

Before the Board of Inquiry
Waterview Connection Project

in the matter of: the Resource Management Act 1991

and

in the matter of: a Board of Inquiry appointed under s 149J of the Resource Management Act 1991 to decide notices of requirement and resource consent applications by the NZ Transport Agency for the Waterview Connection Project

Statement of evidence of Graeme Ridley (Erosion and Sediment Control)
on behalf of the **NZ Transport Agency**

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STATEMENT OF EVIDENCE OF GRAEME RIDLEY ON BEHALF OF THE NZ TRANSPORT AGENCY

INTRODUCTION

- 1 My name is Graeme John Ridley. I am a Director of Ridley Dunphy Environmental Limited, an environmental consultancy that specialises in environmental management of development sites and in particular, erosion and sediment control.
- 2 I have the following qualifications and experience relevant to the evidence I shall give:
 - 2.1 I have a Bachelor of Agricultural Science from Massey University, Palmerston North;
 - 2.2 Prior to forming Ridley Dunphy Environmental Limited, I was employed as an environmental consultant with Environmental Management Services and prior to that I was employed by the Auckland Regional Council (ARC) in numerous roles, including Manager of Consents and Compliance, Manager of the Land and Water Quality Team, and Manager of the Sediment and Stormwater Management Teams;
 - 2.3 A particular focus of my career has been in the field of erosion and sediment control and I have over 20 years' experience in this area. My experience in erosion and sediment control has been widespread and includes detailed involvement for both councils and the community with educational, regulatory (consenting and compliance), policy and research aspects of erosion and sediment control. I am responsible for the design and monitoring of chemical treatment systems for earthworks on a number of development sites throughout New Zealand;
 - 2.4 I have considerable experience in all aspects of earthworks, streamworks and stormwater activities. I have had intimate involvement with policy development and implementation, research, education, training and regulation covering all aspects of development site earthworks, streamworks, stormwater discharges and sediment management;
 - 2.5 I was the primary author of the ARC Technical Publication Number 90 "Erosion and Sediment Control Guidelines for Land Disturbing Activities" (TP90) which is the tool promoted and used by the ARC, and now Auckland Council (AC), for the management of erosion and sediment associated with development sites. I have advised on the implementation of TP90 on development sites and understand firsthand the various aspects of its application;

- 2.6 I am the primary author of the 2010 erosion and sediment control guidelines for the Wellington and Bay of Plenty regions and note that the Bay of Plenty Guideline has now been formally adopted by the Bay of Plenty Regional Council;
 - 2.7 I am a director and past vice president of the Australasian chapter of the International Erosion Control Association; and
 - 2.8 I am an accredited hearing commissioner and have participated in a number of hearings around New Zealand. This has included acting as an independent technical commissioner for the projects such as the Te Uku Wind Farm Project and the Rangiriri Bypass (Waikato), where I provided, amongst other things, technical assessment of erosion and sediment control methodologies for the developments.
- 3 My evidence is given in support of notices of requirement and applications for resource consents lodged with the Environmental Protection Authority (*EPA*) by the NZ Transport Agency (*NZTA*) on 20 August 2010 in relation to the Waterview Connection Project (*Project*). The Project comprises works previously investigated and developed as two separate projects, being:
- 3.1 The State Highway 16 (*SH16*) Causeway Project; and
 - 3.2 The State Highway 20 (*SH20*) Waterview Connection Project.
- 4 I am familiar with the area that the Project covers, and the State Highway and roading network in the vicinity of the Project.
- 5 I have read the Code of Conduct for Expert Witnesses as contained in the Environment Court Consolidated Practice Note (2006), and agree to comply with it. My evidence has been prepared in compliance with that Code in the same way as I would if giving evidence in the Environment Court. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from my opinions expressed.

SCOPE OF EVIDENCE

- 6 My evidence will deal with the following:
- 6.1 Executive summary;
 - 6.2 Background and role;
 - 6.3 Summary of Erosion and Sediment Control Plan (*ESCP*);
 - 6.4 Comments on submissions;

6.5 Proposed earthworks conditions; and

6.6 Conclusions.

EXECUTIVE SUMMARY

- 7 The Project is recognised as being unique from a construction perspective and is not considered a significant, or typical, surface earthworks roading project. The Project includes two portal locations both of which represent significant "holes" below ground level, which in turn results in the ability to have 100% control over all discharges from these specific locations.
- 8 All erosion and sediment control management techniques to be utilised for the Project are based around erosion control in the first instance, through minimising the volume and area of earthworks exposed, and minimising sediment laden discharge to receiving environments through the provision of sediment control devices.
- 9 The erosion and sediment control measures for the Project are designed in accordance with the TP90 and in many circumstances go beyond TP90 in design. The ARC has adopted TP90 as a regional standard for erosion and sediment control.
- 10 The Erosion and Sediment Control Plan (Technical Report G.22) recognises the higher risk areas associated with the Project and sediment discharge. This includes works in the vicinity of the Oakley Creek and also works within, or adjacent to, the coastal marine area. Technical Report G.22 identifies specific measures that will be implemented in these locations, both structural and non-structural measures, to minimise this risk.
- 11 A key practice to be applied to all works within the Oakley Creek or Coastal Marine Area is to work within a dry environment. This is achieved through the provision of fully stabilised diversion systems and portable coffer dams.
- 12 In addition to specific practices, Technical Report G.22 outlines the monitoring that will occur to ensure that control measures are fully effective. This focuses on both freshwater and coastal marine monitoring.
- 13 The proposed consent conditions included in **Annexure A** are considered best practice and will assist in ensuring that any adverse effects on the environment, including water quality, will be negligible.

BACKGROUND AND ROLE

- 14 The NZTA retained Ridley Dunphy Environmental Limited as consultants to assist with the erosion and sediment control aspects of the Project. I prepared a report referred to as the Western Ring Route – Waterview Connection Erosion and Sediment Control Plan (ESCP), to address the management of erosion and sediment effects during the construction period. I was assisted in the preparation of the ESCP by Thomas Moulder, Senior Civil Engineer of Aurecon (formerly Connell Wagner). The ESCP is referred to within the Project application framework as Technical Report G 22.
- 15 Through the development of the ESCP I had ongoing discussions with members of the wider Project team. Of particular relevance to the ESCP development were the following reports:
 - 15.1 Assessment of Freshwater Ecological Effects (Technical Report G.6);
 - 15.2 Assessment of Groundwater Effects (Technical Report G.7);
 - 15.3 Assessment of Land and Groundwater Contamination (Technical Report G.9);
 - 15.4 Assessment of Marine Ecological Effects (Technical Report G.11);
 - 15.5 Assessment of Stormwater and Streamworks Effects (Technical Report G.15);
 - 15.6 Construction Environmental Management Plan (Technical Report G.21);
 - 15.7 Coastal Works Report (Technical Report G.23); and
 - 15.8 Assessment of Associated Sediment and Contaminant Loads (Technical Report G.30).
- 16 I have also attended, and contributed to, a number of specific workshops associated with the Project where erosion and sediment control has been discussed. I have visited the site many times and as part of this have viewed the various receiving environments, have walked the proposed alignment and have assessed the various options associated with erosion and sediment control.
- 17 The ESCP was peer-reviewed by Brian Handyside, Director of Erosion Management Limited, who provided ongoing input throughout the ESCP development. Comments from the peer review have been incorporated into the ESCP.

- 18 The ESCP forms part of the Construction Environmental Management Plan¹ and is one of the sub plans that exists within this framework. The ESCP describes the methods and practices to be implemented to minimise the effects of sediment generation on the aquatic receiving environments associated with the Project. The ESCP is prepared in support of the assessment of environmental effects and to provide guidance to construction contractors during the construction phase.
- 19 The ESCP only considers the activities that will occur during the construction phase. The Assessment of Stormwater and Streamworks Effects Report² considers the activities that will occur longer term and also considers the stormwater diversion and discharge that will occur during the construction period from temporary impervious surfaces such as temporary office buildings and construction yard areas. In many circumstances the linkages between the ESCP and the Assessment of Stormwater and Streamworks Effects has resulted in treatment devices being utilised for dual purposes. These are shown within the Erosion and Sediment Control Plans within Appendix F of the ESCP.
- 20 Ecological effects are detailed within the separate ecological reports.³ Linkages to the ESCP include identification of the potential sediment generating activities, details of the proposed erosion and sediment control measures and as a result the potential sediment yields that may enter the various receiving environments. The ecological reports further assess the specific values of the receiving environments and potential impacts of the sediment discharge on these environments.
- 21 The Assessment of Associated Sediment and Contaminant Loads⁴ also provides a linkage with the ESCP and has integrated the ESCP into the sediment yield calculations undertaken. While these specific yields form part of the assessment of effects reports, the yields are also utilised within the risk assessment framework detailed within the ESCP.
- 22 The ESCP was lodged with the EPA on 20 August 2010 as part of the overall Assessment of Environmental Effects (AEE) (specifically, Part G, Technical Report G.22).

¹ See Technical Report G.21, Appendix F and evidence of Mr Hugh Leersnyder on behalf of NZTA.

² Technical Report G.15.

³ Being Technical Reports G.6 and G.11.

⁴ See Technical Report G.30.

- 23 The ESCP was accompanied by the following sets of Drawings:
- 23.1 Causeway Construction Phase Typical Sections (Drawings 20.1.11-3-D-C-150-301 to 303);⁵
 - 23.2 Indicative Staging of Reclamation and Embankment Works (Drawings 20.1.11-3-D-C-150-371 to 375);⁶
 - 23.3 Erosion and Sediment Control Plans (Drawing Nos. 20.1.11-3-D-EN-740-100 to 114 and 117 to 119);⁷
 - 23.4 Erosion and Sediment Control Details (Drawing Nos. 20.1.11-3-D-EN-740-201 to 203 and 205);⁸
 - 23.5 Maioro Street Interchange Erosion and Sediment Control Plan (Drawing No. 20.1.11-2-D-C-5210-002);⁹ and
 - 23.6 Erosion and Sediment Control Bentonite Plant General Layout (Drawing No. 20.1.11-3-D-EN-740-204).¹⁰

SUMMARY OF EROSION AND SEDIMENT CONTROL PLAN

- 24 In this section of my evidence I summarise the key points of the ESCP and assessment. The ESCP remains as a separate document and contains specific design detail and methodology related to erosion and sediment control and construction activities. I prepared the ESCP to:
- 24.1 Describe the methods to be used to minimise the effects of sediment generation on the aquatic receiving environment;
 - 24.2 Support the assessment of environmental effects; and
 - 24.3 Provide guidance to construction contractors about developing specific Contractors Erosion and Sediment Control Plans (*CESCPs*) that are consistent with the ESCP for each specific area and activity prior to construction.

The assessment of effects and risk¹¹

- 25 Oakley Creek and the coastal marine area (*CMA*) adjacent to the SH16 Causeway are sensitive to sediment discharges.¹²

⁵ See Appendix E of Technical Report G.22.

⁶ See Appendix E of Technical Report G.22.

⁷ See Appendix F of Technical Report G.22.

⁸ See Appendix F of Technical Report G.22.

⁹ See Appendix G of Technical Report G.22.

¹⁰ See Appendix I of Technical Report G.22.

¹¹ See section 4, page 14 of Technical Report G.22.

- 26 Three key aspects of erosion and sediment control are related to the risk of sediment generation and discharge. These are:
- 26.1 Sediment generating potential – the generation potential of an area, based on slope angle, slope length, soils, rainfall and erosion control factors;
 - 26.2 Sediment delivery – this relates to the amount of eroded material that is retained on site in depressions and within the site’s natural contours before it enters any sediment treatment device; and
 - 26.3 Sediment yield – the amount of sediment that leaves the site and enters the environment. This is the key area of interest.
- 27 If sediment generation can be minimised through appropriate erosion control factors, then sediment yields are also consequently reduced.
- 28 The environmental risk for the Project was determined with assistance of the process in TP90¹³, which provides a measure of the risk of sediment generation and yields and assists in identifying controls for managing the risk to the environment from sediment discharges associated with earthworks.
- 29 A modelling exercise was also undertaken by the National Institute of Water and Atmospheric Research (NIWA) to determine more accurate sediment yields from the construction phase of the Project.¹⁴
- 30 In summary, the NIWA modelling estimates showed that Sectors 1, 6 and 9 will produce the highest amount of construction related sediment yield and therefore will need to be carefully managed to minimise this yield.
- 31 The erosion and sediment controls developed for works within Sector 1 (Te Atatu) utilise a range of erosion and sediment control measures that represents the best practicable option for this sector. Progressive stabilisation will also be undertaken to ensure that areas that are completed from an earthworks perspective will not be subject to erosion.

¹² The assessment of effects on these two areas are found in Technical Report G.6 *Assessment of Freshwater Ecological Effects* and Technical Report G.11 *Assessment of Marine Ecological Effects*.

¹³ Auckland Regional Council *Technical Report 90 "Erosion and Sediment Control Guidelines for Land Disturbing Activities"*.

¹⁴ The results and analysis of this modelling are presented in Technical Report G.30 *Assessment of Associated Sediment and Contaminant Loads*.

- 32 Works within Sector 6 involve widening and lane addition works on SH16. These works will be progressively stabilised as works progress. This sector relies on silt fences as the primary control measure. It is recognised that silt fences have a lesser efficiency than other sediment control measures such as sediment retention ponds. Practical alternatives are, however, not available and it is considered that with the progressive stabilisation of this area as works proceed, sediment yields will be greatly reduced from that modelled.
- 33 The construction area within Sector 9 is largely associated with the southern tunnel portal and a large portion of the works area will discharge into this location. This runoff will then be pumped to a sediment retention pond for treatment, as outlined in paragraph 46 of this evidence.¹⁵ With this method of total control of the majority of discharge from this area, and the other erosion and sediment controls to be employed in this sector (including chemical treatment), it is assessed that sediment yields will also be further reduced from that modelled.
- 34 In all of the above three sectors, as with the other sectors, emphasis will be placed upon the monitoring and maintenance of all controls, and particular attention will be paid to these areas prior to, during, and after rain events to ensure controls are in place and are operating effectively.
- 35 Both Oakley Creek, which is located at both the southern and northern extent of the Project, and the coastal environment in the northern location, are widely recognised as containing a range of important values, and emphasis needs to be placed on the Project to minimise any sediment discharge to these environments. From a risk perspective, the Project will place significant emphasis on those works within, or immediately adjacent to, the Oakley Creek, in addition to earthworks in the northern location adjacent to the coastal environment. Of particular note is the avoidance of discharges directly to sandy substrate within the CMA.
- 36 Further risks which the Project team recognises need to be provided for are:
- 36.1 Works within watercourse such as culvert extensions and diversions;
 - 36.2 Works undertaken within the identified 1% annual exceedance probability (*AEP*) flood plain area;
 - 36.3 Works associated with the coastal reclamation; and

¹⁵ See point 17, page 10 of Technical Report G.22.

36.4 Potential failure of the pump system associated with the tunnel portal excavations.

- 37 In recognition of the risks that exist, progressive stabilisation of bare earth will be implemented on a proactive basis. Some areas will be open for only very short periods of time, for example construction yards, where as soon as portions of the yard are at final grade levels, stabilisation with hard fill will occur.¹⁶ The ESCP has accounted for risk by identifying certain sectors in the Project as being 'hotspots' for potential elevated sediment generation.¹⁷ These areas are identified in paragraph 36 above.
- 38 The Project is recognised as being unique from a construction perspective¹⁸ and is not considered significant or typical when considering earthworks in comparison to other recent roading Projects.¹⁹ With recognition of the relatively gentle slopes within the Project footprint and the fact that a large proportion of the Project is associated with tunnel portal construction, the estimated sediment yield will be reduced by utilising contour drains, implementation of chemical treatment for all sediment retention devices, rapid stabilisation, total control of all discharges from portal locations and ensuring all erosion and sediment control measures are given high priority.
- 39 With respect to the streamworks and coastal activities, the methodologies have taken risk into account and this is reflected in all works being undertaken in a "dry" environment wherever practicable, careful consideration of weather patterns prior to and during the works period, and also a relatively intense monitoring and audit programme of these activities. With the above in mind, it is assessed that associated risk of these activities will be reduced to a point of being minor.

Design philosophy and principles²⁰

- 40 The erosion and sediment control measures for the Project will be undertaken with the following priority:
- 40.1 Avoidance of effects - through the careful selection of discharge locations, only necessary streamworks being

¹⁶ See 7.2, page 58 of Technical Report G.22.

¹⁷ Chapter 4 of Technical Report G.22.

¹⁸ Roothing projects typically include large scale surface works which discharge, via gravity diversion channels, through treatment facilities. While this Project includes large scale earthworks, the majority of these earthworks are undertaken within a portal depression and surface flows will be to these portal where the only avenue for discharge is via controlled pumping systems.

¹⁹ See page 6 of Technical Report G.22.

²⁰ See section 2, page 5 of Technical Report G.22.

undertaken, and bridge structures used as temporary stream crossings to avoid stream disturbance;

- 40.2 Erosion control – by preventing sediment generation through a range of structural (physical measures) and non-structural (methodologies and construction sequencing) means; and
- 40.3 Sediment control whereby sediment will be captured and treated within specific control measures. Sediment retention ponds (SRPs), including chemical treatment as the primary control method will be used as a priority, followed by decanting earth bunds, super silt fences, and silt fences. Innovative products such as portable cofferdams may also be used.²¹
- 41 As identified above, reclamation and streamworks are prone to a higher risk of sediment generation due to the vicinity of the receiving environment, and will therefore be undertaken in a manner that recognises this risk and the sensitivity of the associated receiving environment. At all times these activities, and any associated activities within these environments, such as ground improvement works in the coastal environment, will be undertaken in a “dry” environment.²²
- 42 As detailed earlier, the Project also includes the installation of a number of stormwater pond and wetland features for both temporary and permanent stormwater treatment from impervious surfaces.²³
- 43 Stormwater management from temporary impervious areas during the construction phase is a separate and unique phase in the water management of the project. It occurs after earthworks have ceased, and erosion and sediment controls are no longer appropriate for that particular catchment area, but before operational long term stormwater controls are in place. Where it is impractical to install separate SRPs, they will be installed in the same location as the stormwater devices.²⁴
- Erosion and sediment control approach²⁵**
- 44 Erosion control is the *prevention* of sediment generation, while sediment control is the management of sediment *after* it has been generated.

²¹ See page 7 of Technical Report G.22.

²² See point 18, page 11 of Technical Report G.22.

²³ See Technical Report G.15 *Assessment of Stormwater and Streamworks Effects*.

²⁴ See point 4, page 8 of Technical Report G.22.

²⁵ See section 5, page 17 of Technical Report G.22.

- 45 Reducing erosion at source leads to a consequential reduction in sediment generation. The proposed erosion and sediment control measures for the Project have been designed to minimise the extent of erosion and sediment yield from the site, and have been designed with TP90 as the minimum standard.
- 46 Of critical importance with this Project is that it includes formation of tunnel portals which create a significant “cut” in the ground. This in itself forms a natural place for runoff and associated sediment to collect, but also creates a unique situation whereby any runoff from these portal locations will need to be pumped to a discharge point. This allows for 100% control of this water prior to any discharge, which is unique in terms of an earthworks project. Surface water will be pumped to treatment devices while any groundwater runoff from within the tunnel will be pre-treated and will also be subject to both pH and turbidity testing, and other contaminants if necessary, to ensure discharges are of a certain appropriate standard prior to discharge. These control measures are considered to go beyond TP 90 standards as detailed in paragraph 41 of this EIC.
- Erosion and sediment control measures***²⁶
- 47 The ESCP details the specific erosion and sediment control measures (*Measures*) for each of the Project Sectors, all of which meet, as a minimum, industry best practice guidelines as reflected in TP90.
- 48 TP90 outlines the regional and industry accepted best practice design guidelines for implementing and maintaining erosion and sediment control measures. In simple terms, if erosion and sediment control measures are implemented in accordance with TP90, there is general acceptance of adequate and appropriate control.
- 49 For the Project, we have recognised the need to go beyond TP90 (as outlined below), and in doing this have provided for an added level of protection to what is typically expected within the Auckland region. The measures which go beyond TP90 include:
- 49.1 Sizing all SRPs, irrespective of slope angle and length of contributing catchment, on a 3 % volume criterion;
- 49.2 Provision of chemical flocculation treatment, based on soil analysis, for all SRPs and all decanting earth bunds. In addition, decanting earth bunds with contributing catchments greater than 500m² will be subject to rainfall activated chemical treatment rather than manual batch dosing;
- 49.3 Dirtywater and cleanwater runoff diversion channels will be sized to allow for the 1% AEP rainfall event to ensure no

²⁶ See section 6, page 33 of Technical Report G.22.

overtopping of these channels occurs. This sizing exceeds TP90 20% AEP criteria;

- 49.4 Any groundwater that accumulates within the two portal locations from the tunnel excavation will be treated at source through a specifically designed container system²⁷ and will then be pumped to a further treatment device at the surface prior to discharge. pH and turbidity meters will ensure that all discharge from these areas achieves a specified water quality standard;
- 49.5 Any surface water runoff that accumulates within the two portal locations will be pumped to a further treatment device at the surface prior to discharge. This pumping can cease if water quality is not considered appropriate;
- 49.6 All sediment retention ponds are fitted with manual decant risers which allow any discharge to cease, and be further treated, if the water quality is not appropriate; and
- 49.7 Works associated with the reclamation activity will be undertaken in a dry environment with the employment of specific portable coffer dams that will ensure coastal tidal water will be isolated from the area of works.
- 50 As expected with projects of this size and nature, it is anticipated that site specific and activity specific erosion and sediment control plans will also be developed which will follow the general principles of the ESCP. These are referred to as Contractors' Erosion and Sediment Control Plans (*CESCPs*).
- 51 The resourcing and appropriate management of the ESCP and associated *CESCPs* is a critical feature that will ensure the success of the overall erosion and sediment control for the Project. This will ensure that adequate resources, commitment and expertise are provided from the start to finish of the Project. Induction and educational processes are critical part of this team approach. The ESCP provides an outline of the responsibilities associated with the ESCP.²⁸
- Monitoring²⁹**
- 52 Once the erosion and sediment controls are in place, ongoing site monitoring by the contractor and the NZTA representative will occur to ensure that those measures have been installed correctly, are

²⁷ Appendix F of Technical Report G.22 Drawing Number 20.1.11-3-D-EN-740-205 Revision B.

²⁸ See Table 5.1, Page 19 of Technical Report G.22.

²⁹ See section 5.3, page 21 of Technical Report G.22.

functioning effectively and are continually improved throughout the works.

- 53 In association with the ESCP, the Ecological Management Plan (*ECOMP*), a sub plan within the Construction Environmental Management Plan (*CEMP*)³⁰, contains a comprehensive monitoring regime which includes:
- 53.1 Freshwater monitoring of:³¹
- (a) Devices to ensure environmental compliance;³²
 - (b) Flocculation to ensure appropriate operation and maintenance; and
 - (c) Habitat including baseline and resurveying of specific locations;³³ and
- 53.2 Coastal marine monitoring of:³⁴
- (a) Suspended solids at construction phase discharge points such as the Oakley Inlet and the causeway; and
 - (b) pH monitoring adjacent to works associated with concrete and grout activities and also chemical treatment.
- 54 Further coastal monitoring will occur associated with ensuring effects on the coastal environment are appropriately managed. This includes monitoring of benthic invertebrate community composition and sediment grain size and quality, as detailed within Section 4.6 of Technical Report G.21.
- 55 If the monitoring programme detects potential adverse impacts on the receiving environment as a result of the Project, the first order response will be to modify environmental control methods, in consultation with the Auckland Council. This will also include assessment of the appropriateness of the level of the discharge standards from the portal areas. Further monitoring will be undertaken to assess the effectiveness of any alterations made to the devices and or methodologies.

³⁰ See Technical Report G.21, Appendix H.

³¹ See section 5.3.1, page 21 of Technical Report G.22.

³² See section 5.3.1.1, page 22 of Technical Report G.22.

³³ See section 4.5 of Technical Report G.21.

³⁴ See section 5.3.2, page 25 of Technical Report G.22.

Conclusions from the ESCP³⁵

- 56 In my opinion, the following are key points in relation to the erosion and sediment control methods proposed for the Project:
- 56.1 The statutory framework and policy guidance from the Council and the NZTA requires the Project operators to be aware of, and ensure, implementation of appropriate erosion and sediment controls including construction and maintenance of these devices;
 - 56.2 NIWA calculations show a relatively low risk of sediment generation for the various Project Sectors. It is accepted that the works associated with the streamworks and reclamation are higher risk and need careful management to ensure that the construction effects are less than minor;
 - 56.3 A range of erosion and sediment control measures are proposed for the Project. These will be implemented at the same location as the interim and long term stormwater structures where possible. They will, at all times, achieve as a minimum the requirements of TP90 and in many circumstances significantly exceed TP90 and consequently allow for a better environmental outcome;
 - 56.4 The erosion and sediment control methodology relies on a CЕСP being submitted at a later date, prior to any earthworks activity taking place. This process will allow for flexibility, contractor innovation and input from various other bodies such as the Auckland Council; and
 - 56.5 Chemical treatment will be used on the site in accordance with the Chemical Treatment Plan provided with the ESCP, and will be in the form of both rainfall activated pumping and manual dosing regimes.
- 57 With the above measures in place, and subject to the proposed earthworks conditions (see below), I consider that overall, any adverse effects on the receiving environment as a result of the Project will be no more than minor.

COMMENTS ON SUBMISSIONS

- 58 I have read submissions lodged on the Project that raise erosion or sediment control or related issues relevant to my area of expertise. A number of these submissions raise the issue of water quality as a concern but provide no specific details of the nature of this concern. In this circumstance, while I have read the submissions in full, I am not in a position to be further aware of the specific concerns that

³⁵ See page 82 of Technical Report G.22.

may exist. Where submitters have raised specific concerns, I address these in turn below.

Coastal Environment

- 59 A number of submissions raise concerns related to impacts on the coastal environment. In particular they wish to see specific measures detailed for this location and ensure that effects do not result on the associated environments.³⁶
- 60 I refer to Appendix E of the ESCP. This includes a series of plans which outlines the construction phasing of works in this environment, including reclamation activities. On key importance is the use of portable coffer dams in this area such that the works will always be undertaken within a dry environment. Further, within Appendix F of the ESCP (and the Coastal Works Report - Technical Report G.23) plans are included which show indicative locations of the various control measures to be utilised with works in the coastal environment, including coffer dam, sheet piling construction, rock toe silt fence and light weight fill. These will be finalised and approved through the development of the Contractors Erosion and Sediment Control Plans.
- 61 I note that the proposed measures result from significant discussion within the Project team, consideration of the value and vicinity of the receiving environment and analysis through site visits. With respect to reclamation and ground improvement works, a trial will be implemented pre-works which will further support the methodologies proposed.
- 62 I further note the monitoring programme within this environment which includes both suspended solids and pH levels. This monitoring includes both during construction activities and, in particular, prior to any pumping of accumulated water from within the impoundment.³⁷ I remain confident that with the proposed measures as outlined within the ESCP, the earthworks and associated construction activities in this area can be undertaken with the effects being no more than minor.

Oakley Creek

- 63 A number of submissions raise the concern related to impacts on Oakley Creek. These range from concerns associated with the effectiveness of erosion and sediment controls to monitoring of the effectiveness of the control measures³⁸.
- 64 When assessing the erosion and sediment controls proposed that discharge to the Oakley Creek, it is considered that these represent

³⁶ For example, Submitter Nos. 17, 55, 120, 158, 211, 222, 224, 231.

³⁷ See section 7.4, Note 8, page 66 of Technical Report G.22.

³⁸ For example, Submitter Nos. 44, 76, 84, 121, 122, 208, 222.

a high level of treatment. All surface water catchments which will be subject to progressive stabilisation (such as the construction yards), will discharge to sediment retention ponds which in turn are subject to chemical treatment. All discharges which flow to the portal locations, including the cut and cover operation along Great North Road, will be pumped to a sediment retention pond. As outlined in the ESCP, these will also be subject to chemical treatment with chemical applied through a pump injection system. This affords total control over the discharge from these portal locations.

- 65 In the circumstance that discharges are not considered acceptable from a water quality perspective, pumping can cease and the sediment retention pond decants can be manually raised to cease discharge and allow for further treatment.
- 66 Where discharges are from catchments that are not able to be treated through sediment retention ponds, they will be treated through either super silt fences or decanting earth bunds. Decanting earth bunds are again chemically treated and service very small catchment areas only. All discharges from sediment retention devices will be directed through a stabilised outfall structure to prevent erosion.
- 67 The construction yard activity, particularly in Sector 9, represents an overall relatively large area of earthworks. However, as outlined in the ESCP,³⁹ these areas are not only protected with erosion and sediment controls, but are subject to immediate stabilisation with hard fill which will have the effect of immediately preventing any sediment generation. Construction yard 7 is a further example where a sediment retention pond will be utilised during formation works and then the area fully stabilised. These construction yards are considered low risk as a result.
- 68 I further note the monitoring programme within this environment which includes devices monitoring, habitat monitoring and regular checks of all control measures. I remain confident that with the proposed measures as outlined within the ESCP, the earthworks and associated construction activities in this area can be undertaken with effects being no more than minor.

ADDITIONAL COMMENTS

Risk Management⁴⁰

- 69 One of the key tools to be utilised within the ESCP is the management of risk. Risk has been recognised and specific locations and activities identified. I am confident that appropriate

³⁹ See section 7.2, page 58 of Technical Report G.22.

⁴⁰ Submitter Nos. 47 and 222.

account has been given to risk management and that this will further be reinforced through the provision of CESCPS and the content of these as proposed through the conditions of consent.

- 70 Within the sediment yield model, I note that SRP efficiency is based on 94% efficiency. This treatment efficiency arose as the result of running a pond model, rather than being a pre-determined model parameter. The model predicted that TP90-sized SRPs dosed with chemical would achieve, on average, a total load reduction of 94% of the total sediment load. This is based on some conditions where the predicted load reduction was more than this and on others less. In some cases, it was not possible to model the performance of individual ponds and in these cases the average 94% figure generated by the modelling work was applied as a load reduction factor.⁴¹
- 71 All SRPs are chemically treated and I concur with the model assumptions in Technical Report G.30⁴² and would expect that with the management approach proposed, a high treatment efficiency will be attained. My opinion is further reinforced due to the fact that the Project is not a typical construction earthworks project. It includes two significant portal locations which essentially are large holes in the ground from which we need to pump all discharge. There is total control over this discharge, and there will be both pH and turbidity meters to ensure pumping only occurs when certain water quality standards are reached.

Stormwater Diversion and Discharge⁴³

- 72 As outlined earlier in my evidence, the ESCP only considers the activities that will occur during the construction phase, with the stormwater diversion and discharge considered within the Assessment of Stormwater and Streamworks Effects Report.⁴⁴ As explained however, in many circumstances the linkages between the ESCP and the Assessment of Stormwater and Streamworks Effects have resulted in treatment devices being utilised for dual purposes. These are shown within the Erosion and Sediment Control Plans within Appendix F of the ESCPS.
- 73 Streamworks activities associated with the Oakley Creek realignment will occur in Sector 9. These are largely constructed outside of the 1% AEP flood plain. Where works are to occur within a flood plain area, the construction activities will follow the methodologies within the ESCP.⁴⁵ This methodology centres around

⁴¹ Technical report G.31.

⁴² *Assessment of Associated Sediment and Contaminant Loads.*

⁴³ Submitter Nos. 50, 110, 174, 239, 247.

⁴⁴ Technical Report G.15.

⁴⁵ See page 63 of Technical Report G.22.

undertaking the realignment earthworks outside of the main channel, careful management of the time when works are undertaken and progressive stabilisation including daily cover during rainfall events.

- 74 The final stream realignment and stream profile, including details of the flood plain analysis at that time, is detailed within Technical Report G.15.

General

- 75 I consider that the ESCP methodologies and plans provided demonstrate a robust erosion and sediment control programme for the Project. They represent a programme that can be implemented and will provide certainty to the community and the environment that effects from earthworks will be no more than minor.

PROPOSED EARTHWORKS CONDITIONS

- 76 In the documentation lodged with the AEE, the NZTA included a set of Proposed Consent Conditions (see Part E, Appendix E.1). This included proposed earthworks conditions, which I recommended would be appropriate. Nothing I have read in submissions causes me to alter my assessment and I remain supportive of the conditions as currently worded. The conditions are reproduced in full in **Annexure A** to my evidence.

A handwritten signature in black ink on a light grey background. The signature reads "G.O. Ridley" in a cursive, slightly slanted script.

Graeme Ridley
November 2010

Annexure

Annexure A: Proposed Earthworks Conditions

ANNEXURE A: PROPOSED EARTHWORKS CONDITIONS⁴⁶

E.1	<p>Pre-construction conditions</p> <p>The NZTA shall inform the [Auckland Council] in writing at least 10 working days before the start date of the works authorised by this Consent.</p>
E.2	<p>Prior to commencement of works, in each period between October 1 and April 30 that this Consent is exercised, a pre-construction site meeting between [Auckland Council] and relevant parties, including the primary contractor, shall be conducted. The approved Contractors Erosion and Sediment Control Plan (CESCP) as per Condition E.5 of this Consent shall be made available and discussed at the pre-construction meeting.</p>
E.3	<p>Erosion and Sediment Control Conditions</p> <p>Erosion and sediment control shall be in general accordance with the plans and information submitted with the application, and in particular, Technical Report G.22 <i>Erosion and Sediment Control Plan</i>, subject to such amendments as may be required by the following conditions of this Consent.</p>
E.4	<p>A detailed schedule of construction activities shall be prepared and forwarded to the [Auckland Council] prior to the commencement of works, and updated at 3 monthly intervals during the works. These schedule shall include details of:</p> <ul style="list-style-type: none"> (a) The location, commencement date and expected duration of any major earthworks operations, including but not limited to, the portal excavations and the Great North Road cut and cover operation; and (b) The proposed construction and methodology, including staging of earthworks.
E.5	<p>Prior to the commencement of works for each specific area and/or activity, a "Contractors Erosion and Sediment Control Plan" (CESCP) shall be prepared. This document shall follow the principles and practices within Technical Report G.22 Erosion and Sediment Control Plan and shall detail any specific variations from that report. The CESCPs shall include, but not be limited to:</p> <ul style="list-style-type: none"> a) Contour information at suitable intervals; b) Erosion and sediment controls including specific pond design; c) Supporting calculations; d) Catchment boundaries for the sediment controls; e) Location of the works, and cut and fill operations; f) Details of construction methods to be employed, including timing and duration; g) A programme for managing exposed area, including progressive stabilisation considerations; h) The identification of appropriately qualified and experienced staff to manage the environmental issues onsite; i) The identification of staff who have clearly defined roles and responsibilities to monitor compliance with the Consent Conditions and CESCP; j) Provision of details of a chain of responsibility for managing environmental issues and details of responsible personnel; and k) The establishment of a sediment control team (including representatives from the contractor, [Auckland Council] and the NZTA) to meet and review erosion and sediment control on a weekly basis.

⁴⁶ Contained in AEE, Part E, Appendix E.1, page 49.

E.6	For each specific area of works, a CЕССР shall be submitted a minimum of 20 working days prior to earthworks commencing, for the written approval of the [Auckland Council], which shall be obtained prior to earthworks commencing. The approved CЕССР shall be implemented accordingly.
E.7	Any amendments to the CЕССРs must be approved by the [Auckland Council] in writing prior to any amendment being implemented.
E.8	Erosion and sediment control measures shall be constructed and maintained in accordance with ARCs Technical Report 90 (TP90) (and any amendments to that document), except where a higher standard is detailed in the documents referred to in Conditions E.3 and E.5 above, in which case the higher standard shall apply.
E.9	The NZTA 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 at the portal location. On completion of 3 months of the monitoring programme this water quality standard shall be applied to the treatment pump system and set at a limit that reflects the monitoring results. The monitoring programme shall be developed by the NZTA and approved by the [Auckland Council] prior to any tunnel excavation works commencing. Initial pump treatment standards shall be set at a turbidity of 50NTU and pH of 7.5. Ongoing monitoring and changes to the turbidity and pH standards shall be implemented with the approval of the [Auckland Council].
E.10	All 'cleanwater' runoff from stabilised surfaces, including catchment areas above the site, shall be diverted away from earthwork areas via a stabilised system, so as to prevent surface erosion.
E.11	All perimeter controls shall be operational before earthworks begin.
E.12	Prior to the construction of sediment retention ponds, super silt fences or other devices approved by the [Auckland Council] shall be constructed below the entire area of the sediment retention pond footprint.
E.13	The NZTA shall ensure that procedures are adopted to prevent the deposition of slurry, clay or other materials on the roads by vehicles leaving the site. Should the exercise of this Consent result in material being deposited on the road, that material shall be removed immediately to the satisfaction of the [Auckland Council].
E.14	Notice shall be given to the [Auckland Council] prior to any erosion and sediment control measures being removed and/or on completion of the works.
E.15	Prior to the commissioning of chemical treatment for sediment management purposes (as per condition E16) the NZTA shall provide [Auckland Council] with a Chemical Treatment Plan (CTP), for the written approval of the [Auckland Council]. The CTP shall follow the principles and chemical treatment details outlined within the Technical Report G.22 Erosion and Sediment Control Plan and shall include as a minimum: a) Specific design details of the chemical treatment system; b) Monitoring, maintenance (including post-storm) and contingency programme (including a Record Sheet); c) Details of optimum dosage (including assumptions); d) Results of the initial flocculation trial which will build on the information within Technical Report G.22 Erosion and Sediment Control Plan; e) A spill contingency plan; f) Details of the person or bodies that will hold responsibility for long-term maintenance of the flocculation treatment system and the organisational structure which will support this structure.

	Any amendments to the CTP shall be approved by the [Auckland Council], in writing, prior to implementation.
E.16	All sediment retention ponds and decanting earth bunds are to be chemically treated in accordance with the Chemical Treatment Plan required under Condition E.15 of this consent.
E.17	<p>Prior to bulk earthworks commencing, a certificate signed by an appropriately qualified and chartered professional engineer (“as built”) shall be submitted to [Auckland Council] to certify that the erosion and sediment controls have been constructed in accordance with the CЕСCP as specified in Condition E.5 of this consent. Certified controls shall include sediment retention ponds, chemical treatment systems, decanting earth bunds, super silt fences, silt fences and diversion channels/bunds. The certification for any subsequent measures shall be supplied to the [Auckland Council] immediately upon completion of construction of those measures.</p> <p>Information supplied to [Auckland Council], if applicable shall include:</p> <ol style="list-style-type: none"> a) Contributing catchment area; b) Retention volume of structure (dead storage and live storage measured to the top of the primary spillway); c) Shape of structure (dimensions of structure); d) Position of inlets/outlets; and e) Stabilisation of the structure.
E.18	A copy of the “as-built(s)” and approved CЕСCP’s shall be kept on site, and all erosion and sediment control measures (including staging boundaries and particularly the extent of exposed areas) shall be updated as soon as practicable as changes are made. As-built plans shall be accompanied by text detailing the relevant earthworks methodology, constraints and likely progressions, and shall be revised as required to enable clear interpretation as to the day to day operation and management of erosion and sediment controls.
E.19	<p>Monitoring</p> <p>The NZTA shall carry out monitoring in accordance with the Technical Report G.22 Erosion and Sediment Control Plan and the approved CЕСCP and shall maintain records detailing:</p> <ol style="list-style-type: none"> a) The monitoring undertaken; b) The erosion and sediment controls that required maintenance; c) The time when the maintenance was completed; and d) Areas of non-compliance with the erosion and sediment control monitoring plan (if any) and the reasons for the non-compliance. <p>This information shall be made available to the [Auckland Council] upon request.</p>
E.20	<p>Stabilisation</p> <p>The site shall be stabilised against erosion as soon as practicable, and in a progressive manner, as earthworks are finished over various areas of the site.</p>
E.21	<p>The NZTA shall ensure that the following earthworks shall be stabilised as soon as practicable after completion thereof, or within 5 working days of completion, whichever shall occur first:</p> <ol style="list-style-type: none"> (a) Temporary erosion and sediment controls; and (b) Construction yards.

E.22	<p>Seasonal Restriction</p> <p>No surface earthworks on the site shall be undertaken between 1 May and 30 September in any year, without the written approval of the [Auckland Council]. Earthworks in this regard refers to bulk earthworks (cut/fill/waste) associated with the site.</p>
E.23	<p>Revegetation/stabilisation shall be completed by 30 April in the year of bulk earthworks in accordance with measures detailed in the approved CЕСCP, unless a later date is approved in writing by the [Auckland Council] Manager at least two weeks before 30 April.</p>