BEFORE THE TARANAKI REGIONAL COUNCIL AND NEW PLYMOUTH DISTRICT COUNCIL

MT MESSENGER BYPASS PROJECT

In the matter	of the Resource Management Act 1991
and	
In the matter	of applications for resource consents, and a notice of requirement by the NZ Transport Agency for an alteration to the State Highway 3 designation in the New Plymouth District Plan, to carry out the Mt Messenger Bypass Project

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REBUTTAL EVIDENCE OF GRAEME JOHN RIDLEY (CONSTRUCTION WATER MANAGEMENT) ON BEHALF OF THE NZ TRANSPORT AGENCY

30 July 2018

BUDDLEFINDLAY
Barristers and Solicitors
Wellington

Solicitors Acting: **Paul Beverley** / **David Allen / Thaddeus Ryan**
Email: david.allen@buddlefindlay.com / thaddeus.ryan@buddlefindlay.com
Tel 64-4-499 4242 Fax 64-4-499 4141 PO Box 2694 DX SP20201 Wellington 6140

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INTRODUCTION

1. My name is Graeme John Ridley.

2. My rebuttal evidence is given in relation to applications for resource consents, and a notice of requirement by the NZ Transport Agency ("the **Transport Agency**") for an alteration to the State Highway 3 designation in the New Plymouth District Plan, to carry out the Mt Messenger Bypass Project ("the **Project**"). It is my third statement of evidence for the Project, following my evidence in chief ("**EIC**") dated 25 May 2018 and my supplementary statement of evidence ("**Supplementary Evidence**") dated 17 July 2018.

3. I have the qualifications and experience set out in my EIC.

4. I repeat the confirmation given in my EIC that I have read the 'Code of Conduct' for expert witnesses and that my evidence has been prepared in compliance with that Code.

5. In this evidence I use the same defined terms as in my EIC.

SCOPE OF EVIDENCE

6. The purpose of my rebuttal evidence is to discuss the evidence of Richard Duirs and Mr Thomas Drinan on behalf of DOC.

7. My rebuttal evidence should be read in conjunction with my EIC and my Supplementary Evidence. My rebuttal evidence is ordered based on the same order as the evidence of Mr Duirs, adopting the same headings to allow easier cross reference between this evidence and Mr Duirs' evidence.

8. By way of overall response to Mr Duirs, I confirm that none of my conclusions outlined within my EIC or Supplementary Evidence have changed. In my opinion the construction water management plan framework and monitoring programme for the Project are robust. Together they represent a through and appropriate approach to construction water management on the Project.

9. I consider that Mr Duirs is overstating the erosion and sedimentation risks associated with the Project, and I do not think he provides a balanced view with respect to the overall approach that will be applied.

10. Finally, I confirm that while the Project has recognised risks, these risks are clearly identified and accounted for within the approach taken (including through best practice construction water management, and a robust and full monitoring regime). I do not consider this Project is a particularly ‘risky’ one in construction water terms. Overall, I reiterate my opinion that the erosion and sedimentation effects of the Project will be negligible.[1]

[1] As per paragraph 37 of my Supplementary Evidence.

MR DUIRS' KEY FACTS AND OPINIONS SECTION

11. Mr Duirs (in paragraph 3.2) notes that the earthworks:

> *"comprise large scale land disturbance activities occurring across an area of 36ha. Earthworks volumes are proposed in the vicinity of 1,000,000m3. In addition, the project proposes numerous other land disturbance activities including vegetation clearance, access tracking, temporary and permanent culvert installations, temporary and permanent stream diversions, a large scale tunnelling operation and a large bridge installation. All of these activities present a risk for adverse erosion and sediment effects"*

12. I refer to my Supplementary Evidence, and confirm that as a 36ha earthwork roading project, this is in fact a relatively small-scale project. Many New Zealand roading projects are significantly larger and are also constructed on very challenging terrain and environmental conditions[2].

13. I confirm that the "*other land disturbance activities"* referred to by Mr Duirs will all involve construction works at varying scales and at varying risk. These activities are however not unique in any way and there is much experience and success with managing the associated construction and environmental outcomes.

14. An example of this is the main bridge over the Mimi Valley wetland which has been promoted within the Project as an activity that reduces risk for construction effects. This activity as an example stays out of the associated gully system and effectively minimises the footprint of works to a point that no activity will occur within the gully itself. I consider this to be very low risk and easily manageable from a risk profile perspective.

15. In his (first) paragraph 3.5, Mr Duirs makes a comparison of this Project to other roading projects in New Zealand. I confirm that topography, clay based soils, high rainfall, significant earthwork cuts, high value receiving environments and large number of streamworks activities (all of which are suggested by Mr Duirs as factors that elevate the erosion and sediment control risks for this Project) are aspects that are a key part of construction water management of many New Zealand earthwork projects. These elements and factors are not unique to this Project.

16. I would add that in the 25 years of my experience with such projects, I am not aware of any "failure" of sediment retention ponds. While there are times when diversion channels or silt fences may not perform as expected and can overtop, as an example, this is not the case for sediment retention ponds. I discuss this matter in more detail below and also note the rebuttal evidence of Mr Symmans, who has specific expertise in this area.

[2] Transmission Gully and Puhoi to Warkworth are two recent examples.

17. Mr Duirs in his (second) paragraph 3.5 comments on the four year construction timetable. From a construction water management perspective this equates to a much slower and managed process for the small amount of earthworks required as compared to similar timeframes for larger projects. This timeframe reflects access provision timetables and the completion of discrete areas of work in a managed and controlled fashion. I do not see this as a challenge from a construction water management perspective, but instead consider it allows for an appropriately and carefully managed and controlled process.

ASSESSMENT OF ADEQUACY OF THE APPLICANT'S PROPOSED EROSION AND SEDIMENT CONTROL MANAGEMENT METHODS

18. Mr Duirs records that the proposed erosion and sediment control measures for the Project generally reflect best practice, and that a number of his previous concerns have now been addressed.[3]

19. He goes on to say (in paragraph 4.5) that:

> "*However, my key outstanding concern in regard to the proposed erosion and sediment control methods and subsequent sediment effects of the Project is the ability of the applicant to physically implement best practice erosion and sediment control measures for the works... The absence of any existing access into [the central part of the site] (including pedestrian access) is a significant construction challenge/risk and will determine the requirement for multiple phases of enabling works to get to a point where bulk construction activities are even able to proceed within these areas."*

20. Mr Duirs in paragraph 4.12 (which immediately follows paragraph 4.5) states:

> "*If the Applicant is practically unable to implement best practice erosion and sediment control measures in these challenging parts of the site (e.g the ability to construct appropriately sized water impoundment devices on the side of steep slopes or within incised gully systems), there will be a lower level of sediment treatment than anticipated through the NOR."*

21. I understand Mr Duirs may be referencing Fills 12 and 13 in this above paragraph. I confirm that the two construction methodologies for Fill 12 and 13 discussed with Mr Duirs, and to be confirmed via a detailed SCWMP process, includes, as one option, a staged step by step methodology. This methodology may not require a sediment retention pond (appropriately sized water impoundment device as referred to by Mr Duirs) and will rely on daily stabilisation of the full area of works as works progress. This will not result in a lower level of sediment treatment as Mr Duirs suggests. It in fact has the opposite effect of largely preventing sediment generation as a first step, and

[3] Paragraph 4.4.

therefore will result a better water quality outcome. This is reflective of best practice.

22. Mr Duirs in paragraph 4.13 states: *"Furthermore, the construction of erosion and sediment control devices within this terrain presents an increased risk for failure of sediment control devices both during typical work conditions, or during greater than design events."*

23. As noted above, in the 25 years of my experience with such projects I am not aware of any "failure" of sediment retention ponds within these projects. While there are times when diversion channels or silt fences may not perform as expected and can overtop or scour, this is not the case for the sediment retention ponds. Mr Duirs comments that this is a relatively common occurrence, however this is not my experience. I do not agree with Mr Duirs' comment that there is a high potential for failure of erosion and sediment control measures.

24. There are also safeguards built in to manage any risk of the failure of sediment retention ponds and other sediment control devices, as outlined in the following paragraphs.

25. As specified within the CWMP I note:

    (a) Section 2.3 confirms that as part of all preparatory works prior to earthworks geotechnical investigations will occur;

    (b) Section 6.9 confirms that cut embankments are likely to require geotechnical stabilisation; and

    (c) Drawing # MMA-DES-ESC-C0-DRG-4001 (in Appendix A of the CWMP) confirms that prior to sediment retention pond construction geotechnical assessment will occur.

26. Within the NZTA Guidelines which remains as the "adopted" guideline for the Project the following is stated[4]:

    (a) Diversion Channels and Bunds: Stability of Structure:

    - *Ensure the bunds associated with the runoff diversion channels are well compacted, and stabilised. In some instances, this may require specific geotechnical design to ensure the stability and integrity of the structure;*

    (b) Diversion Channels and Bunds: Limitations:

    - *In some examples (e.g. steep slopes and/or unstable ground), specific geotechnical design will be required to avoid failure of the structure;*

[4] NZTA Guidelines Sections 8.3.3, 8.3.4, 9.1.4.10 and 9.1.5.

(c) Sediment retention ponds embankments:

- *Thoroughly compact the sediment retention pond embankment, with material laid in 150mm layers and compacted to engineering standards. In a number of instances (e.g. steep slopes and low strength soils) specific geotechnical design will be required*; and

(d) Sediment retention pond construction specifications:

- *Clear areas under proposed fills of topsoil or other unsuitable material down to competent material. Large fill embankments may need to be keyed in.*
- *Use only approved fill.*
- *Place and compact fill in layers as per the engineer's specifications. In a number of instances (e.g. steep slopes and/or low strength soils) specific geotechnical design and certification will be required.*

27. Condition 41 of the proposed designation condition set requires a geotechnical and structural peer review of all works (including assessment of risk from natural hazards) prior to construction.

28. Finally, I note that geotechnical engineering is not my area of expertise and I reply on the evidence of others (in particular Mr Symmans) in this regard.

POTENTIAL SEDIMENT EFFECTS OF THE MT MESSENGER BYPASS PROJECT

Sediment yield modelling

29. Mr Duirs in paragraph 5.3 and 5.4 refers to the modelling of sediment yields that has been utilised for this Project. Mr Duirs appears to assess these yields as an isolated assessment process and provides commentary on what he believes is the unsuitability of these.

30. I confirm as per paragraph 12 of my EIC that the sediment yield modelling from the Puhoi to Warkworth (Transport Agency highway) project was utilised for the Project for comparative sediment yield purposes. This model is referred to as the GLEAMS model.

31. Paragraph 89 to 96 of my EIC further expands on the rationale for the use of this sediment model and associated outcomes. Importantly, the GLEAMS model used is an accepted model for the purpose of sediment yield calculations in a New Zealand context. It provides a significant amount of water quality data that allows assessments and comparative analysis to occur for various construction scenarios. Prior to the use of this approach for this Project, discussions with TRC were held to confirm its acceptance (and TRC did confirm it accepts this approach).

32. I further note the importance of placing this sediment yield process in the context of the full risk assessment approach that has been used for this Project. This risk assessment and the associated progressive stabilisation and monitoring programme provides the basis for the assessment conclusions reached.

33. Mr Duirs in paragraph 5.4 states that no details of the parameters for the GLEAMS model were provided and he therefore has been unable to confirm applicability. I am surprised by this comment. I provided Mr Duirs the opportunity through meetings, site visits and telephone discussions to discuss any aspects of the application, and the GLEAMS model process. However my understanding was that Mr Duirs had confirmed via telephone discussions with me that he required no further detail for his assessment.

Increased sediment yields in context

34. In paragraph 5.4 Mr Duirs assumes that the sediment control devices are modelled at "*optimum efficiencies".* In fact, within the GLEAMS model these efficiencies vary, depending upon the rain intensity, and therefore Mr Duirs' assumption is incorrect. As rain intensity increases the efficiency of the sediment control devices diminishes and the GLEAMS model outputs account for these scenarios.

35. In paragraph 5.5 Mr Duirs refers to a 600% increase in sediment yield from the existing forested site cover. This is based on the sediment yields I have assessed on a per hectare unit basis.

36. I agree that, utilising the data as Mr Duirs has, this represents an approximately 600% increase. However, Mr Duirs does not provide any context for this figure. The 600% increase is related to the specific actual area of earthworks only and does not provide any context for the increase in yield on a sub catchment or catchment basis.

37. For illustration purposes, I have calculated what occurs on a percentage basis if this same approach was applied to an area of flat land of less than 10% slope (in other words, a straightforward site in earthworks terms). Utilising the Universal Soil Loss Equation ("**USLE**")[5] and changing just the 'cover factor'[6] from grass to bare soil,[7] the C factor changes from 0.02 (pasture) to 0.1 (bare soil with a 90% efficiency control in place).

38. This represents a 500% increase in sediment yield per unit area. This illustrates the context, and simply confirms earthworks as an activity has a higher sediment yield than pasture, which is a recognised fact.

[5] An accepted simple empirical formula for undertaking comparative assessments of sediment yields.
[6] One of the input key parameters in the USLE.
7 While maintaining the same slope and soils and assuming a sediment control efficiency of 90%.

39. I assess that the 600% that Mr Duirs has stated would apply to any significant earthworks operation. It also bears no relationship to actual yields from the Project or to effects.

The impact of the increased sediment yields

40. In paragraphs 5.8 and 5.9 Mr Duirs comments on the assessed 46% increase in sediment yield in the Mangapepeke sub catchment. He then states this is at a level that could give rise to adverse sedimentation effects.

41. Works in the Mangapepeke catchment are small overall (25ha of earthworks total with an upstream catchment of 332ha) but involve earthworks directly within headwater stream systems and hence have a much greater percentage sediment yield increase when considered in this context.

42. As per paragraph 94 to 96 of my EIC I note that on a wider catchment basis, for both catchments, the Project is likely to result in an insignificant increase in potential sediment yields to the marine environment, equating to less than 1% on an annual basis. On a sub-catchment basis, this equates to less than an 8% annual increase for the Mimi catchment, and a 46% annual increase for the Mangapepeke catchment. These percentage increases assume the full area of earthworks will occur within the catchment, whereas in reality these works will be progressively constructed and stabilised over the construction period. These open areas will not be in an exposed state to the full areal extent for long lengths of time, and the percentage increase in sediment yields therefore also represent a worst case scenario.

43. Works in the Mangapepeke catchment also involve earthworks directly within headwater stream systems, and hence have a much greater percentage sediment yield increase when considered in this context.

44. In addition, discharges from sediment retention devices, including within the Mangapepeke catchment, will be of a fine particle size and will likely remain in suspension for long periods of time with minimal settlement within the immediate environment. The potential effects of such discharges from the Project on the downstream receiving environment (i.e. short term effects) are discussed by Mr Hamill in his evidence.

45. Mr Duirs concludes in paragraph 5.12 that there is a: "*high potential for adverse water quality and aquatic habitat impacts within the immediate site receiving watercourses which could be significantly more than minor*".

46. Habitat effects are a matter for expert ecological assessment, and this issue is addressed by Mr Hamill for the Transport Agency. However, I reiterate my view that Mr Duirs has significantly overstated the erosion and sedimentation risks associated with the Project. My views in this respect remain as set out in my EIC and Supplementary Evidence.

ASSESSMENT OF ADEQUACY OF PROPOSED MONITORING AND MITIGATION

47. Mr Duirs comments on the CWDMP in section 6 of his evidence. He appears to focus on the possible exceedance of the management thresholds. I confirm that the management thresholds are a key component of the CWDMP. However, they are one component only, and in particular might properly be considered as the 'stage 2' components, which occurs following the detailed 'stage 1' components.

48. I refer to Appendix 1 of my Supplementary Evidence, which illustrates the significant commitment and focus of the monitoring programme, and the various components that apply. It is important that any assessment of the monitoring programme looks at the full context, and not just at single stages within it as Mr Duirs appears to have done.

49. The full details of this CWDMP are outlined within paragraphs 18 to 28 of my Supplementary Evidence.

50. I re-emphasise the two agreed objectives of the construction monitoring programme that have been confirmed in discussions with TRC and DOC, and further reinforced within the updated CWDMP.[8] These two overall objectives are:

    (a) to provide information for making effective on-site decisions on necessary continuous improvement of erosion and sediment control measures (both structural and non-structural); and

    (b) to assist in understanding the outcome of on-site decisions for water quality and stream ecology, and support any determination of potential ecological effects from sediment discharged by the Project earthworks.

51. Any monitoring component must link back to these objectives. My assessment remains that the monitoring as proposed is comprehensive, reflects the scale and extent of the proposed earthworks, allows for informed decision making and will achieve in full the objectives outlined.

52. With respect to the ecological response, again I defer to Mr Hamill. The ELMP outlines in section 8.4.3 the ecological monitoring that will occur as part of the CWDMP. In addition, the ecological response to a management threshold exceedance is also outlined by Mr Hamill.

53. In paragraph 6.4, Mr Duirs states that:

> "*Proposed sediment discharge monitoring methods were limited to manual, grab sampling methods only to detect compliance with the*

[8] These objectives are discussed in paragraph 118 of my EIC. The updated CWDMP is Attachment C to the updated CWMP attached to Mr Roan's supplementary evidence.

above triggers. It is very difficult to ensure that peak sediment discharge events are captured using manual sampling methods"

54. As detailed above, the CWDMP as a whole and the specific sediment discharge monitoring methods, is significantly more comprehensive than just manual grab sampling, and it is critical that the CWDMP be assessed as a complete package.

55. I note Mr Duirs' concern that manual sampling will not always coincide with the peak of the rain event and sediment discharges. This is correct, in that the manual sampling provides a snap shot of the water quality discharge at the time of sampling only. However, over a number of rain events sampled, the sample time will be such that it captures points over the discharge hydrograph.

56. If reliance for monitoring was solely based on this manual grab sampling I would agree that more sample points would be beneficial. However, in the context of the full CWDMP, I remain comfortable that the programme is comprehensive and achieves the two overall objectives referred to above. Given the scale of earthworks for this Project there is no justification for automated sampling to be utilised on sediment retention ponds.

57. It is unclear in reviewing Mr Duirs' evidence why he is recommending continuous sampling at two sediment retention ponds, except that he supports the original TRC position as specified in the TRC Section 42A report. My assessment in this respect remains as set out in my EIC and Supplementary Evidence. It is also important to acknowledge that any sampling results alone are not a basis to determine effects. This needs to be determined through the ecological assessment with the water quality sampling supporting this assessment.

58. There is no need for this Project to have continuous sampling of inlet and outlets from sediment retention ponds to assist with on site erosion and sediment control decisions. This information if collected effectively becomes a research initiative related to sediment retention pond efficiency.

59. I note my experience with sampling on earthworks sites over a range of projects and locations. I confirm that manual sampling in the context of a comprehensive monitoring programme is adequate to achieve the two overall monitoring objectives, and in particular to inform key on site decisions.

60. In paragraphs 6.7 and 6.8, Mr Duirs refers to the downstream turbidity meters to be installed, and recommends that upstream turbidity meters also be installed. I agree that a baseline sampling programme is important to allow some comparative analysis of results during construction. However, the proposed downstream turbidity meters will allow for this to occur, and will provide adequate time for such data to be collected. In addition, with the nature of the topography it is very difficult to provide for an upstream sample point that would be of direct comparison to the downstream location. With

many sub-catchments “feeding” into the Project, and the fact earthworks will be undertaken in the headwater streams, this would not reflect an accurate outcome for comparative purposes.

61. Utilising the same downstream turbidity meter on a continuous basis pre and during construction allows for baseline, accurate comparison during construction. It also provides the ability to easily determine water quality trends.

62. In addition, I confirm that the stream sampling sites WQ1 to WQ5 will continue to be employed, and this also provides a catchment wide understanding of water quality over time. This data has been collected since November 2017. It has been supplemented with further water quality data based on grab sampling collected from downstream locations.

63. In Appendix 1 I include an updated set of water quality results for these sites which expands on the earlier water quality results previously supplied within the CWDMP (Appendix C of the CWMP). This confirms:

    (a) In the context of the wider receiving environment, sediment concentrations are very high, where WQ1 (control north) is an order of magnitude above WQ2 (Managapepeke d/s of project); and WQ4 (control south) is close to double that at WQ5 (d/s of Project);

    (b) In the immediate receiving environments, sediment concentrations measured following trigger rainfall are considered high. This includes measurements downstream of the Mimi Swamp Wetland; and

    (c) Turbidity/TSS in the downstream environments are often higher than that measured within the Project site.

64. I wish to reconfirm my assessment that the CWDMP as proposed is comprehensive, and achieves the objectives as required. It includes a 3 monthly review of the CWDMP components for the first 12 months, and an annual review following that time. This provides me with further confidence that the monitoring programme can be adjusted and amended over time as necessary to adapt to site conditions and Project circumstances if required.

EVIDENCE OF MR THOMAS DRINAN

65. I have read paragraph 35 of Mr Drinan’s evidence. Mr Drinan refers to the baseline monitoring program that has occurred to date for the Project and my EIC where I refer to the monitoring outcomes to date. I confirm that where I have referred to sediment loadings within my EIC I am in fact referencing sediment concentrations as per the reported water quality results. My conclusions with respect to the baseline monitoring program remain and none of my conclusions require amendment. Appendix 1 of this rebuttal evidence provides further updated water quality results. My conclusions refer to

sediment concentrations and with respect to water quality trends these remain as detailed.

66. Mr Drinan also notes in paragraph 35b:

> *"previous research into suspended sediment yields from New Zealand rivers demonstrates that rivers in this region (West coast study region) generally have low to moderate yields of suspended sediment"*.

67. I have referred to Appendix 2 of Mr Drinan's evidence (sourced from Hicks et al. 2011) and note that this appendix demonstrates the sediment yields from the Tongaporutu catchment to be between 2 to 5000 tonnes per square km per year. I am unsure of the rationale to Mr Drinan's evidence except to note that from the work he presents that this confirms a high baseline sediment load from the catchment.

ASSESSMENT OF DRAFT NZTA CONDITIONS

68. In paragraph 8.2 Mr Duirs states:

> "*I consider that the consent/environmental management requirements on these type of Projects are most effective when they are explicit and referred to directly within consent conditions (rather than buried deeply within multiple layers of management plan documents). This ensures that they are clear and are not subject to misinterpretation or modification. In this instance, the NZTA draft conditions are focussed predominantly on management plan development, submittal and amendment processes and do not provide clear, measurable conditions that can be easily assessed by either the consent holder, consent authority or other stakeholder groups to determine site compliance "*

69. I remain of the view that a comprehensive set of management plans setting out all the requirements remains as an appropriate approach for this Project. Mr Roan is best placed to discuss whether the proposed conditions of consent should be more detailed in terms of construction water management issues.

Graeme Ridley

30 July 2018

APPENDIX 1: Water quality sampling updated results

[Separate document]