BEFORE AN EXPERT PANEL **FTAA-2504-1048**

UNDER	the Fast Track Approvals Act 2024
IN THE MATTER	of a substantive application for marine consents that would otherwise be applied for under the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
BY	Trans-Tasman Resources Limited

EVIDENCE OF DR CHARINE COLLINS ON BEHALF OF TRANS-TASMAN RESOURCES LIMITED IN RESPONSE TO COMMENTS RECEIVED

13 OCTOBER 2025

HOLM | MAJUREY

Mike Holm/Nicole Buxeda
PO Box 1585
Shortland Street
AUCKLAND 1140

Solicitor on the record Mike Holm
Contact solicitor Nicole Buxeda
Counsel Morgan Slyfield

[redacted]

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EXECUTIVE SUMMARY

1. My evidence relates to the far-field sediment plume modelling carried out by Earth Sciences New Zealand (previously National Institute of Water and Atmospheric Research) on behalf of Trans-Tasman Resources Limited for the Taranaki VTM project.

2. All the sediment plume modelling work was carried out between 2013 and 2017. The sediment plume model has not been updated since then because

   (a) there is no new information relating to the character and properties of the sediment

   (b) any updates to other aspects of the modelling (e.g. code and atmospheric forcing) will not result in any significant changes.

3. Significant effort has gone into the calibration/validation of the model, and all available data were used, where suitable and in an appropriate manner, to assess the model's uncertainty.

4. The sediment plume modelling approach are based on best practices for far-field sediment plume modelling within the computational constraints at the time of development and used the best information available at the time for all the different components of the modelling.

INTRODUCTION

Qualifications and experience

1. My name is Charine Collins. I am an Ocean Numerical Modeller at Earth Sciences New Zealand (ESNZ) where I have been employed since 2019. I was awarded a Bachelor of Science (Zoology and Ecology) by the University of Cape Town in 2006, a Master of Science (Applied Marine Science) by the University of Cape Town in 2009 and a PhD in Physical Oceanography by the University of Cape Town in 2013.

2. I have over 10 years' experience in regional ocean modelling with a focus on developing, analysing and using high-resolution hydrodynamic models to address a range of scientific and applied research topics. I have broad research interests in coastal ocean dynamics, marine connectivity and physical-biological interactions. I have authored numerous peer-reviewed science publications, consultancy reports and conference presentations.

3. I have had no previous involvement in the Taranaki VTM project or in the sediment plume modelling undertaken for Trans-Tasman Resources Limited (TTR). I am an expert in using the Regional Ocean Modelling System (ROMS) for a range of application including modelling ocean dynamics and river plumes.

Code of Conduct

4. I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Practice Note dated 1 January 2023. I have read and agree to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Involvement in project

5. I have had no previous involvement in the Taranaki VTM project or in the sediment plume modelling undertaken for Trans-Tasman Resources Limited (TTR). I also have not been involved in any of TTR's previous applications.

6. I have been asked by TTR to provide this statement of evidence on plume modelling. For this I have relied on the sediment plume modelling carried out by Dr Mark Hadfield and Dr Helen Macdonald and previous statements of evidence from them.

Scope of evidence

7. I have been asked by Trans-Tasman Resources Limited to review and respond to the comments related to the sediment plume modelling provided by Invited Parties on the 2025 Fast Track application by Trans-Tasman Resources Limited, the Taranaki VTM project (FTAA-2504-1048).

8. In preparing this evidence I have relied on the sediment plume modelling carried out by Dr Mark Hadfield and Dr Helen Macdonald[1] and previous statements of evidence[2] from them.

9. I have consulted the following documents in preparing my statement:

    (a) Hadfield, M.G. (2013). South Taranaki Bight iron sand extraction sediment plume modelling: Phase 3 studies. NIWA Client Report WLG2013-36, 86 p.

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1 Hadfield, M.G. and Macdonald, H.S. (2015). Sediment Plume Modelling, 117 p.

2 Supplementary Technical Report 20e - Evidence Dr Helen Macdonald - sediment plume modelling - May 2023, at [29].

(b) Hadfield, M.G. (2014). Statement of Evidence in Chief of Dr Mark Hadfield on behalf of Trans-Tasman Resources Ltd, 59 p.

(c) Hadfield, M.G. (2014). Statement of Summary Evidence of Dr Mark Hadfield on behalf of Trans-Tasman Resources Ltd, 18 p.

(d) Hadfield, M.G. and Macdonald H. (2015). Sediment plume modelling. NIWA Client Report WLG2015-22, 117 p.

(e) Macdonald, H. and Hadfield, M.G. (2017). South Taranaki Bight sediment plume modelling: Worst Case Scenario. NIWA Client Report TTR17301, 51 p.

(f) Macdonald, H.S. (2023). Expert Evidence of Helen Skye Macdonald on behalf of Trans-Tasman Resources Limited, 14 p[3].

(g) Macdonald H.S. (2024). Expert Rebuttal Evidence of Dr Helen Skye Macdonald on behalf of Trans-Tasman Resources Limited, 10 p.

(h) Joint Statement of Experts in the Field of Sediment Plume Modelling Dated 25 March 2014.

(i) Joint Statement of Experts in the Field of Sediment Plume Modelling Dated 13 February 2017.

(j) Joint Statement of Experts in the Field of Sediment Plume Modelling – Setting Worst Case Parameters Dated 23 February 2017.

10. While not contained in this evidence brief, I have also provided further response comments in the response tables

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[3] Supplementary Technical Report 20e - Evidence Dr Helen Macdonald - sediment plume modelling - May 2023

provided as part of TTR's wider comments response package to the FTAA Panel. I confirm that comments in response to sediment plume modelling have been provided by myself and are within my scope of expertise.

RESPONSE TO SUBMITTER COMMENTS

Updating evidence

11. Several submitters[4] have commented that the sediment plume modelling is out-of-date and suggested updating it.

12. I confirm that there has been no update of the sediment modelling since it was undertaken by Hadfield and Macdonald[5] and Macdonald and Hadfield[6].

13. This has been addressed in Macdonald[7]. In summary, there is no new information relating to the character and properties of the sediment (background and mining sources) that will have a significant impact on the sediment plume modelling. Since the sediment plume modelling was completed there has been several updates to both the hydrodynamic and sediment model code but both still resolve the same processes as the model code used for the sediment plume modelling.

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4 E.g. Te Rūnanga o Ngāti Mutunga Comments on the Taranaki VTM Project, paragraph 38; Comment by Ngāti Hāua Hapu with respect to the Taranaki VTM application, paragraph 5; Fast Track Panel for the Taranaki VTM Project (FTAA-2504-1048) written comments from Te Korowai o Ngāruahine Trust, paragraph 38.1.

5 Hadfield, M.G. and Macdonald, H.S. (2015). Sediment Plume Modelling, 117 p. https://www.epa.govt.nz/assets/FileAPI/proposal/EEZ000011/Applicants-proposal-documents/8e6049938f/NIWA-Sediment-Plume-Modelling-Report-Full-version.pdf

6 Macdonald, H.S and Hadfield, M.G. (2017). South Taranaki Bight Sediment Plume Modelling Worst Case Scenario, 51 p. https://www.epa.govt.nz/assets/FileAPI/proposal/EEZ000011/Evidence/ac41266d7d/TTR-Appendix-to-HRW-Report.pdf

7 [Refer to Helen Macdonald statement of expert evidence, 19 May 2023 at [7]].

Model uncertainties

14. Several submitters[8] have expressed concern regarding the uncertainty in the sediment plume modelling.

15. The uncertainty associated with the sediment plume modelling have previously been addressed in detail by Dr Mark Hadfield[9] and Dr Helen Macdonald[10].

16. As stated by Hadfield[11] *"All model predictions have an associated uncertainty and… that uncertainty is hard to quantify"*. I agree with that statement. The sediment plume modelling approach used the best information available at the time for all the different components of the modelling and are based on current best practices for far-field sediment plume modelling.

17. In paragraph 15 of Professor Luick's statement[12] on behalf of KASM and Greenpeace, he suggests that a discrepancy in vertical velocity may produce a vertical shear. The figure he refers to is Figure 3.4 in Hadfield and Macdonald[2].

18. This figure contains three panels:

    (a) The top panel is a scatter plot of velocity components with the left plot representing observed data and the right plot representing modelled velocities.

    (b) The middle panel is the velocity along the main direction of the currents (i.e. flow in the direction that the main current is heading in); and

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8 E.g. Whanganui District Council Comments, page 8.; NZ RLIC comments on TTR's application under the FTAA 2024, paragraph 8; New Plymouth District Council Comments on the Taranaki VTM Project, paragraph 3.

9 [Refer to Mark Hadfield statement of expert evidence, 17 February 2014 at [30-31]].

10 [Refer to Helen Macdonald statement of expert evidence, 19 May 2023 at [16-25]].

11 [Refer to Mark Hadfield statement of expert evidence, 28 March 2014 at [60]].

12 Statement of Evidence of Professor John Luick on Behalf of KASM and Greenpeace.

(c) The bottom panel is velocities perpendicular to the main direction of the current and is slower.

19. The bottom panel shows the biggest difference between model and observed velocities (also indicated by the low r-value), but as noted in Macdonald[13] this discrepancy is not "*often double the observations*" as described by Professor Luick. The across-current flow is much weaker compared to the along-current flow (middle panel) and it is not expected that this discrepancy will lead to a large vertical shear

20. Professor Luick requests a thorough examination of the model's ability to represent vertical velocities. However, observations of vertical velocities are difficult to obtain. Vertical velocities are often estimated from horizontal velocities or other ocean parameters. These methods, while useful, tend to produce very noisy results because vertical velocities tend to be small and is masked by the noise in the horizontal velocities. As a result, comparisons of observed and modelled vertical velocities are not standard practice for coastal models of the scale used for the far-field sediment plume modelling.

Model Calibration

21. Taranaki Regional Council[14] and Whanganui District Council[15] are concerned that the uncertainty in the calibration of the sediment plume across different years and timeframes is an indication of the model's inability to accurately resolve oceanic conditions.

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13 [Refer to Helen Macdonald statement of expert evidence, 23 January 2024 at [14]].

14 Taranaki Regional Council Taranaki VTM Project: Written Comment, paragraph 33.

15 Whanganui District Council Comments, page 8.

22. The sediment plume model in Hadfield and Macdonald[16] was run for a period of 1000 days (~3 years) and was evaluated and calibrated against:

    (a) Current meter data (**ADCP**) collected for three 2-3 month periods in 2011 and 2012.

    (b) Observed Suspended Sediment Concentrations (**SSC**) collected in February to May 2013[17].

    (c) Satellite derived total suspended solids using measurements between 2002 and 2008[18].

23. As stated in Hadfield[19] the sediment plume model was evaluated for a two-year period from 21 March 2011 to 20 March 2013. Time series of wind speed, significant wave height and river flow for the period 2008-2014 revealed that the analysis period was not anomalous and thus the statistics derived from the two-year analysis period are representative of other multi-year periods. SSCs are highly variable in time in response to winds, waves and river flow. The two-year analysis period spanned a wide range of weather conditions, including a weather bomb that crossed central New Zealand on 2 March 2012 and a drought in early 2013. It also captured seasonal variability in hydrodynamics and SSCs.

24. The major calibration steps for the sediment plume modelling were outlined in Hadfield[20].

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16 Macdonald, H.S and Hadfield, M.G. (2017). South Taranaki Bight Sediment Plume Modelling Worst Case Scenario, 51 p.

17 MacDonald, I., Gall, M., Bremner, D. 2013. "Nearshore Optical Water Quality in the South Taranaki Bight" NIWA Client Report No: HAM2013-040, Updated November 2015c.

18 Pinkerton, M.H, and Gall, M. (2015). Optical effects of proposed iron-sand mining in the South Taranaki Bight region. NIWA client report WGL2015-06

19 [Refer to Mark Hadfield statement of expert evidence, 17 February 2014 at [24]]

20 [Refer to Mark Hadfield statement of expert evidence, 17 February 2014 at [27]]

25. Taking all the above matters into account, I do not share the Councils' concerns about the model's ability to accurately resolve oceanic conditions.

26. In paragraph 22 of his evidence, Dougal Greer[21] expresses concern about the model calibration/evaluation of predicted SSC against observed data. In particular, he notes that observed SSC was, at times, five to ten times higher than model predictions and supplied a figure from Hadfield[22] (Figure 4.9) and Hadfield and Macdonald[2] (Figure 4.11).

27. The figure included by Mr. Greer shows a time series of near-bottom modelled sand concentrations against estimates from Acoustic Backscatter Sensor (**ABS**)[13] [23] estimates at a site on the northern border of the project area.

28. While the model does have a tendency to underestimate the near-bottom sand concentrations at sites closer inshore, it tends to overestimate the near-bottom sand concentrations at the more offshore sites. In addition, while the model near-bottom sand concentrations at some locations might be underestimated, it still captures the increase in concentrations associated with events and it also captures the timing of these events correctly.

29. Hadfield[18] (Section 4.3) and Hadfield and Macdonald[2] (Section 4.3) ascribes the difference between observed and modelled near-bottom sand concentrations to an inability of the model to *"reproduce the wide range of variation in susceptibility to sand resuspension between different locations on Patea Shoals"*.

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[21] Statement of Evidence of Douglas Greer filed on behalf of Kiwis Against Seabed Mining Incorporated and Greenpeace Aotearoa Incorporated

[22] Hadfield, M.G. (2013). South Taranaki Bight iron sand extraction sediment plume modelling: Phase 3 studies. NIWA Client Report WLG2013-36, 86 p

[23] MacDonald, I., Budd, R., Bremner, D., & Edhouse, E. (2015). *South Taranaki Bight Iron Sand Mining: Oceanographic Measurements Data Report*

30. Hadfield[18] (Section 4.3) and Hadfield and Macdonald[2] (Section 4.3) also notes that this can only be improved through *"a lot of tuning to local conditions"*. However, this would require information on local conditions across the entire model domain as tuning to conditions confined to a specific area might lead to improvements in that region but degrade the model elsewhere.

31. Taking these matters into account, I do not share Mr Greer's concern about differences between modelled and observed data. In my view, for the reasons stated above, the model remains fit for its purpose.

32. In paragraph 12(e) Professor Luick[24] asks for order of magnitude model assessments.

33. This has been addressed in Macdonald[25] who stated that the recommended analysis is a lower standard of assessment than those presented in section 3 of Hadfield and Macdonald[2]. Macdonald[17] considered the recommended analysis inappropriate for assessing sediment particle fall rates as mixing and other vertical current movements will make an estimate based on only sediment fall rates inaccurate (as stated by Professor Luick himself in his paragraph 12(e)). Use of velocity directions from HYCOM (or other similar models) is also inappropriate as HYCOM does not include tides and resolves the Cook Strait region at a relatively coarse resolution.

34. Based on this, I also consider Professor Luick's recommended analysis of a lower order and unsuitable for the far-field sediment plume modelling.

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24 Statement of Evidence of Professor John Luick on Behalf of KASM and Greenpeace.

25 [Refer to Helen Macdonald statement of expert evidence, 23 January 2024 at [12]].

Model domains and resolution

35. Professor Luick[26] expresses concern that the high-resolution (1 km South Taranaki Bight domain) sediment model domain does not cover a large enough region and there is a potential for accumulation of sediments in the mid-bight due to a recirculation seen in a figure of time- and depth-averaged modelled velocities.

36. It is correct that the sediment dispersion modelling did not extend to cover the entire Taranaki Bight. This was a deliberate and necessary decision, as the suspended-sediment simulations were computationally intensive and a balance had to be struck between spatial coverage and resolution. The model domain was designed to capture the area of greatest potential effect — namely, the region around the mining site where suspended concentrations and deposition rates would be highest.

37. With respect to the circulation patterns within the bight, I note that the feature described by Professor Luick as a recirculation is an artefact of time-averaging. The hydrodynamics of the South Taranaki Bight are highly variable, influenced by wind events, tidal forcing, and seasonal shifts in regional currents. In Section 2.2 of Hadfield and Macdonald[2] the circulation is described as a throughflow along the coast (Kahurangi → Patea Shoals → Kapiti → Cook Strait), and there is no evidence of a persistent, stationary recirculation cell that would act to retain sediments indefinitely. On the contrary, episodic forcing events break up such patterns and contribute to export of suspended material from the bight.

26 Statement of Evidence of Professor John Luick on Behalf of KASM and Greenpeace, paragraph 12(d).

38. Dr McComb[27] expresses concern regarding the model resolution not being able to capture the impact of changes to currents. *"The effect of pits and mounds on the local and regional currents have not been considered in sufficient detail by TTRL. The grid of the highest resolution model included in the Application (being 500 m), is too large to capture even the existing dynamical effects of the bathymetry" …"a mound of 8-9 m height will have a profound effect on the local hydrodynamics in water of 30-40 m depth"*

39. I acknowledge Dr McComb's concern that seabed features such as pits and mounds can influence local hydrodynamics. The 500 m grid used in the highest-resolution model was not designed to resolve turbulence or wake effects around 8–9 m mounds, but rather to capture the regional circulation and sediment transport pathways across the South Taranaki Bight.

40. Resolution-sensitivity tests presented by Hadfield[28] demonstrate that suspended sediment concentrations more than 2–3 km from the source are not sensitive to grid spacing. This indicates that far-field sediment dispersion and accumulation — the primary focus of TTR's assessment — are robust to the grid size used. It was also stated in the Joint Statement of Experts in the field of sediment plume modelling[29] that "*while being coarser than ideal to simulate accurately the variability and near-field behaviour, [the model grid] represent a reasonable balance between the competing demands of spatial-grid resolution and computing power requirements*".

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27 Statement of evidence of Peter John McComb (Seabed Morphology) for Taranaki Offshore Partnership, paragraph 34.

28 [Refer to Mark Hadfield statement of expert evidence, 17 February 2014 at [pages 36-40]]

29 Joint Statement of Experts in the Field of Sediment Plume Modelling Dated 25 March 2014.

41. While it is true that mounds of several metres may cause local wake effects in ~30–40 m water depth, these processes dissipate over scales of hundreds of metres and do not significantly influence the regional circulation or plume dispersion at tens of kilometres. Consequently, they are not expected to affect the predicted far-field environmental effects of the project.

Length of simulation

42. Professor Luick[30] and Mr Greer[31] expressed concerns over the length of the sediment plume model simulation and recommended that the sediment transport model be extended to cover a 20-year period. While I acknowledge the merit in considering long records, such a requirement is not practical for this type of modelling. The suspended-sediment model is highly computationally expensive, and simulations on the order of 10–20 years were not feasible with the resources available at the time.

43. Instead, the modelling approach follows best practice: Hadfield and Macdonald[2] demonstrated that a two-year simulation adequately captures the natural variability of currents, waves, and sediment dynamics within the South Taranaki Bight. Their analysis showed that the circulation features and suspended sediment behaviour observed in any two-year interval are representative of conditions across longer periods. This is because the key drivers of variability: wind forcing, tides, and seasonal changes, were fully expressed within a two-year window.

44. I note that sediment dispersion is influenced by episodic events (e.g. storms, ENSO anomalies), rather than by slow,

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30 Statement of Evidence of Professor John Luick on Behalf of KASM and Greenpeace, paragraph 15(e).

31 Statement of Evidence of Douglas Greer filed on behalf of Kiwis Against Seabed Mining Incorporated and Greenpeace Aotearoa Incorporated, paragraph 34.

steady accumulation over decades. These high-energy events act to redistribute and flush sediments, ensuring that longer-term model runs would not produce fundamentally different outcomes, but would only increase computational cost without significantly improving predictive reliability.

45. Accordingly, the two-year simulation period represents an appropriate and scientifically robust compromise: it is long enough to resolve the key environmental drivers while being computationally feasible. Extending the model to 10 or 20 years would not materially change the predicted patterns of sediment dispersion or deposition

46. Mr Greer[32] also expresses concern that climate change effects were disregarded in the sediment plume modelling. To take climate change into account in any meaningful way would require running the model with climate-projection atmospheric forcing and waves. While global climate projections might provide information on river flow, they and thus do not provide information on riverine sediment fluxes. They also do not provide information on the background SSC. Riverine sediment fluxes can be estimated from river flow using sediment rating curves, however this method is imperfect. To my knowledge it is also not possible to create estimates of background sediment SSCs - this will require a sediment transport model which is not possible to run at a global scale and on the timescales required for climate projections. Therefore, running a sediment plume model with the aim of resolving climate change effects is not feasible at present.

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32 Statement of Evidence of Douglas Greer filed on behalf of Kiwis Against Seabed Mining Incorporated and Greenpeace Aotearoa Incorporated, paragraph 35.

Model post-processing

47. In paragraph 24 of Mr Greer's evidence[33], he argues that the temporal frequency of the model output, saved as 12-hour averages, is too coarse and that a higher temporal frequency (e.g. hourly) should have been used. A higher temporal frequency would retain the peaks in SSC associated with tidal excursions.

48. We agree with Mr Greer that the 12-hourly averages mask short-term peaks in SSC. Hadfield (2014, paragraph 63) and Hadfield and Macdonald[2] (page 38) also acknowledges that the strong tidal variations are not represented in the 12-hour averages of the model output.

49. The model output was saved as 12-hourly averages due to storage limitations encountered at the time. The sediment plume model consisted of more than 10 three-dimensional variables and 3 two-dimensional variables. Saving hourly outputs of all these variables for the entire 1 km model grid generates very large files and the storage capacity available at the time did not allow for model output to be saved at higher temporal frequencies.

50. Mr Greer, in paragraph 31, asks that *"SSC contour plots and median and 99th percentile plots should be generated for shorter periods of time corresponding to the periods of highest release"*. He is referring to Figures 3-16 to 3-19 in Macdonald and Hadfield[3].

51. As stated in Macdonald[34] *"Statistical analyses such as the 99th percentile cannot be generated for short time periods as there are not enough data points (i.e., the 99th percentile occurs once in every 100 data points which we get once*

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33 Statement of Evidence of Douglas Greer filed on behalf of Kiwis Against Seabed Mining Incorporated and Greenpeace Aotearoa Incorporated.

34 [Refer to Helen Macdonald statement of expert evidence, 23 January 2024 at [15]].

every 50 days which is much more than the 20-day periods of the high releases). Time-series of SSC at locations of interest were included in Macdonald and Hadfield[3] *which showed how short-term increases relate to the median and 99th percentile"*.

52. I agree with Macdonald on this matter. Calculating the 99th percentile for short time periods will not give any meaningful results as there will not be enough data points to obtain a robust result.

Bottom-attached plume

53. Professor Luick[35] expresses concern about a bottom attached plume that is reported in Hadfield and Macdonald[2] but is not seen in the Figures. Professor Luick is concerned that the vertical profile of sediments is indicative of an issue with the sediment density. The figures that Professor Luick refers to are Figures 5.2, 5.4, 5.5 and 5.6 in Hadfield and Macdonald[2].

54. This comment was addressed in Macdonald[36]. In summary, the statement Professor Luick refers to describes the nearfield plume behaviour and how this was incorporated into the far field sediment model domain. Once the nearfield plume is in the model, it can mix into the water column depending on environmental conditions. The vertical cross sections in the figures Professor Luick referenced are snapshots of transects across the plume, chosen to demonstrate variability in this region. These snapshots are for different times and positions and are unsuitable for understanding the evolution of the plume over a couple of days.

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35 Statement of Evidence of Professor John Luick on Behalf of KASM and Greenpeace paragraph 12(a)

36 [Refer to Helen Macdonald statement of expert evidence, 23 January 2024 at [6]].

Vertical velocities

55. Professor Luick[37] expresses concern that large scale wind forcing is not captured in the 1 km South Taranaki Bight grid, raising concerns about vertical velocity.

56. This is addressed in Macdonald[38] as follows: "*Vertical velocities have not been ignored as stated by Professor Luick in paragraph 15(b), and the vertical movement of sediment is calculated using a combination of modelled vertical velocity and sediment sinking velocity. The model domain is sufficient to capture local wind driven processes such as upwelling/downwelling, and these will be created locally within the model domain. Larger-scale wind driven processes are included in the model via the horizontal boundaries.*" On that basis, I do not consider there is any basis for Professor Luick's concern.

Brine Modelling

57. A number of submitters, including Mr Greer, expressed concerns regarding the lack of detailed modelling of brine discharge.

58. ESNZ was not contracted by TTR to carry out any brine modelling.

Interaction of sediment sources

59. A number of submitters have expressed concerns about the interaction of two sediment sources**.**

60. I acknowledge the concern that there will be interaction of the sediments from the two different sources (hydro-cyclone

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37 Statement of Evidence of Professor John Luick on Behalf of KASM and Greenpeace, paragraph 12(e).

38 [Refer to Helen Macdonald statement of expert evidence, 23 January 2024 at [11]].

and de-ored discharge) and this is not addressed in the sediment plume modelling.

61. However, the sediment plume modelling of Hadfield[18] Hadfield and Macdonald[2] modelled the sediment discharge from the hydro-cyclone and that from the de-ored discharge (patch) separately. As noted, the suspended sediment from the different sources is likely to interact with each other and this interaction can only be modelled if the two sources are included in a single simulation. Combining the separately modelled sources to determine how the plumes from the two sources will interact is not appropriate as the interactions of the sediments aren't included in the different simulations.

62. In the plume model, the de-ored source consists mainly of coarse, fast sinking sediments and a small fraction of fine sediment. It is assumed that the de-ored source will act to trap a fraction of the fine sediment. The suspended source on the other hand consists of fine, slow sinking sediments. If the two sources were included in the same model simulation and released at the same time and same depth, it is possible that the de-ored source could trap a fraction of the fine sediment from the suspended source potentially reducing the size of the surface sediment plume and increasing the sediment concentration within the depositional area.

CONCLUSION

63. The sediment plume modelling, like all models, has uncertainties and errors. The sediment plume model/s developed for the Taranaki VTM project followed many of the CSIRO recommendations on dredge plume modelling[39] even though these recommendations were not available when the models were developed. Despite some short comings (e.g.

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[39] Sun, C., Branson P., Mills D. (2020) Guideline on dredge plume modelling for Environmental impact assessment. WASMI Dredging Science Node (CSIRO Research Publications Repository - Publication)

coarser resolution that desired) the sediment plume model is of good quality and fit for the purpose it was used.

C Collins

Dr Charine Collins

13 October 2025

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