Before a Board of Inquiry
MacKays to Peka Peka Expressway Proposal

under: the Resource Management Act 1991

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

applicant: **NZ Transport Agency**
Requiring Authority

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

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STATEMENT OF EVIDENCE OF GRAEME RIDLEY FOR THE NZ TRANSPORT AGENCY

QUALIFICATIONS AND EXPERIENCE

1 My full 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, 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 (Draft Only) (*Wellington Guidelines*) 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 worked as a hearing commissioner for a number of hearings around New Zealand. This has included acting as a hearing commissioner for projects such as the Tauranga Eastern link Project and the Rangiriri Bypass (Waikato), where I provided, amongst other things, technical and policy assessment of erosion and sediment control methodologies for the developments.

3 My evidence is given in support of the Notice of Requirement (*NoR)* and applications for resource consent lodged with the Environmental Protection Agency (*EPA)* by the NZ Transport Agency for the construction, maintenance and operation of the MacKays to Peka Peka Expressway (the Project).

4 I am familiar with the area that the Project covers and the State highway and local roading network in the vicinity of the Project. I

have visited the Project area on numerous occasions and have walked the majority of the alignment to ensure familiarity with topography, soils and receiving environments.

5 I am the author of the Erosion and Sediment Control Plan (the *ESCP*) lodged in support of the Project.[1]

6 I have read the Code of Conduct for Expert Witnesses as contained in the Environment Court Consolidated Practice Note (2011), and I agree to comply with it as if this Inquiry were before the Environment Court. My qualifications as an expert are set out above. I confirm that the issues addressed in this brief of evidence are within my area of expertise. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

7 My evidence will deal with the following:

7.1 Executive summary;

7.2 Background and role;

7.3 Potential effects of erosion and sediment discharge ;

7.4 Erosion and sediment control plan approach;

7.5 Proposed erosion and sediment control measures;

7.6 Proposed monitoring;

7.7 Response to submissions;

7.8 Response to section 149G Key Issues reports;

7.9 Proposed conditions; and

7.10 Conclusions.

[1] Appendix H of the Construction Environmental Management Plan (CEMP).

8 Erosion and sediment control is a construction phase issue and the ESCP only considers the activities that will occur during this construction phase. This is distinct from stormwater management which relates to longer term stormwater diversion and discharge from the operational motorway, and also the short term stormwater diversion and discharge that will occur during the construction period from temporary impervious surfaces. Importantly erosion and sediment control is focused on the reduction and minimisation of construction related erosion followed by the capturing and retaining, to the maximum extent possible, of any sediment that has resulted from any erosion.

EXECUTIVE SUMMARY

9 In my opinion, the following are key points in relation to the erosion and sediment control methods proposed for the Project:

9.1 The statutory framework and policy guidance from the respective Councils and the NZTA requires that the Project constructors be aware of, and ensure, implementation of appropriate erosion and sediment controls (including construction and maintenance of these devices);

9.2 USLE calculations show an acceptably low risk of sediment yield for the Project following the implementation of the erosion and sediment control measures proposed. It is accepted that the works associated with the steeper areas of the Project and streamworks are higher risk and need more careful management to ensure that the construction effects in terms of sediment load are less than minor;

9.3 A range of erosion and sediment control measures are proposed for the Project. These will be implemented at the same location as the short term and long term stormwater structures where possible. At all times, these measures will achieve as a minimum the requirements of the Wellington Guidelines and in many instances exceed these and consequently achieve a better environmental outcome;

9.4 The erosion and sediment control methodology relies on the sector specific Construction Erosion Sediment Control Plans (CESCPs) 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 Greater Wellington.

10 With the above measures in place, and subject to the proposed earthworks conditions (discussed below), I consider that overall, any adverse sediment generation effects on the receiving environment as a result of the Project will be no more than minor.

11 I have reviewed submissions lodged on the project relevant to my area of expertise. Nothing raised in those submissions causes me to depart from the conclusions reached in my technical assessment of the Project.

BACKGROUND AND ROLE

12 The NZTA retained Ridley Dunphy Environmental Limited as part of a consortia team to assist with the erosion and sediment control aspects of the Project. I prepared the ESCP to address the management of erosion and sediment effects during the construction period. I was assisted in the preparation of the ESCP by Mr Andrew Goldie (Fletcher Construction Limited) and Mr Stan Goodman (Goodman Contractors Limited).

13 The ESCP is referred to within the Project application framework as Appendix H of the Construction Environmental Management Plan (*CEMP*).

14 Through the development of the ESCP, I had ongoing discussions with members of the wider Project team. Of particular relevance to the ESCP development are the following reports:

14.1 Construction Methodology Report (Technical Report 4);

14.2 Assessment of Construction Air Quality Effects (Technical Report 14);

14.3 Assessment of Groundwater Effects (Technical Report 21);

14.4 Assessment of Hydrology and Stormwater Effects (Technical Report 22);

14.5 Assessment of Land and Groundwater Contamination Effects (Technical Report 23);

14.6 Baseline Water and sediment Quality Investigation (Technical Report 24);

14.7 Contaminant Load Assessment (Technical Report 25);

14.8 Ecological Impact Assessment (Technical Report 26); and

14.9 Construction Environmental Management Plan (Volume 4 of the AEE).

15 I have also attended, and contributed to, a number of specific workshops associated with the Project where erosion and sediment control has been discussed. As noted earlier, I have visited the Project area and have viewed the various receiving environments, have walked the proposed alignment and have assessed the various options associated with erosion and sediment control.

16 The ESCP was peer-reviewed by **Mr Andrew Goldie**, Fletcher Construction Limited,[2] who provided ongoing input throughout the ESCP development. Comments from the peer review have been incorporated into the ESCP.

17 As noted above, the ESCP forms part of the CEMP[3] 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

[2] Mr Goldie is a Civil Engineer and as the Construction Manager for the Project is responsible for formulating the construction programme, construction sequencing and the development of operational methodologies for the designed works.

[3] See Volume 4 of the AEE.

assessment of environmental effects and to provide guidance to construction contractors during the construction phase.

18 The ESCP only considers the activities that will occur during the construction phase. The Assessment of Hydrology and Stormwater Effects[4] considers the activities that will occur longer term (i.e. the stormwater diversion and discharge from the operational motorway), and also the short term 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 situations and locations the linkages between the ESCP and the Assessment of Hydrology and Stormwater Effects have resulted in stormwater treatment devices being utilised for dual purposes. These are shown within the Erosion and Sediment Control Plans within Appendix H.B of the ESCP.

19 The ecological effects of sediment discharge are detailed within a separate ecological report.[5] That report identifies, from the ESCP, the potential sediment generating activities (and locations) and the magnitude of sediment yields that may enter the various receiving environments, which enables assessment of potential impacts of the sediment discharge on these environments. I also note that, as part of the development of the ESCP, full consideration of land and groundwater contamination was provided for. This is reflected within Technical Report 23 *"Assessment of Land and Groundwater Contamination Effects"*

20 The ESCP was lodged with the EPA on 20 April 2012 as part of the overall Assessment of Environmental Effects Report (*AEE*) for the Project.[6]

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4 Technical Report 22.

5 Technical Report 26.

6 The ESCP was accompanied by sets of Drawings included in AEE, Volume 5: Plan Set (Management Plan Appendices).

POTENTIAL EFFECTS OF EROSION AND SEDIMENT DISCHARGE

21 The site generally has peat soils overlaying sand layers in addition to areas of sand dominant soils. Peat is essentially an accumulation of partially decayed vegetation matter that has formed when plant material is inhibited from decaying fully by the acidic conditions. Peat is soft and easily compressed and, under pressure, water in the peat is forced out. For the ESCP, it is important to recognise that the peat has a high groundwater table which can limit the types of erosion and sediment controls that can be utilised.

22 Further, the areas of sand-dominant soils in many locations within the Project create an environment that requires specific management from an erosion and sediment control perspective. These sand soils are subject to significant infiltration, can erode relatively easily if surface runoff occurs, however they also settle very quickly within a water column. Permeability rates of sand are well recognised as significantly higher than that of clay based soils[7] and within the Project much of these areas are expected to experience minimal runoff at all times.

23 From a risk management perspective, I consider that the steeper areas of the site present a higher erosion risk and in this regard need to be carefully managed and monitored over time. These areas have been clearly identified within the ESCP.[8]

24 Streamwork activities are also higher risk activities, which need to be protected through the minimisation of discharges and the implementation of erosion and sediment control measures over and above those typically implemented for erosion and sediment control.

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[7] Personal communication Goodman Contractors confirmed where they have worked in these specific sand locations with no ponding or runoff ever experienced in un-compacted sand.

[8] Drawings CV-CM 272 to 282 - AEE, Volume 5: Plan Set (Management Plan Appendices).

EROSION AND SEDIMENT CONTROL PLAN APPROACH

25 In this section of my evidence I summarise the key points of the ESCP approach and the principles underlying it. The ESCP contains specific design detail and methodology related to erosion and sediment control for construction activities.[9]

26 I prepared the ESCP to:

26.1 Describe the methods required to be used to minimise the effects of sediment generation on the aquatic receiving environment;

26.2 Support the assessment of environmental effects; and

26.3 Provide minimum requirements to construction contractors about developing site specific Construction Erosion and Sediment Control Plans (*CESCPs*) prior to construction, that are consistent with the ESCP.

Planning Framework[10]

27 During construction activities, the ESCP will require that erosion and sediment control measures will be put in place to minimise potential adverse effects by utilising measures which meet industry best practice guidelines such as reflected by the Greater Wellington Regional Council's Erosion and Sediment Control Guidelines for the Wellington Region, September 2002 (*Wellington Guidelines*).

28 The draft NZTA Erosion and Sediment Control Standard for State Highway Infrastructure dated August 2010 (*NZTA Draft Standard*)[11] has also been considered to the extent relevant. As the NZTA Draft Standard provides no specific management techniques or direction with respect to peat soils, I have adapted the erosion and sediment control measures for the soil types that will be encountered. This adaptation reflects my experience with other similar earthworks and

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9 See in particular Section 6 (Specific erosion and sediment control methodology) and Section 7 (Activity details and methodologies).

10 Refer Sections 3 and 8 of the ESCP.

11 Located at http://www.nzta.govt.nz/consultation/erosion-sediment-control/index.html

soil types and what I consider to be best practice. The NZTA Draft Standard outlines the issues associated with wind erosion and dust management and these have been considered, and incorporated as relevant, for the management of the sand soils.

29 As is the case for projects of this size and nature, it is expected that site and activity specific erosion and sediment control plans will be prepared which will follow the principles of the ESCP as a minimum requirement to be complied with. These are referred to as CESCPs.[12]

30 Under the ESCP (and the specific CESCPs) a variety of measures will be used to manage construction activities and ensure that construction is being undertaken in a way that avoids, minimises or mitigates the effects of sediment generation on the environment. This will include implementation of specific structural (physical measures) and non structural (methodologies and construction sequencing) measures and environmental monitoring.[13]

31 The emphasis through the ESCP has been placed on the non structural methodologies associated with the proposed earthworks. This is due to the prioritisation of the non structural methodologies in avoidance of erosion, prior to implementation of structural control (both erosion and sediment control) measures. Non-structural methodologies include items such as peat replacement methodologies, pre load methodologies and working in appropriate weather windows.

Context for development the ESCP[14]

32 As detailed earlier the site generally has peat soils overlaying sand layers in addition to areas of sand dominant soils, which can limit the types of erosion and sediment controls that can be utilised.

33 Higher risk streamwork locations also require particular attention, and particular focus has been placed on the Waikanae River and the

[12] Refer ESCP Section 2 (Design philosophy and principles) at pages 7 – 8.

[13] Refer ESCP page 20 (and sections 6 and 7).

[14] Refer Section 2 of ESCP.

Te Harakeke/Kawakahia Wetland because of their high ecological values.[15]

34 Sediment will generally arise from the bulk earthworks phase of the Project where there are potential erodible areas exposed by these works and the time required to undertake the works. Bulk earthworks within the Project will however be undertaken according to the soil type which largely determines the construction methodology to be adopted. The methodology therefore includes a staged approach and therefore minimisation of potential erosion. Other land disturbing activities also need to be taken into account when considering potential generation and discharge of sediment. These include stream diversion and culvert placement activities.

Design principles

35 The erosion and sediment control measures proposed for the Project are designed to minimise the extent of soil erosion and any resultant sediment yield. (These measures are detailed later within this evidence). In many circumstances, where I consider there is a greater perceived or recognised environmental risk associated with undertaking the works, I have recommended measures exceeding the Wellington Guidelines.

36 The erosion and sediment control principles are detailed within Section 2 of the ESCP, which sets out:

36.1 General Principles;

36.2 Erosion Control Principles;

36.3 Sediment Control Principles; and

36.4 Streamwork Principles.[16]

37 These principles will be carried through into the CESCPs developed throughout the implementation of the Project.[17]

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15 Refer Ecological Impact Assessment Technical Report 26.

16 Refer ESCP, pages 6 to 11.

17 As required by proposed resource consent condition E.2.

38 Erosion and sediment control measures will be undertaken and implemented with a hierarchy and priority order as follows:

38.1 Avoidance of effects will be the first priority. For example, exposed areas will be limited at any one time, any discharge locations will be carefully selected and streamworks will only be undertaken where they are a necessary component of the Project construction.

38.2 Erosion control (avoidance of sediment generation) will be a priority in all circumstances by preventing sediment generation through a range of structural and non structural means.

38.3 Sediment Retention Ponds (*SRPs*) will be utilised. However, given the nature of the Project, the soil types, the flat contour and the generally high groundwater table; alternative devices will also provide viable and effective solutions such as, for example, rock filters within diversion channels for sand based soils.[18] While chemical treatment will be utilised, the need for this is considered to be limited and it will only be used as a risk management tool.[19] Priority of controls will then be decanting earth bunds, super silt fences and silt fences. Various innovative products may also be used (and could include measures such as filter socks).[20]

39 The earthwork methodologies are based on two key activities being peat replacement and peat preload. These two activities have specific methodologies and processes which will be followed which assist in the avoidance of sediment generation.[21]

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[18] Refer for example to ESCP drawing CV-CM 210 - AEE, Volume 5: Plan Set (Management Plan Appendices).

[19] Based on research undertaken (O*rica Chemnet – Appendix H.L of ESCP)* it is confirmed that there is the ability to chemically treat sediment laden water to help achieve the necessary water quality on an "as required" basis. Chemical treatment will therefore be utilised as a risk management tool and will be based around the use of polyacrylamide contained within flocculant socks.

[20] Principle Number 1c, page 7 of ESCP.

[21] Appendix H.C and H.D of ESCP.

40 No specific discharge water quality standards are pre determined through the ESCP. The discharge from the Project is designed to avoid conspicuous change in the colour or visual clarity of the discharge (after reasonable mixing) in the receiving environment.[22] In addition, there is an ongoing adaptive monitoring programme which includes setting trigger levels for further investigation and potential changes to the erosion and sediment control measures.[23]

Assessment of Risk

41 In estimating sediment yields arising from the Project, I have followed procedures within the Universal Soil Loss Equation (USLE). The USLE provides a measure of the risk of sediment generation and yields, and assists in identifying controls required for managing this risk to the environment from sediment discharges. I have also used USLE as a comparative tool to gain an understanding of the expected increase in catchment wide sediment yields as a result of the proposed earthworks activity. Consistent with my approach, discussions with Greater Wellington Regional Council have confirmed that the USLE should be used as a risk assessment process rather than a specific sediment yield estimation tool for the purposes of determination of specific effects.

42 As noted above, the Project is of flat contour and is predominantly of sand and peat geology. Sand consists of large size particles and while it erodes relatively easily, it also settles very quickly in water. These soil and contour factors are critical in concluding that the sediment generation and eventual sediment yields from the Project will be low as a result.

43 The Project is lineal in nature and will involve works occurring on several fronts and will also be subject to ongoing stabilisation as works progress. It is considered that the key elements of risk for this Project are the exposure of bare land, the receiving environment locations and the value of these receiving environments.

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[22] Principle Number 7, page 8 of ESCP.

[23] Section 5.3 of the ESCP.

44 Key recognised erosion and sediment control risks are:

44.1 Works within and adjacent to watercourses and wetlands such as culvert placement and extensions, stream diversions and bridge works;

44.2 Pumping of sediment laden water from excavations; and

44.3 Stockpiling of excess spoil material.

45 Three recognised key aspects of erosion and sediment control are related to risk of sediment yield:

45.1 Sediment generating potential - this highlights the generation potential of the area in question and is based on slope, slope length, soils, rainfall and erosion control factors.

45.2 Sediment delivery – this relates to the amount of eroded material that is retained on site in depressions and within the site's natural contours prior to it entering any sediment treatment devices.

45.3 Sediment yields – the amount of sediment that actually leaves the site and enters the receiving environment. It is well recognised that this is the key area of interest for environmental management.

46 Specific USLE calculations have been included within the ESCP as detailed within Appendix H.G.

47 The USLE is an accepted estimation tool to be utilised in earthworks projects whereby sediment yields can be calculated for the purposes of risk assessment and comparative analysis.

48 USLE calculates a quantity of sediment generated from a site, or part of a site, and with the calculation of erosion and sediment control efficiencies determines sediment yield. Key factors within the USLE are:

48.1 Rainfall Factor (R) – is a factor that measures the erosive force and intensity of rain in a normal year. The two components of the factor are total energy and the intensity of storms. The 6 hour duration 1 in 2 year storm event is the accepted rainfall figure to be utilised.

48.2 Soil Erodibility Factor (K) – this is measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. This is predominantly driven to soil texture however structure, organic matter and permeability also contribute and are taken into account. The preferred method of calculating this factor is the nomograph method whereby the percentage of clay, silts and sands is utilised.

48.3 Length Slope Factor (LS) – this factor describes the combined effect of slope length and slope gradient and is the ratio of soil loss per unit area on a site to the corresponding loss from a 22.1m experimental plot.

48.4 Cover factor (C) – this is the ratio of soil loss from land under specified crop or mulch conditions to the corresponding loss from bare land.

48.5 Erosion Control Practice factor (P) – is defined as the ratio of soil loss with a given surface condition to soil loss with vertical plowing.

49 While the USLE has recognised limitations however, as detailed above it is accepted as an excellent risk assessment tool.

50 While USLE calculates average soil loss and therefore is often said to underestimate the sediment yields from a site, my experience is that USLE in an earthworks scenario can often overestimate sediment yield. This was recently demonstrated through the Long Bay development in Auckland whereby sediment yields using USLE of approximately 26.3 tonnes were estimated for a part of the site

during earthworks, whereby actual measured yields were significantly lower (at less than one tonne)[24].

51 The significant stabilisation policies, the flat contour and the sandy soil types on the Project all contribute to a relatively low expectation of sediment yields.

52 With respect to the duration of earthworks, I note that for the purpose of the USLE I have assumed a 2 month window as the expected timeframe prior to stabilisation of that specific area of works. Again I emphasise the use of USLE as a comparative analysis tool only. While the 2 month window is the expected duration of exposed surfaces, there will be times where such periods are reduced or exceeded dependent upon site conditions at that time. If the duration of earthworks exceeds that as assumed within the USLE, there is the ability to manage this through the provision of more progressive stabilisation techniques and the implementation of further measures (such as contour drains) to further reduce slope lengths and reduce sediment yields accordingly. Such details will be provided within the CESCPs to be developed. Comparative sediment yields and risks will remain as documented.

53 These USLE figures highlight that, based on a range of assumptions detailed in Appendix H.G, the pre earthworks yields (i.e. existing yields) from the site equate to approximately 4.2 tonnes of sediment over the Project footprint. To allow a direct comparison, this yield is based on the same duration of earthworks as estimated will occur during the construction period for each area of works. During the earthworks phase of the Project, this background level is estimated to increase to a total yield (after capture in sediment control measures) of 16.64 tonnes of sediment, with full erosion and sediment control measures implemented (over an area of approximately 138.8 ha).[25]

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[24] Measured using automatic sampling devices from two of the three sediment retention ponds on site. Measured yields of 0.65 tonnes were recorded for the 2011/2012 earthworks season.

[25] ESCP, page 14.

54 When considered on a catchment wide basis (as defined within the ESCP related to the entire wider catchment areas of the Whareroa, Wharemauku, Waikanae, Waimeha and Ngarara), the USLE allows for a comparative analysis to be undertaken which demonstrates pre earthworks catchment yields[26] of 753 tonnes and during earthworks an increase to 766 tonnes, representing a 1.7 % overall increase. Within the ESCP this is further analysed on a sub catchment basis. Importantly I note that the catchment yields should not be used for specific sediment yield determination but can be used as a comparative analysis tool.

55 The table below highlights the specific USLE calculated sediment yields from the various sub catchment areas:

Sediment Yield (tonnes) Over a 2 Month Period	Project Footprint Pre Earthworks	Whole Catchment Pre Earthworks	Project Footprint During Earthworks	Whole Catchment Less Project Footprint Pre Earthworks	Whole Catchment Including Earthworks Area	% Increase – Pre Earthworks to Earthworks Whole Catchment
Whareroa	0.11	18.17	0.58	18.06	18.64	2.6
Wharemauku	0.87	38.02	4.50	37.15	41.65	9.5
Waikanae	1.16	644.72	3.96	643.57	647.53	0.4
Waimeha	0.16	2.37	0.77	2.20	2.97	25.3
Ngarara	1.90	50.56	6.83	48.66	55.49	9.8
TOTALS	4.21	753.84	16.64	749.63	766.28	1.7

56 Provided the methodologies and practices are implemented according to the ESCP, I am confident that a low sediment generation and a high efficiency of sediment capture will occur within the Project footprint.

57 This was further emphasised through a peat replacement trial that was undertaken as part of the Project[27] where the nature of the works demonstrated that sediment treatment efficiencies will be high. I further note that, from my experience with water quality

[26] Note this is based on USLE only and does not account for any streambank or streambed erosion.

[27] Appendix H.N of ESCP and Section 7.3 of ESCP.

monitoring programmes from other earthworks activities (as per my earlier evidence) the USLE can overestimate sediment generation and yield calculations.

58 I also note that the water column settlement tests undertaken on the peat soil (used to demonstrate the effectiveness of polyacrylamide chemical treatment) support the high efficiency rate used in the USLE calculations.[28] Samples tested showed turbidity of less than 50 NTU[29] after 10 mins with treatment. Further, sand soils settled very quickly without the need for chemical flocculants. The ESCP provides that the use of chemical flocculation is an option that will be used only as necessary[30] and the CESCPs will outline this specific requirement as necessary.

59 For the purposes of the USLE, the Project has been considered in various slope classes and it can be stated that those areas of greater slope typically present a higher risk of sediment yield. Accordingly during earthworks activities, the ESCP provides for these slopes to be reduced and batter slopes progressively stabilised.[31] I note the importance of ensuring that these steeper areas receive a degree of focus to ensure the slope lengths are reduced and progressive stabilisation occurs on a proactive basis.

60 While overall the USLE provides a comprehensive overview of potential sediment yields, it is recognised as theoretical only and the maximum value is gained through the comparative analysis of the yields calculated (as provided for within the USLE calculations within Appendix H.G of the ESCP). USLE calculations should continue to be undertaken as more specific details of Project material and location

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28 Appendix H.L of ESCP.

29 NTU refers to Nephelometric Turbidity Units – a unit of measurement quantifying the degree to which light travelling through a water column is scattered by the suspended particles. The scattering of light increases with a greater suspended load.

30 Section 7.12 of ESCP.

31 Stabilised is defined within the Wellington Guidelines as "*An area sufficiently covered by erosion-resistant material such as a cover of grass, or paving by asphalt, concrete or aggregate in order to prevent erosion of the underlying soil"* and typically is defined as achieving an 80% ground cover over 100% of the area of concern.

are obtained and should continue to form part of the implementation risk assessment process.

61 The plans provided in the ESCP[32] highlight the various slope classes and therefore the areas of potentially higher sediment generation. In recognition of this increased risk, comprehensive methodologies have been developed, progressive stabilisation of bare earth will be implemented and seasonal timing and duration of operations are key considerations.[33]

62 I also note that from an overall risk perspective, some earthworks areas will be open for only very short periods of time (for example peat excavation locations will be backfilled with a sand layer on a daily basis) which in itself will largely prevent sediment generation.

63 Overall, best practice techniques will be employed during all works with particular emphasis on higher risk activities and locations.

64 With respect to the streamworks activities which I have identified as a particular risk area, the methodologies require that all works be undertaken in a "dry" environment (such that all stream flows are either pumped or diverted around the area of disturbance and works) 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.[34] With the above in mind, I consider that the associated risk of these activities will be adequately reduced.

PROPOSED ESCP MEASURES

65 The erosion and sediment control measures contained within the ESCP for this Project are based on:

65.1 Viewing the proposed Project works such that all construction activities, and the full effects of these construction activities, are considered as a package.

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[32] Appendix H.F of ESCP.

[33] Sections 5.4, 7.2 and 7.4 of ESCP.

[34] Section 5.3 of ESCP.

65.2 Minimising potential adverse effects by utilising measures which meet or exceed industry best practice guidelines.

65.3 Undertaking pre-construction meetings for specific stages of work and having regular toolbox meetings on site with relevant key construction personnel as part of the construction phase.

65.4 Maintaining a register of control measures and "As Built" information of key controls (such as diversion bunds and sediment retention ponds) to allow for quick referencing and understanding of erosion and sediment control measures, and as a result assisting with identification of issues, monitoring outcomes, remedial works and associated ongoing improvements. These aspects in themselves will assist with ensuring sediment generation is minimised.

65.5 Including both structural and non-structural elements within the methodologies to be employed such as:

- Diversion channels and rock filters;
- Manually raised decant devices on SRPs;
- Chemical treatment utilising polyacrylamide as a risk management tool;
- Proactive monitoring programme;
- Risk identification and management accordingly;
- Progressive stabilisation as works progress ;
- Weather response; and
- Ensuring contracting staff are aware of the erosion and sediment controls employed and do not remove them without seeking appropriate approval.

66 For this Project, the ESCP has a focus on managing sediment from land disturbing activities. This includes sediment generated by pumping water from peat excavations due to the high natural groundwater levels (which will be a key activity on the site). In this circumstance water will be pumped through treatment devices and then will also discharge overland prior to entry into surface water bodies. This is a key treatment train approach and will also assist

with issues such as increasing dissolved oxygen levels in any discharge. It is expected (from the site visits and field investigations) that a large percentage of this water will actually percolate back into the groundwater prior to entering a surface water body.

67 The ESCP contains detailed methodologies which focus on the prevention of adverse effects from the following key activities:[35]

- Peat replacement;
- Works within sand environment;
- Pre load activities;
- Works in swales / overland flow paths and placing pipes away from watercourses;
- Culvert extensions;
- Bridge construction;
- Temporary and permanent stream diversions;
- Stone Columns;
- Rip rap placement;
- Wetland and Flood Storage Facilities;
- Pumping;
- Chemical Treatment;
- Pile Construction; and
- Construction Yards.

Sediment retention ponds

68 The sediment retention ponds (*SRP*) are all based on a 2% volume criterion[36] due to compliance with both the Wellington Guidelines and the NZTA Draft Erosion and Sediment Control Standard, the nature of the soil types and in particular the high infiltration of the sand soils, flat contour and discussions held with Greater Wellington. In addition soil settling analysis has confirmed that this volume criterion is adequate to achieve a high standard of water quality discharge in recognition of the receiving environment values. Where the SRP is to form the same footprint as the permanent stormwater pond, the permanent stormwater pond outlet will be

35 ESCP, Section 7.

36 2% volume criteria equates to $2m^3$ of storage within the sediment retention pond for each $100m^2$ of contributing catchment area.

isolated from the SRP feature by the formation of a temporary bund. The SRP will then be established and discharge via a typical sediment retention pond design outlet into the permanent stormwater outlet.[37]

Dust[38]

69 Earthworking activities of the Project have the potential to generate dust that may be considered to be a nuisance in times of dry and windy weather particularly when working in sand soil environments.

70 The main practice to be used to control construction dust on the Project is the application of water to keep soil moisture high enough to prevent dust generation. Also, the timing of works can be crucial for dust management. If the earthworks can be carried out during the wetter winter season then dust control will be less of a problem.

71 In addition, stabilised haul roads will be utilised wherever construction traffic is likely to damage existing stabilised areas. These haul roads will be constructed from sand backfill with a progressive cover of clean granular material as the works progress.

72 Mulch, including both the use of hay/straw mulch and wood mulch will also be utilised to assist with dust management (in particular with respect to stockpiles and batter establishment).

73 Where dust generation is the predominant issue then water carts will be utilised as the initial treatment option. This in particular applies to the batter slopes which will also be subject to stabilisation. For pre load activities, short term batters (expected duration less than 6 months) will have a final layer of clean granular material applied over sand to prevent wind disturbance of the surface while longer term batter slopes (greater than 6 months) will have topsoil and grass established. For final cut slopes, stabilisation will be through the use of topsoil and grass from the top of the slope downwards as the cut progresses.

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[37] Drawing Number CV- CM 248 in Appendix H.I of ESCP - AEE, Volume 5: Plan Set (Management Plan Appendices).

[38] Refer Section 5.4 of ESCP.

Chemical treatment[39]

74 Peat soil samples were collected from along the Project alignment and tested for soil particle size and also subject to bench tests with numerous flocculants by Orica Chemnet Limited. The purpose of this sampling was to determine whether chemical treatment was required to improve water quality. The testing confirmed that unassisted soil particle settlement was satisfactory and so chemical treatment is not likely to be required as a primary tool for the erosion and sediment control methodologies. The pH levels of the samples tested were considered low at between 4.09 and 4.01.[40]

75 Within the ESCP I have recommended that, where chemical treatment is considered necessary, the Project does not use an aluminium based coagulant (such as Poly Aluminium Chloride or Aluminium sulphate) due to the relatively low starting point pH and the need to either pre-treat or post-treat the impounded runoff. Polyacrylamide was shown to be effective on the peat soil samples without the associated pH problems.[41]

76 I note that polyacrylamide will degrade in the environment in 24 to 48 hours in low concentrations. Further, these scenarios are typically lower than the NZ drinking water standard[42] (which allows for 0.5ppm polyacrylamide dosing into a drinking water plant for public consumption).

77 In my opinion, as a back up to unassisted settlement, the use of polyacrylamide provides a realistic option for ensuring that water quality expectations, related to suspended solids and turbidity, can be achieved.

Sector Approach

78 In the ESCP I assessed each of the four identified sectors within the Project and provided specific erosion and sediment control

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39 Refer Section 7.12 of ESCP.

40 A pH of 7 is neutral. A pH below 7 is acidic and above 7 is basic or alkaline.

41 Section 7.12 of ESCP and Appendix H.L of ESCP.

42 Drinking Water Standards for New Zealand 2005 (revised 2008), Ministry of Health.

methodologies and plans that will apply in these cases.[43] While CESCP's will be developed in future for each stage of works prior to implementation, this sector by sector analysis has allowed for identification of any key areas and methodologies that will apply.

79 **Sector One** runs from chainage 1900[44] to 4500 and includes preloading activity and a number of culvert extensions. Both preload and culvert extension erosion and sediment control methodologies will be followed as per the ESCP. Sediment retention ponds will also be established[45].

80 **Sector Two** runs from chainage 4500 to 8300 and includes pre loading up to Kāpiti Road, north of which some peat replacement will occur. Both preload and peat replacement erosion and sediment control methodologies will be followed. In addition, six Sediment Retention Ponds will be established.[46]

81 Long term stormwater wetland features are to be utilised as a short term construction sediment retention pond where practical. These are identified within the ESCP to assist with reduction of earthworks activity, unnecessary development of further control measures and efficiencies with implementation.[47] Where the long term stormwater wetland features are to be utilised as a short term construction sediment retention pond, it is expected that these long term facilities will be established early in the Project to enable utilisation as outlined during construction activities. [48]

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43 Refer Section 6 of ESCP.

44 Chainages are distances measured in metres along the Proposal alignment starting with zero at MacKays crossing and increasing as you travel north.

45 As outlined within Drawing CV CM 248 within Appendix H.I of ESCP.

46 ESCP – Section 6.2: Sector Two (Drawings CV CM 205 to 212 - AEE, Volume 5: Plan Set (Management Plan Appendices)).

47 On some projects long term stormwater features are not suitable to be utilised for short term sediment control measures due to timing of earthworks and development of impervious surfaces, design differences and maintenance obligations. These issues are not considered to be significant in the context of the erosion and sediment control in this Project and have been confirmed as appropriate within the construction methodology.

48 ESCP – Section 6.2, page 29 (Example at Drawing CV CM 212 - AEE, Volume 5: Plan Set (Management Plan Appendices)).

82 **Sector Three** runs from chainage 8300 to 12400. Both peat replacement and preload erosion and sediment control methodologies will be utilised including the use of sediment retention ponds, topsoil bunds and decanting earth bunds.[49] North of Otaihanga Road, a large area of sand works will utilise the methodology associated with the permanent swale drainage system and the use of rock filters spaced at 100m centres.[50]

83 **Sector Four** from chainage 12400 to 18050 includes a large proportion of the work occurring directly in sand plus additional pre load and peat replacement. These will all be undertaken in accordance with the relevant erosion and sediment control methodologies and utilisation of the permanent drainage swales and rock filters features within this sector.[51]

84 The relatively large stream diversion that is required north of the Ngarara Road is to be fully established in the "dry", and only once a fully stabilised channel is established will stream flows be directed into the new channel alignment. Once the stream diversion is operational, as an early part of the works in this location, it will be fully protected with super silt fence. Further to this, a permanent diversion of the Kakariki Stream is also required in this location. This will involve some ground improvement work which will be undertaken outside of the stream channel and the stream flow diverted to the new channel once full stabilisation has occurred to allow for bridge construction in the "dry".

85 New wetland and offset flood storage facilities are to be established along the Project alignment for treatment purposes and their construction will be undertaken in accordance with the methodologies outlined in the ESCP.

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[49] ESCP – Section 6.3: Sector Three. (Drawings CV CM 212 to 217 - AEE, Volume 5: Plan Set (Management Plan Appendices)).

[50] Example at Drawing CV CM 214 - AEE, Volume 5: Plan Set (Management Plan Appendices).

[51] Drawings CV CM 217 to 229 - AEE, Volume 5: Plan Set (Management Plan Appendices).

PROPOSED MONITORING

86 Section 5 of the ESCP describes the various types of monitoring proposed for this aspect of the Project.

87 As part of the ESCP methodology, ongoing site monitoring by the Project team will occur to ensure that the proposed erosion and sediment control measures have been installed correctly, and that required methodologies are being followed and are functioning effectively throughout the duration of the works. Weather forecast monitoring will also ensure that critical works such as those associated with stream diversions only occur during a suitable weather window.

Freshwater monitoring

88 The freshwater monitoring programme has two critical components, being "devices" monitoring and "habitat" monitoring. In addition baseline monitoring, scheduled monitoring and triggered monitoring will occur throughout the Project implementation.

89 Baseline surveys will define the antecedent conditions within the Project area by measuring preconstruction environmental (including ecological) variables. Scheduled monitoring will be undertaken during the construction period and triggered monitoring will occur when pre-determined thresholds are exceeded.

Devices monitoring

90 Environmental compliance for the Project during the construction period is based upon the appropriate installation, location, maintenance, and monitoring of control devices.[52] I also note the importance of ensuring that work practices and methodologies (such as having dedicated erosion and sediment control staff, monitoring checklists and specific construction methods) form part of the construction process and need to be checked to ensure success and effectiveness is achieved.[53]

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[52] ESCP Section 5.3.2, page 21.

[53] ESCP Section 5.2, page 20.

91 'Devices' monitoring comprises the monitoring of on-site construction activities, but more particularly the monitoring of on-site structures and devices designed to control the potential adverse effects of those site activities (in particular erosion and subsequent sedimentation). The key purpose of this monitoring is to ensure that all practices, control measures and devices are constructed, operated and maintained so they remain fully effective at all times. The 'Devices' monitoring will act as a trigger for more detailed monitoring or remedial action should this be required.

92 During the undertaking of activities considered higher risk (such as those associated with in-stream works), the monitoring of devices will be undertaken on a daily basis and more frequently during heavy rainfall. Within the ESCP I have included a checklist which will form the basis for this monitoring and ensure appropriate follow up action is undertaken if necessary.[54]

Flocculation monitoring

93 While chemical treatment remains as an option that may be utilised, it is clear that not all sediment retention ponds or decanting earth bunds established on the site will require chemical treatment. The CESCPs will determine whether chemical treatment is necessary.

94 A key part of the chemical treatment will be monitoring, in order to check that the systems are all working as anticipated and to provide data to facilitate management of the flocculation systems.

95 In the event that adverse impacts on the receiving environments are detected by the ecological monitoring programme, a possible (cause-effect) association with the Project will be investigated and erosion and sediment control measures and methodologies fully investigated and amended as necessary.

RESPONSE TO SUBMISSIONS

96 In this section of my evidence, I will respond to submissions which raise issues within my area of expertise.

[54] Appendix H.K of ESCP.

General Sediment and Contaminant Impacts.

97 A number of submissions raise the issue of sediment and other contaminant discharge impacts on the receiving environments.[55] In response, I refer to the ESCP Design Principles,[56] specific erosion and sediment control methodologies for each sector,[57] and also activity details and methodologies[58] (discussed earlier in my evidence)

98 I confirm that these provisions represent best practice, and represent a methodology and process whereby sediment and other construction related contaminants will be appropriately managed and monitored throughout the Project.

99 With respect to cement contamination from concrete works, it is important to recognise that there is no intention within the Project to discharge such a contaminant directly into the receiving environment. Treatment of cement runoff is specifically outlined within the ESCP[59] and includes the use of housekeeping practices, discharging through appropriate filter facilities or direct removal from the site via sucker truck. Dedicated concrete wash facilities will be established on site as required. All of these methodologies contribute to a comprehensive approach to ensuring effects are no more than minor.

Dust

100 Some submissions reference concerns related to construction dust.[60] While the ESCP outlines specific dust management techniques that will be employed, it also reiterates specific methodologies and measures that will apply[61]. This includes consideration of timing of works, stabilisation of bare surfaces, reducing vehicle speeds and

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55 Submissions include, for example, Bull (16), Hare (150), Fawthorpe (318), Vagg (346), Coe (362), Cooke (396), Gray (424), Puna (479), Save Kāpiti Inc (505), Cameron (580) and MetlifeCare (608).

56 ESCP Section 2, page 4.

57 ESCP Section 6, page 27.

58 ESCP Section 7, page 36.

59 ESCP Section 7.8.3, page 52

60 In particular Transpower (178) and Grieve (474).

61 ESCP Section 5.4, page 25.

also the use of water carts to wet the soil surface and reduce dust generation.

Kãpiti Coast District Council (682) and Greater Wellington Regional Council (684)

101 These two submissions generally support the ESCP however mention the need to appropriately prioritise and address erosion and sediment control into wetland environments.[62]

102 While the ESCP is a comprehensive overview of the erosion and sediment control measures that will apply for the Project, importantly it is based on the future development and submission of CESCPs.[63] As described earlier, these CESCPs allow for future innovation, flexibility and practicality of approach to changing conditions and the erosion and sediment control measures implemented.

103 I remain comfortable that the erosion and sediment control measures proposed for the Project, including techniques such as stream diversion methodologies, are best practice and will ensure effects are no more than minor[64]. This includes undertaking a comprehensive risk management approach to the earthworks required.

Kãpiti Coast District Council (682)

104 This submission makes specific reference to the Otaihanga Wetland environment and expresses concern regarding sediment discharge into this environment. The submission goes on to say[65] that the ESCP needs to include appropriate erosion and sediment control measures for the following wetlands: El Rancho, Raumati and Otaihanga.

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62 Refer KCDC submission (paras 82-84) and GWRC submission (page 4, 1st bullet point).

63 ESCP Principle 5, page 7.

64 ESCP Section 5, page 16.

65 KCDC Submission (para 85).

105 The ESCP plans for these areas show the specific control measures to be utilised during construction[66]. This includes:

105.1 Utilisation of a yet to be developed long term stormwater wetland device as a short term sediment retention pond with associated diversion channels (El Rancho),;

105.2 A sediment retention pond (SRP # 2) with associated diversion channels and super silt fence (Raumati); and

105.3 Diversion channels, decanting earth bunds and super silt fence (Otaihanga).

106 For each of these locations, the full suite of controls will be implemented during the construction period with the ESCP providing the full design criteria and details that will apply. In no location will earthworks be undertaken with a direct discharge into the wetlands identified within the KCDC submission. While eventual flows may enter these environments, this is only after full treatment has occurred on site. Further to this the Otaihanga Yard location has specific erosion and sediment control measures which will be implemented as part of the construction process[67].

107 Importantly when considering the erosion and sediment controls in these locations, reference must also be made to the specific construction methodologies[68] which in themselves act as a management tool for the control of erosion and sediment yields.

108 The KCDC submission also makes reference to the assumption of 95% efficiency for all sediment retention measures and states that this appears to be overstated.[69] With respect to treatment efficiencies of the various control measures, I note the emphasis is placed on erosion control and prevention of sediment generation as a first step. The peat replacement trial and chemical treatment investigations both demonstrate the very effective nature of the

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66 Appendix H.B of ESCP - AEE, Volume 5: Plan Set (Management Plan Appendices).

67 Appendix H.BI of ESCP - AEE, Volume 5: Plan Set (Plan Number CV CM 234).

68 ESCP Sections 7.2, 7.4 and 7.5.

69 KCDC Submission (para 84).

control measures and provide a large degree of confidence that high sediment removal efficiencies can be obtained. I also note the very high natural infiltration rates that will occur within the sand environments and, in this regard, my experience confirms that runoff in un-compacted sand locations will be minimal.

Greater Wellington Regional Council (684)

109 GWRC raise four specific issues related to erosion and sediment control. These include:

109.1 Clarification around assessment of impacts and further information on adequacy of measures to avoid, remedy and mitigate effects;

109.2 Further information on the adequacy of the monitoring proposed;

109.3 Further information on sediment yields and if these have been adequately modelled; and

109.4 Further information on management methods and in particular the Waikanae River works and other watercourses.

110 The ESCP is based on a series of clear principles and the development of future CESCPs. While CESCPs will provide more specific site by site detail, I note the significant information that has already been incorporated into the ESCP which incorporated the findings of a full walk over of the entire alignment footprint. Of particular importance is the flat contour of the Project and also the geology, in particular the sand environments. These factors in themselves make this Project very unique and significantly reduce the erosion potential from earthworks operations. Methodologies are clearly outlined in the ESCP[70] and, with the addition of specific structural control measures,[71] I remain of the view that the measures proposed (both structural and non structural) are adequate for the Project.

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[70] ESCP Section 7.

[71] Appendix H.B of ESCP - AEE, Volume 5: Plan Set (Management Plan Appendices).

111 The ESCP outlines the proposed monitoring which includes an adaptive management approach[72] whereby specific monitoring outcomes lead to a full review of the erosion and sediment control measures as necessary. This approach in itself is now standard practice within a large percentage of earthworks sites around New Zealand and ensures that innovation, flexibility and the ability to implement necessary changes to control measures can be undertaken to achieve a high level of treatment.

112 With respect to the sediment yields from the proposed earthworks, the USLE has been utilised as detailed in paragraph 41 above. This provides a measure of the risk of sediment generation and yields, and assists in identifying controls required for managing this risk to the environment from sediment discharges. Earlier discussions with GWRC have confirmed the suitability of this as a risk assessment tool.

113 Finally I note that the issue of works within watercourses is clearly outlined within the ESCP[73]. This confirms that such works will be undertaken in a "dry" environment wherever practicable to ensure that no direct discharges occurs within the stream system. The works within the Waikanae River are identified as higher environmental risk and specific methodology and erosion and sediment control plans[74] have been provided to outline the approach in this location and to again ensure effects are managed appropriately. I confirm that these methodologies and controls are appropriate.

114 On 22 August 2012, the GWRC produced a without prejudice Discussion Document to provide further detail on the matters raised in its submission. Matters in that Document relevant to my area of expertise are paragraphs 1.1 and 1.2.

115 In relation to sediment yield I refer to paragraphs 41 to 63 above. This highlights the clear benefits of using USLE as a risk assessment

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[72] ESCP Section 5.3, page 20. (As further discussed in the evidence of **Mr Stephen Fuller**.)

[73] ESCP Section 7.6, 7.7 and 7.10.

[74] Appendix H.R of ESCP - AEE, Volume 5: Plan Set (Management Plan Appendices)

tool and an indicator for the likely sediment yields. I note that GWRC confirmed in earlier discussions[75] the suitability of USLE for this Project and also that the USLE is a prediction tool utilised in the majority of earthworks sites on a national basis.

116 Transmission Gully is referenced within the Discussion Document and it is important to recognise the significant differences between that project and this Project.

116.1 This Project is of a very flat contour and has sand and peat geology. Transmission Gully by comparison is of a very steep contour and has clay type soils.

116.2 Transmission Gully is a much more significant earthworks project with 27km of earthworks involving 6.3 million cubic metres of cut and 5.8 million cubic metres of fill, with cut batters of up to 80m and fill depths of up to 60m.[76]

In my opinion, it is nonsensical to compare the two projects.

117 I have read the Transmission Gully final decision and note that a number of sediment yield tools were discussed.[77] The decision document confirms that *"the sediment yields have to be viewed as a guide as to the magnitude of the sediment discharge, not an absolute value."* This same approach applies to this Project and, irrespective of the sediment modelling tool utilised, a similar outcome will be achieved. I acknowledge that the USLE does not take account of all forms of erosion within a catchment and excludes, for example, stream bank and bed erosion that may result. However this is not considered necessary for the comparative analysis undertaken within the USLE calculations for this Project and the relative difference between yields would remain. Other models have similar limitations and are also based on a range of assumptions.

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75 Team Leader of Environmental Regulation (S Baker).

76 Transmission Gully Decision, para 305.

77 Transmission Gully Decision, paras 312, 313 and 323.

118 I have addressed the issue of treatment efficiencies earlier in my evidence (paragraph 108) above.

119 In relation to management of cement contaminated stormwater, further information or details are sought by GWRC regarding the proposed methods of treatment for stormwater contaminated with cement, or quantify the potential discharges and associated effects. Within the ESCP, working with cement related products and the management techniques is outlined[78]. This places emphasis on full removal of concrete slurry away from the site and outlines some well accepted house keeping practices that will be employed. Further to this and, if necessary, any discharges on site will be discharged only after treatment through treatment tanks and bark filled filter socks with pH checked prior to discharge to the stream environment. The ESCP also outlines the management of bentonite and polymers should these be utilised on site[79].

Raumati South Residents Association Inc (707)

120 This submission makes specific reference to the Raumati Manuka Wetland and states that no erosion and sediment controls are proposed in this location.[80] That is incorrect.

121 I note that Drawing Number CV CM 203 and 204[81] highlights that the area of earthworks within this location will be managed, on both the eastern and western extent of the alignment, through the provision of a Super Silt Fence with an earth topsoil bund and decanting devices. The ESCP within this area includes some cut material and as such there will be no direct discharge to the wetland location.

78 ESCP section 7.8.2 and 7.8.3.

79 ESCP Section 7.8.4.

80 Submission at section 6.

81 Appendix H.I of ESCP - AEE, Volume 5: Plan Set (Management Plan Appendices).

122 The ESCP also highlights[82] that the cycleway will be managed through specific staged development and stabilisation where the earthworks cannot discharge to existing controls.

123 While the specific erosion and sediment control measures form part of the ESCP, I confirm that the content of the ESCP (including the principles) will be required to be implemented for all associated Project earthworks. In this regard, any earthworks in the vicinity of the Raumati Manuka Wetland will be required to comply with the principles of the ESCP and to submit a CESCP[83] accordingly.[84]

RESPONSE TO SECTION 149G(3) KEY ISSUES REPORTS

124 The majority of the matters recorded within the section 149G(3) key issues reports from KCDC and GWRC[85] have been addressed within the body of my evidence.

KCDC Report

125 The section 149G(3) report prepared by KCDC raised the following issues.

125.1 NZ Coastal Policy Statement.[86] This comment related to the fact that while the proposed expressway "is not located within or adjacent to or will directly discharge into the CMA", the ultimate receiving environment for sediment laden water is the coastal marine area. This needs to be carefully managed in respect to discharges from construction related activities.

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82 Appendix H.B of ESCP – AEE, Volume 5: Plan Set (Management Plan Appendices).

83 ESCP, page 2.

84 The submission also raises sediment related issues similar to those raised by KCDC, which I have addressed earlier in my evidence.

85 Dated 8 June and 11 June 2012 respectively.

86 KCDC Key Issues Report, section 4.4.2.

125.2 The Proposed Regional Policy Statement identifies soil erosion as an issue with the aim of minimising effects from earthworks and vegetation disturbance.[87]

125.3 The Kãpiti Coast District Plan contains an objective, policies and methods related to ensuring that adverse effects of earthworks on natural landforms and outstanding landscapes are avoided, remedied or mitigated.[88]

126 These issues are all addressed in full within the ESCP where a comprehensive approach to erosion and sediment control during construction is proposed. The ESCP provides a minimum standard that will apply throughout the construction phase earthworks. Further, the development of CESCPs to be provided throughout the construction period will ensure full compliance with the principles of the ESCP.

127 My evidence has earlier outlined the assessment of risk within the construction period and the specific measures to be implemented throughout.

GWRC Report

128 The section 149G(3) report prepared by GWRC raised the following issues.

128.1 The Regional Soil Plan contains a policy which requires consideration of locating activities which have the potential for irreversible effects on soils, on soils of low versatility.[89]

128.2 The Report suggests that clarification is required as to whether the NZTA is intending to construct other forms of erosion mitigation structures in, on, or over watercourses.[90]

128.3 Existing consents are in place for various KCDC streamworks in the vicinity of the Mazengarb Drain.

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87 Proposed Regional Policy Statement, Section 3.11.

88 KCDC District Plan, Objective 1 and Policies 1, 2 and 3.

89 GWRC Key Issues Report, paragraph 94.

90 GWRC Key Issues Report, paragraph 131.

Concern was noted related to the potential of construction activities coinciding with the Project construction and the cumulative effect on the volume of sediment being discharged to the receiving environment.[91] In addition, GWRC identified a number of other active consents in the Project vicinity.[92]

128.4 Under the heading 'Discharge from Earthworks', potential sediment yields are discussed and the potential effects of this sediment on receiving environments, both freshwater and coastal. GWRC has commented on the proposed use of chemical treatment and questioned the ability to ensure low sediment yields, in particular during high intensity rain events. Comment is also provided on the duration of works and efficiency of the proposed erosion and sediment control measures assumed as part of the USLE calculations.[93]

128.5 Streamworks have been identified as an area of concern with particular note of temporary culvert design and fish passage issues.[94]

128.6 Specific receiving environments have been identified and are noted to have high ecological values which can be impacted by sedimentation during the earthworks construction period.[95]

129 In response, I note that these issues are all addressed in full within the ESCP where a comprehensive approach to erosion and sediment control during the construction activities is proposed. The ESCP provides a minimum standard that will apply throughout the construction phase earthworks which will be reflected within the CESCPs provided through the construction period.

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91 GWRC Key Issues Report, paragraph 170.

92 GWRC Key Issues Report, paragraph 178.

93 GWRC Key Issues Report, paragraph 188 to 203.

94 GWRC Key Issues Report, paragraph 204.

95 GWRC Key Issues Report, paragraph 245.

130 In response to the GWRC Report's comments in section 7.1, I note that the USLE, as provided within the ESCP is primarily a comparative assessment tool. It is designed to show pre earthworks yields and during construction yields based on a series of assumptions. These assumptions include that the areas of earthworks will be exposed for a 2 month period, and this is considered a realistic assumption considering the construction sequence. Peat replacement methodologies (as outlined within Section 7.2 of the ESCP) and pre load activities (as outlined within Section 7.4 of the ESCP) both highlight the progressive nature of the works. In particular I also note that for pre load activities, batters will be subject to surface stabilisation as outlined within the ESCP.[96]

131 I am unsure where the GWRC Report's reference to 70% and 75% treatment efficiency is obtained from.[97] The efficiency of treatment provided for within the USLE calculation is higher[98] than these levels and is based on the soil settleability tests[99] and the peat replacement trial[100]. These both demonstrate the high efficiency of the control measures and methodologies proposed to be utilised and support such a treatment efficiency.

132 The GWRC Report comments (at paragraph 200) that no assessment has been made of sediment yields for other sized rain events,[101] despite the likelihood of a storm event. In response I note that I have further considered the necessity of applying a series of different rain event intensities to determine sediment yields during such events. The USLE is based on a 6 hour duration 1 in 2 year storm event. Rainfall depths are provided within Appendix H.G of the ESCP for a range of storm events. I note that the 6 hour duration 2 year storm event is considered an acceptable

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96 Principle 11 Page 9 of ESCP.

97 GWRC Key Issues Report, paragraph 199.

98 USLE calculations utilise 95% as per trail and settling tests. While it is unclear as to the GWRC reference to efficiencies, it is assumed the 70% and 75% refers to long term stormwater management and not erosion and sediment control.

99 Appendix H.L of the ESCP.

100 Appendix H.N of the ESCP.

101 I.e. other than a 6 hour, 1 in 2 year rainfall event.

rain event representing both erosive force and intensity of rain and is used throughout New Zealand when utilising USLE calculations. While it is acknowledged that different rainfall intensities will provide a different sediment yield, in my opinion comparative analysis of pre and during earthworks will be similar. As a result I have not undertaken an assessment based on different rainfall events.

133 Section 4 of the ESCP and paragraphs 41 to 67 within my evidence outline the risk based approach which will apply to all construction activities. The USLE has assisted in identifying the higher sediment yield areas and, as part of this, provides a significant benefit in identifying an opportunity to address these higher risk areas as areas requiring more focus on implementing, maintaining and monitoring control measures.

134 With respect to streamworks activities, Sections 7.6 and 7.7 of the ESCP outline the proposed methodologies. These are focused on ensuring that such activities are undertaken in a "dry" environment and that fish passage is fully considered at all times from both a seasonal and during works perspective. I note the importance of the CESCPs in ensuring this process is adequately addressed throughout the Project construction phase.

PROPOSED CONDITIONS

135 The lodged Project included proposed resource consent conditions relevant to sediment and erosion control, being:

135.1 Proposed conditions G.27 – G.28; and

135.2 Proposed conditions E.1 – E.11.[102]

136 Proposed conditions E.1 and E.2 require the submission of an ESCP and CESCPs and outline the requirements of such plans. In my opinion, the draft ESCP already provided (Appendix H of the CEMP) will fulfil the ESCP requirement. The conditions formalise the need to submit and implement the ESCP and CESCPs and will allow any amendments through the BOI hearing process to be included in

[102] For ease of reference, a copy of these proposed conditions is attached to my evidence **(Annexure A).**

them. Proposed conditions G.27 and G.28 are similar in nature reflecting the broad requirement for an ESCP and for CESCPs in the general conditions.

137 I recommend, however, that the "purpose" and objectives of the ESCP and CESPs would be better described within proposed conditions G.27 and G.28 respectively. I have therefore relocated that wording from conditions E.1 and E.2. These changes are shown in **Annexure A.**

138 I also recommend that clear Advice Notes be incorporated that identify the principles of the current ESCP and the value of producing the CESCP as construction earthworks progress. I have incorporated Advice Notes within proposed conditions G.27 and G.28 to reflect this recommendation (refer **Annexure A**).

139 Proposed conditions E.4 to E.10 provide further requirements related to design, certification timing and monitoring of erosion and sediment control measures.

140 Proposed condition E.11 allows for chemical treatment, if required, in accordance with the CESCP as per condition E.3. While I support this condition, I recommend that an advice note be added that clearly outlines that chemical treatment is not considered likely to be necessary, and will not be required or implemented, on all earthworks activities (in particular on sand soils and some peat soils as demonstrated through the chemical settleability tests undertaken[103]). This will be determined on a case by case basis, and subject to certification by GWRC. I recommend an advice note be incorporated as shown within Annexure A of this evidence.

141 Other than as expressly amended above, I support the proposed conditions as lodged.

CONCLUSIONS

142 The Project is recognised as being unique from a construction perspective with flat contour, peat and sand soils and the ability to

[103] ESCP Section 7.12, page 60.

manage the sediment generation and yield through many construction practices.

143 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.

144 The ESCP recognises the higher risk areas associated with the Project and sediment discharge. Further, the development of future CESCPs allows for innovation and amendments as necessary.

145 In addition to specific practices and methodologies, the ESCP outlines the monitoring that will occur to ensure that control measures are fully effective.

Graeme Ridley
3 September 2012

ANNEXURE A:

RELEVANT PROPOSED CONDITIONS CONTAINED IN LODGED APPLICATION

Amendments proposed to the lodged conditions are shown in redline (strikethrough and underlining).

	Erosion and Sediment Control Management Plan
G.27	The consent holder shall finalise, submit and implement through the CEMP, an Erosion and Sediment Control Management Plan (ESCP) to be submitted to the Manager for certification at least 15 working days prior to works commencing in accordance with Condition E.1. The purpose of the ESCP is to describe the methods and practices to be implemented to minimise the effects of sediment generation and yield on the aquatic receiving environments associated with the Project. In addition, the ESCP shall: a) Outline the principles that the ESCP shall seek to adhere to; b) Be developed in accordance with the objectives outlined in NZTA's Environmental Plan, including: c) Ensuring construction and maintenance activities avoid, remedy or mitigate effects of soil erosion, sediment run-off and sediment deposition. d) Identify areas susceptible to erosion and sediment deposition and implement erosion and sediment control measures appropriate to each situation with particular emphasis on high-risk areas. e) Use bio-engineering and low-impact design practices where practicable. [Advice Note: This ESCP shall follow the principles and practices as outlined within the ESCP, Appendix H of the CEMP].
G.28	The consent holder shall prepare, submit and implement through the CEMP, site specific Construction [stage] Erosion and Sediment Control Plans (CESCP) to be submitted to the Manager for certification at least 5 days prior to work commencing in that site~~, in accordance with Condition E.2~~. The purpose of the CESCP is to allow the consent holder and GWRC to further develop methodologies to be implemented throughout the duration of the project to address the specific characteristics of various sites along the route. In addition, the CESCP shall: a) The CESCP will be consistent with the CEMP as required for G.20 and the ESCP as required for G.27 and E.1. b) Any changes to the CESCP shall be approved by the Manager prior to the amendment being implemented The CESCP will be consistent and in accordance with the CEMP as required for G.20 and the ESCP as required for G.27 above. Advice Note: These CESCPs will be developed within the context of the principles and practices of the ESCP and will allow for innovation, flexibility and practicality of approach to erosion and sediment control. The CESCPs will also ensure ongoing adaption to changing conditions throughout the project lifetime.

	Erosion and Sediment Control
E.1	The consent holder shall finalise, submit and implement through the CEMP, an Erosion and Sediment Control Management Plan (ESCP) to be submitted to the Manager for certification at least 15 working days prior to works commencing. ~~The purpose of the ESCP is to describe the methods and practices to be implemented to minimise the effects of sediment generation and yield on the aquatic receiving environments associated with the Project. In addition, the ESCP shall:~~ ~~a) Outline the principles that the ESCP shall seek to adhere to;~~ ~~b) Be developed in accordance with the objectives outlined in NZTA's Environmental Plan, including:~~ ~~c) Ensuring construction and maintenance activities avoid, remedy or mitigate effects of soil erosion, sediment run off and sediment deposition.~~ ~~d) Identify areas susceptible to erosion and sediment deposition and implement erosion and sediment control measures appropriate to each situation with particular emphasis on high risk areas.~~ ~~e) Use bio-engineering and low impact design practices where practicable.~~ ***Advice Note:*** *Erosion and sediment control measures shall be constructed and maintained in accordance with the NZTA's Draft Erosion and Sediment Control Standard for State Highway Infrastructure and Draft Field Guide for Contractors (and any subsequent amendments to that document that occur after this consent is granted and prior to the commencement of construction), except where a higher standard is detailed in the ESCP referred to in Condition G.27 and E.1, within these conditions in which case the higher standard shall apply.*
E.2	The consent holder shall prepare, submit and implement through the CEMP, site specific Construction [stage] Erosion and Sediment Control Plans (CESCPs) to be submitted to the Manager for certification at least 5 days prior to work commencing in that site. ~~The purpose of the CESCP is to allow the consent holder and GWRC to further develop methodologies to be implemented throughout the duration of the project to address the specific characteristics of various sites along the route. In addition, the CESCP shall:~~ ~~a) The CESCP will be consistent with the CEMP as required for G.20 and the ESCP as required for G.27 and E.1 above.~~ ~~b) Any changes to the CESCP shall be approved by the Manager prior to the amendment being implemented.~~
E.3	The CESCPs shall meet the purpose in Condition ~~E.2~~ G.28 and include, but need not be limited to: a) Contour information at suitable intervals; b) Erosion and sediment control measures including specific pond design (including calculations supporting pond sizing); c) Chemical treatment design and details; d) Catchment boundaries for the erosion and sediment control measures; e) Location of the Work, and cut and fill operations; f) Details of construction methods to be employed, including timing and duration; g) Design details including: i. Contributing catchment area; ii. Retention volume of structure (dead storage and live storage

	measured to the top of the primary spillway); iii. Shape of structure (dimensions of structure); iv. Location of flood waters v. Safety and access vi. Position of inlets/outlets vii. Stabilisation of the structure; and viii. Maintenance. h) A programme for managing non-stabilised areas of earthworks, including progressive stabilisation considerations; i) The identification of appropriately qualified and experienced staff to manage the environmental issues onsite; j) The identification of staff who have clearly defined roles and responsibilities to monitor compliance with the Consent Conditions and the ESCP; k) Provision of details of a chain of responsibility for managing environmental issues and details of responsible personnel; and l) Methods and procedures to be undertaken for decommissioning of erosion and sediment control measures.
E.4	Prior to any earthworks commencing within a site (other than those required to establish erosion and sediment control measures), a certificate signed by an appropriately qualified and experienced sediment control practitioner shall be submitted to GWRC to certify that the erosion and sediment control measures for that site have been constructed in accordance with the relevant CESCP.
E.5	A copy of the "as-built(s)" and the certified CESCPs 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 prepared by a suitably qualified person and 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 control measures, provided that such revisions are in general accordance with the CESCPs.
E.6	All necessary perimeter controls for a site or stage shall be operational before earthworks (or relevant stage of earthworks) within the site or stage commence.
E.7	No sediment retention ponds, chemical treatment systems or perimeter controls shall be removed or decommissioned from a site, or stage before the entire area is stabilised, unless such removal and decommissioning is in accordance with the CEMP or a CESCP, and the Manager has been informed not less than 2 working days prior.
	Erosion and Sediment Control Monitoring
E.8	The Consent Holder shall carry out monitoring in accordance with the ESCP and the certified CESCP and which will seek to ensure that: a) The proposed erosion and sediment control measures have been installed properly; b) Methodologies are carried out properly; and c) Erosion and sediment control measures are functioning effectively throughout the duration of the project.

E.9	In the event of either a failure of erosion and sediment control devices or where a storm event exceeds the design volume of the device, and where the discharge is to a perennial or intermittent freshwater body, wetland or estuarine/marine environment, a suitably qualified ecologist(s) shall be notified within 24 hours, who shall then inspect the relevant area to determine whether significant adverse effects on the affected area's ecological values have occurred. The Project's Environmental Manager shall prepare a report on the effects of the failure and any recommended measures that may be required to remedy the effects; the report shall be submitted to the Manager for approval within 5 working days of the event. The remedial measures shall be implemented within 10 working days of the approval of the Manager.
E.10	The consent holder shall carry out weekly inspections of all site haul roads in order to ensure they are well maintained and that erosion and sediment control devices remain effective.
	Chemical Treatment (Flocculation)
E.11	a) Prior to the commissioning of chemical treatments for sediment management purposes, the Consent Holder shall provide GWRC with a Chemical Treatment Plan (CTP) for each site, or stage of the works, or in association with an CESCP, at least 10 working days before the commencement of flocculation works. b) The CTP shall be submitted to the Manager for certification that the proposed use of chemical flocculation will assist in achieving appropriate sediment removal efficiencies in accordance with the principles of the ESCP. c) Each CTP shall include, but need not be limited to: i) Specific design details of the chemical treatment system; ii) Monitoring, maintenance (including post-storm) and contingency programme (including a Record Sheet); iii) Details of optimum dosage (including catchment specific soil analysis and assumptions); iv) Procedures for carrying out an initial treatment trial; v) A spill contingency plan; vi) A performance monitoring plan; and vii) Details of the person or bodies that will hold responsibility for the maintenance of the chemical treatment system and the organisational structure which will support the system. d) Any amendments to a CTP shall be approved by the Manager at least 10 working days prior to implementation. Advice Note: The CTP will demonstrate the nature of soils within which the works are to occur and, through the necessary bench testing and settleability analysis, will determine the need for chemical treatment or not. This will be reflected within the CESCPs submitted for certification to the Manager.