To:	Environmental Protection Authority
From:	Peter Longdill
CC:	Department of Conservation
Date:	28 March 2017
Subject:	Comment on Sediment Plume Related Conditions (as revised by TTR and labelled as "TTR Proposed Consent Conditions – Version 3", dated 15 March 2017)

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1. I provided advice to the Department of Conservation in respect of a TTR application for iron ore mining within the South Taranaki Bight. The summary of my involvement is documented in a report provided to the EPA[1].

2. At the request of the EPA I appeared via skype in-front of the DMC on 17 March 2017.

3. On 16 March the EPA made TTR's revised conditions available via their website (these revised conditions are dated 15 March 2017). The revised conditions incorporate changes relating to monitoring and management of the sediment plume relative to the conditions framework submitted with the Impact Assessment (IA). I had previously provided advice to the Department of Conservation on sediment plume related conditions prior to the application being submitted to the EPA. These are the conditions attached to the IA as Attachment 1.

4. At the hearing on 17 March the EPA asked me to review the revised conditions and provide comment on them as they relate to monitoring and management of the sediment plume. This memo sets out that review.

5. I do not address non-sediment plume related conditions, or non-sediment plume specific overarching management conditions.

Comment on the Sediment Plume Related TTR Proposed Consent Conditions – Version 3, dated 15 March 2017. (Condition numbering follows the 15 March 2017 numbering).

6. From my review, I understand the main changes to sediment plume related conditions between the 15 March 2017 conditions and those submitted as Attachment 1 to the Impact Assessment (IA) is a change from a 'receptor based' to a 'discharge based' compliance framework. Where receptor based frameworks require sediment plume compliance to defined limits at key sensitive receptor sites, discharge based frameworks require compliance to 'end of pipe' limits.

7. The complete removal of receptor based SSC controls from the 15 March 2017 conditions increases greatly the decision making reliance being placed on the output from the IA sediment plume model as there is no 'fail-safe' sediment compliance requirement at the sensitive receptors. Under the IA conditions, the accuracy and validity of the Operational

[1] Summary Report on 'Pre-Application' Advice from Dr Peter Longdill to the Department of Conservation Relating to Sediment plume Dynamics and Management Associated with a Revised Proposal by Trans-Tasman Resources Ltd to Extract Iron Ore Offshore in the South Taranaki Bight. – dated 15 March 2017 and provided to the EPA/DMC on 16 March 2017.

Sediment Plume Model (OSPM) during the exercise of any potential consent would be anticipated to be greater than the currently available IA sediment plume model. This is because under the IA set of conditions several assumptions incorporated in the IA model would be replaced with data based on actual measurements from pre-mining environmental monitoring and thereafter the OSPM would be regularly updated and validated by ongoing monitoring at the Schedule 2 receptor sites once mining operations commence. Unlike the 15 March 2017 conditions, the receptor based compliance conditions framework submitted with the IA places more reliance on the subsequent OSPM rather than the initial IA sediment plume model, and also has clear and fixed SSC limits at the receptor sites themselves.

8. Accordingly, I could support a conditions framework which included both discharge and receptor based controls, or a receptor based framework such as that submitted with the IA. However, I have very strong concerns with an approach which relies wholly on discharge controls for sediment plume management. In the below paragraphs I provide more detailed comment on a condition-by-condition basis.

9. Introduction of discharge limits (mass and PSD/fines content) within new condition 5.

    a. Condition 5a is a limitation of 8,000 tonnes/hour for sediment extraction from the seabed (one month period). This limitation is generally consistent with the extraction limits proposed in the conditions attached to the IA dated August 2016 and excludes operational downtime. If discharge controls are to be included within the conditions, 8000 t/hr is an appropriate limit because it is consistent with the original model relied upon for the IA by other experts such as biologists and ecologists. Operational down time (periods of no mining activity, and thereby no sediment release), was included within the IA sediment plume model relied upon for the assessment (at a rate of 20%[2] of the total operational time, and thereby 20% less sediment release compared to a situation with no breaks in mine operation). Accounting for this 'down-time' within the conditions, which has been included within the simulated plume output relied upon for the IA is addressed in the paragraph below.

    b. Condition 5b includes a limit on the maximum volume of de-ored sediment discharged onto the seabed of 7190 t/hr. I cannot find any direct reference in the modelling reports submitted to the EPA with the application to the rate of 7,190 t/hr. Using figures from the HR Wallingford Source Terms Report[3], I calculate the figure to be 7,016.4 t/hr excluding any down time (1863 kg/s of coarse + 86 kg/s of fines = 7016.4 t/hr). The value proposed in Condition 5b (7190 t/hr) represents a higher discharge rate (and thereby higher potential sediment plume effect) than what was simulated within the sediment plume model submitted for the application (due to both the instantaneous value being higher and the model discharge being factored down by 20% due to anticipated down-time).

        I recommend that if a discharge based compliance framework is imposed that this condition should match exactly the values used within the sediment plume model, and also include the reduction for down-time. I further recommend that the units specify 'dry sediment' or equivalent.

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[2] Page 8 of NIWA, 2015. Sediment Plume Modelling, Prepared for Trans-Tasman Resources Ltd. WLG2015-22, October 2015

[3] Section 2.2 of HR Wallingford, 2015. Support to Trans-Tasman Resources. Source terms and sediment properties for plume dispersion modelling, DDM7316-RT004-R01-00, October 2015.

c. Condition 5c includes a limit (in units of m^3/hr) on the proportion of ultrafines in the de-ored material discharged (130 m^3/hr over any 48 hours, 83 m^3/hr over any 7 days, and 66 m^3/hr over any 3 months). Section 7 of the HR Wallingford Source Terms Report[3] confirms that the model accounts for the discharge of sediments < 38 µm is (57.8 kg/s + 8.1 kg/s = 65.9 kg/s). Assuming a conservative dry bulk density of 1860 kg/m3 (though TTR Ltd should confirm the density of the discharged sediment – as it is expected the discharge has lower density following iron ore extraction), this equates to 127.5 m^3/hr. It is not clear why condition 5c utilises units of m^3/hr rather than kg/hr, and it is not clear how the limits themselves are calculated. Conversion from the kg/s units (in the Source Terms Report) to the m^3/hr as proposed in the condition, requires the use of a dry bulk density factor of the discharged sediment. It is notable that the dry bulk density of the discharged sediment is not available nor defined in any of the modelling reports which I have reviewed, as that modelling utilised a measured sediment fall velocity approach to define the sediment behaviour.

   I recommend that if retained, Condition 5c should be in units of kg/s (measured as dry sediment) or kg/hr (measured as dry sediment). I further recommend that the value utilised for the condition should match that used within the sediment plume model[3] relied upon for the IA and likewise relied upon for any decision the DMC may arrive at regarding the consent.

10. Monitoring, recording, and reporting of key measures which affect discharges and compliance to conditions is an essential component under both receptor and discharge based frameworks. Whereas the conditions which were included as Attachment 1 to the IA included a requirement (as condition 54) for the <u>continuous monitoring</u> and recording of particle size distribution and regular reporting to the EPA through the Quarterly Operational Report there is no equivalent requirement in the Condition 5 of the 15 March 2017 conditions. In my opinion, to ensure accountability, it is fundamentally important that there be regular reporting to the regulator of critical performance measures and also the ability for the regulator to independently verify and audit the information provided. I recommend that the requirements of original condition 54 be retained.

Deleted (fully or partial) Sediment Plume Conditions (Condition numbering follows Attachment 1 to the Impact Assessment (IA Version)).

11. I have strong concern regarding the deletion or partial deletion of the following conditions:

a. **Baseline Environmental Monitoring – Condition 14 (IA version)**

   Deletion of bullet point 14d which required baseline collection of (continuous) SSC/turbidity data from the key sites which were listed at Schedule 2. This condition was required because of a data gap at the AEE stage (i.e. absent MEASURED baseline SSC concentrations at all Schedule 2 sites. Measured as opposed to model predicted baselines at those sites). I consider that mandating the collection of these measured data during the baseline/pre-commencement phase is essential. I interpret 'continuous' to mean uninterrupted measurements at a frequency of around 15 minutes.

b. Updating of compliance limits – Condition 17 (IA version)

Deletion of Condition 17 which required updating of compliance limits at the key sites based on the collection of actual data during the baseline/pre-commencement phase. Due to the data gap at the AEE stage (i.e. the absent measured baseline SSC concentrations at all Schedule 2 sites), I consider this step to be essential.

c. Operational Sediment Plume Model (OSPM)-Condition 18 (IA version)

i. Deletion of sub-bullet 18a which defined a key objective of the OSPM, to assist the development of response methods to ensure compliance. The OSPM should be utilised by a potential consent holder to manage their environmental compliance. I suggest that rather than full deletion of sub-bullet 18a that it could be re-worded to still emphasise one of the main purposes of the OSPM

ii. In the first paragraph under 18 deletion of "*to best enable iron sand extraction activities to maintain compliance…*". I consider the statement is still important to require that the OSPM is being used as intended. I suggest that if the wording is problematic, to replace "best-enable" with "ensure that".

I recommend that the meaning and aspirational purpose of the OSPM continue to be defined within the consent conditions to ensure that there is sufficient high level guidance on the purpose of that model.

d. Environmental Monitoring Requirements – Condition 20 (and deletion of Schedule 2) (IA version)

i. Deletion of requirement for CONTINUOUS turbidity measurements (first bullet point) during the course of any mining activity. This deletion is very significant for the calculation of statistical parameters over time for SSC/turbidity. Without a mandated requirement for continuous measurement, relevant time series data are unlikely to be achieved, as an operator would likely favour less frequent measurement (e.g. once per month manual measurement as opposed to automated every 15 minutes). High frequency (e.g. 15 minutes) measurements are absolutely necessary for determination of meaningful SSC/turbidity statistics. I consider that these data should be collected at the Schedule 2 sites continuously regardless of the conditions framework (receptor vs discharge vs combined).

ii. Deletion of sub-bullet 20b when linked to other requirements within the conditions framework mandated that there should be no significant contribution from mining at the Schedule 2 receptor sites. This significant deletion has removed any compliance requirement for SSC/turbidity at the key sites (listed in Schedule 2). I do not support the deletion of this requirement from the revised conditions framework. I consider the previous requirement to be material those conditions attached to the Impact Assessment and which informed my advice to the Department of Conservation prior to the application being submitted to the EPA.

e. Operational Assessment Report – Condition 47 (IA version)

i. Deletions made to 47f, which required that a consent holder develop procedures to avoid (mining and exposing) fine sediments as necessary to ensure meeting the SSC limits. The content of this condition is intended to not only avoid mining areas with excessive fines, but also to avoid the EXPOSURE of fine sediments to 'natural' erosive forces, thereby further contributing to the SSC within the area. I consider that this concept should be retained within the consent conditions to ensure that additional sediment sources are not created as a result of exposing fine sediments.

f. Reporting and compliance – Conditions 79 and 20 (IA version)

i. Condition 79k which required the consent holder to report on actual 25, 50 80 and 95th percentile SSC values at the key sites listed in Schedule 2 each three months and compare those actual values with the "naturally occurring" values predicted by the validated OSPM has been deleted. I consider this condition should be retained because it ensures that the predictive performance of the OSPM along with operational effects (if any) at the Schedule 2 sites can be regularly assessed by the EPA. Condition 79k also linked to condition 20b which specified that an adverse effect capable of enforcement compliance will have occurred if in the opinion of the EPA the actual percentile values at the key sites is significantly greater than those "naturally occurring" values predicted by the OSPM (i.e. significant adverse effect if there is ANY measurable contribution due to the mining activity). The 15 March 2017 set of conditions do not contain any similar requirement and rely almost entirely on the IA sediment plume model – (refer to paragraphs 7 and 13 of this memo). Those 15 March 2017 conditions contain no conditions equivalent to conditions 79k and 20 that provide for reporting and assessment of the performance of the OSPM to the EPA nor any mechanism for compliance enforcement if the OSPM under predicts the SSC effects on the receiving environment.

g. Schedule 2 and 3. (IA version)

i. Schedules 2 and 3 have been deleted. Refer to comments above regarding conditions 20 and 79.

Conclusion

12. I consider that the now proposed discharge conditions (Condition 5 of the 15 March 2017 conditions document) are not mutually exclusive with a receptor based SSC compliance requirement (i.e. the clear and fixed requirements listed at Condition 20 (sub-bullet b) and its inter-linkage to other conditions of the conditions framework which was attachment 1 to the IA). In fact, utilising both approaches could be an optimal solution achieving both a specific requirement at receptor sites whilst also controlling the 'end-of-pipe' in a more fixed, rigid manner. I consider the inclusion of clear and fixed requirement at the receptor sites to be more precautionary as it reduces the reliance which would otherwise be placed on the performance and output of the 'sediment plume model' which was presented with the application.

13. The sediment plume model is, at the time of the hearing, based on assumed parameters (e.g. ROM PSD, performance and output from the on-board processing plant, discharged sediment density, assumed burial of sediments in the pits, operational up/down time assumptions, parameterisation of key physical forcings such as wave conditions). Those

necessary assumptions carry through to the model output. I am of the view that to rely on discharge conditions to manage the plume in the absence of clear and fixed limits at receptor sites is not best practice as it places the full decision making reliance on the output from the sediment plume model at a time when there has not been an opportunity to verify or validate those necessary assumptions.

14. I consider a more precautionary approach would be to include both limits on the discharge (similar to those suggested in Condition 5 of the 15 March 2017 conditions document) and fixed clear receptor based limits (similar to Condition 20 of the conditions which were attached to the IA). A potential mine operator could then utilise the OSPM to ensure their operational compliance to those fixed and clear receptor based limits. At that time the key assumptions which are currently built into the sediment plume model could be replaced inside the OSPM by real measurements (e.g. of the input sediments, the output PSD of the plant, the actual wave conditions, the actual SSC/turbidity monitoring data, etc.).

15. The set of conditions attached to the IA collectively established a framework of checks and balances that envisaged the OSPM informing the day to day management of mining activities with the predictive performance of the OSPM regularly reported to the EPA which, if required, could take enforcement action if either the OSPM consistently under-predicted actual SSC values obtained from monitoring at the key sites OR if specified SSC compliance limits were exceeded at those sites. The 15 March 2017 set of conditions does not seem to contain equivalent provisions. I consider this to be a significant omission. The performance of the OSPM as a predictive tool needs to be constantly assessed and reported against actual monitoring results (i.e. continuous SSC/turbidity measurements which should be required to be collected by the conditions) and that process needs to be overseen by the regulator.

Dr Peter Longdill

28 March 2017