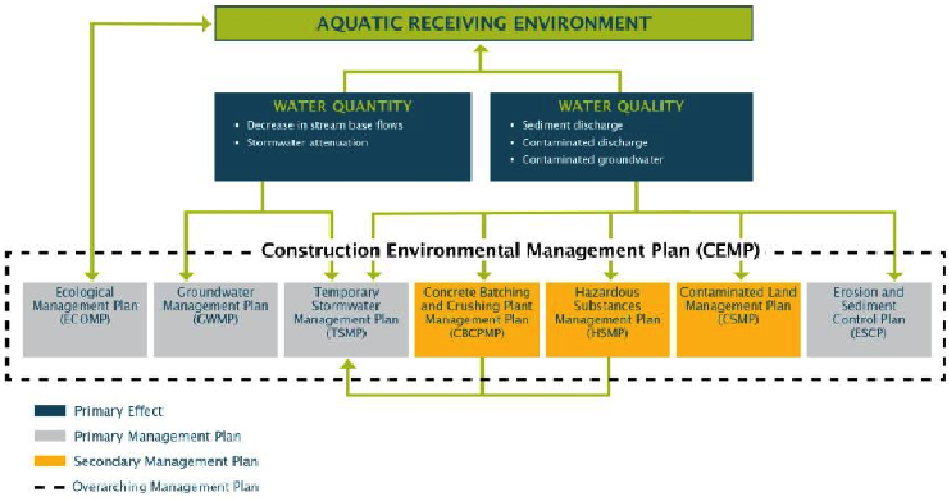

Figure 2 *Relevant sub-plans which detail mitigation of potential impacts from construction activities on the aquatic receiving environment (Figure 1-1 redrawn from the Ecological Management Plan).*

8.2 An "*Ecological Management Plan*" (ECOMP) has been developed to manage and monitor the ecological values in the Project area. It includes a freshwater monitoring programme with two primary components: "devices" monitoring and habitat monitoring. Trigger events for device

[14] Collier *et al*. 2009. Ecological values of Hamilton urban streams (North Island, New Zealand): constraints and opportunities for restoration.

monitoring may require ecological monitoring to ascertain the magnitude of the effect.

8.3 Freshwater ecological monitoring consists of four stages and three levels of monitoring intensity:

- Baseline Monitoring (routine monitoring intensity - Level 1);
- Scheduled Operational Monitoring (routine monitoring intensity - Level 2);
- Triggered Monitoring (greater monitoring intensity - Level 3);
- Post Construction Monitoring (routine monitoring intensity).

8.4 The variables to be monitored in this programme, together with their frequency, appear adequate. The Auckland Regional Council submission has requested that fish and macroinvertebrate monitoring be undertaken during the summer months. I recommend that this monitoring be undertaken in both summer and winter to account for potential seasonal changes particularly for fish.

9. DRAFT CONSENT CONDITIONS

9.1 There are several sets of draft conditions proposed by the applicant that have relevance to freshwater ecology. They are:

- Proposed Groundwater Conditions;
- Proposed Contaminated Land and Contaminated Discharges Conditions;
- Proposed Earthworks Conditions;
- Proposed Stormwater Conditions;
- Proposed Streamworks Conditions;
- Proposed Freshwater Conditions.

9.2 These proposed sets of conditions generally reflect the expected level of effects identified in the AEE following implementation of the mitigation approaches recommended in the various technical reports. To that extent, I am comfortable that they provide an appropriate level of control on activities that may adversely affect freshwater environments. However, I do have several concerns regarding specific proposed conditions, I and have identified these below along with some general comments.

9.3 The Proposed Groundwater Conditions requires the implementation of a Groundwater Management Plan (GWMP). The approach is sound, but I consider groundwater monitoring trigger levels contained in the proposed GWMP need to be linked to local water levels and flow in Oakley Creek, and consideration should be given to establishing a trigger level for flow in Oakley Creek when monitoring detects that tunnelling activities are having a significant drawdown on surface flow. Without some type of trigger for flow reductions in Oakley Creek there appears to be

no real incentive for the consent holder to act on any adverse changes that may result from groundwater diversions.

9.4 The Proposed Contaminated Land and Contaminated Discharges Conditions include a condition (CL.5) requiring the consent holder to remove contaminated soil and remove and dispose of any contaminated groundwater/surface water from the site in accordance with a Contaminated Soil Management Plan (CSMP). It is important that such conditions are retained in order to minimise the potential for adverse effects on freshwater ecosystems.

9.5 The Proposed Earthworks Conditions include condition E.9, which states the consent holder shall ensure that all discharges from tunnel dewatering activities shall be treated and monitoring undertaken of the discharge into the Oakley Creek, and of the Oakley Creek itself, to determine an appropriate water quality standard for turbidity and pH for the discharge. Initial pump treatment standards of 50 NTUs[15] for turbidity and 7.5 for pH has been set by the applicant. This level of turbidity could create discolouration of Oakley Creek, depending on the rate of discharge and degree of dilution available in the creek, but would be tolerated by the existing fish community. A pH value of 7.5 is acceptable and within typical guideline levels for freshwater.

9.6 The Proposed Stormwater Conditions do not specify a minimum stormwater treatment device efficiency. Technical supporting documents refer to the adoption of a higher than usual level of treatment (80%) for the removal of total suspended solids from stormwater. This minimum limit should be specified in the consent conditions.

9.7 Management plans specified in draft consent conditions should have a requirement that they be submitted to the Council for final certification.

10. SUBMISSIONS

10.1 There are few submissions that present detailed concerns about potential effects on freshwater ecology. Most provide cursory comments concerning potential effects of stormwater discharges to Oakley Creek. There are almost no comments on Pixie Stream or Meola Creek. I am satisfied that the draft consent conditions proposed by the applicant largely cover all the important matters raised by submitters in relation to freshwater ecology. Below, I have made comments on several individual submissions.

10.2 Auckland City Council: The ACC is largely supportive of the Project with respect to potential effects on freshwater ecology. It seeks assurances that restoration measures for Oakley Creek are in line with NZTA's '*Oakley Creek realignment and rehabilitation guidelines'.* It also seeks that the construction of water treatment devices (e.g., wetlands and ponds) be undertaken in a naturalistic form sympathetic to their surrounding environment. This Council supports the

[15] Nephelometric Turbidity Units - a measure of water turbidity or cloudiness.

implementation of the proposed Ecological Management Plan (ECOMP), including its design principle of avoidance of adverse effects on ecological values, and remediation or mitigation only where avoidance is not possible.

10.3 Auckland Regional Council: The ARC submission is generally supportive of the approach adopted with respect to freshwater ecology. The submission acknowledges that the freshwater monitoring programme should be sufficient to detect any adverse effects and will provide a baseline to assess any impacts. The Council is satisfied with the recommended rehabilitation measures for Oakley Creek.

10.4 DOC: The Department of Conservation makes no comment on freshwater ecology in its submission.

10.5 Friends of Oakley Creek: The Friends of Oakley Creek submission expresses general concern over the lack of adequate erosion and sediment control measures during construction and general impact on the natural environment. They are also concerned with effects on groundwater levels, the diversion of Oakley Creek, and discharges of sediment and stormwater. They seek a higher quality discharge of stormwater (95% efficiency) but provide no justification for this level of treatment.

10.6 Forest and Bird Motu Manawa Restoration Group: This group is focused on coastal aspects of the Project only.

10.7 Ngati Whatua 0 Orakei Corporate Limited: This stakeholder states that catchment wetlands associated Oakley Creek (Te Auaunga) provided significant biodiversity, food and other resources for Ngati Whatua 0 Orakei ancestors. The submitter seeks a deep tunnel option to be extended through to Maioro Road as this would ensure that Oakley Creek is retained and "*the important ecological linkage provided by the existing green spaces is preserved without being severed by motorway infrastructure*". I am satisfied that the ecological functioning of Oakley Creek will be maintained, and potentially enhanced, by the Project provided the mitigation measures recommended in the technical reports, and contained within the management plans to accompany draft consent conditions, are adopted.

10.8 Sharon Erdrich: This submitter has expressed concern that the potential for flooding of Oakley Creek downstream of the Project has not been adequately assessed and that such flooding would have detrimental effects on the returning native fauna (fish and nesting birds) in and around the creek. With respect to fish, the native fish species present in Oakley Creek are well adapted to flood conditions and eels in particular use floods to feed on flood plains and to assist in their migrations. Therefore I do not consider the submitter's concerns about this issue are warranted in this instance.

10.9 Elisabeth van Alkemade: This submitter cites the applications lack stormwater cleansing and filtering from all road surfaces. It is my understanding from reading the AEE documentation that stormwater from all new road surfaces will receive some form of treatment prior to being discharged to receiving water environments. The proposed degree of sediment removal in treatment systems appear to meet or exceed that required under ARC's Proposed Auckland Regional Plan: Air, Land and Water. Many other contaminants are typically bound to sediment particles (e.g., bacteria, heavy metals and hydrocarbons) and so removal of sediment will by default act to remove other contaminants of potential concern.

Greg Ryder
12 November 2010