Memo

Aquatic Environmental Sciences

To: Michael Holm, Vicki Morrison-Shaw

From: Mark James

CC:

Date: 25-May-17

Re: TTR – Significance of change

I have been asked by TTR to provide technical advice on the degree of change that is to be applied to the percentiles for SSC (Suspended Sediment Concentration) in the water column at the monitoring sites (Condition 6c) and the level of reduction that would be acceptable in terms of benthic ecology monitoring (Condition 8).

Suspended sediments

The proposed Condition 6c requires that there must be no significant change in the 25th, 50th, 80th and 95th percentiles for SSC at any of the seven sites. Significant change is defined as when the difference between the measured statistical metric is more than 10% of that predicted by the OSPM over any 12 month period.

The difference of 10% referred to here is a comparison of what is predicted with mining at a particular point and the actual measured levels of SSC with mining. As an example if the model predicted a level with mining of 1.5 mg/L for a percentile then the actual level cannot be over 1.65 mg/L. In my opinion the 10% is reasonable and appropriate and such an increase would not have any more of an impact on other components of the system (water column or benthic biota) than presently predicted. This is based on the following:

a. Even close to site the highest SSC in surface waters would be a median of 1.45 mg/L and 99th percentile of 8.2 mg/L and would be 0.4 and 3.1 mg/L 20 km downstream near some of the more sensitive sites. A difference of 10% would make no difference ecologically to biological communities at these levels.
b. It should also be noted that the higher levels will be for very short periods (a few days) as can be seen in the attached time-series for 20 km away. There will be periods that there will be no mining and benthic and water column biota can tolerate short periods at higher levels.
c. It is important to relate SSC levels to tolerance levels for biota. With mining and a 10% increase, levels are still very low compared with tolerances of biota found in the area or for similar biota elsewhere. Examples are given in my supplementary evidence. For example, kelp beds can tolerate levels around 20 mg/L during 2 month field trials, paua and kina 18-74 mg/L for 9-25 days and are found inshore under SSC conditions much higher than predicted at sites impacted by the plume. Fish eggs and larvae and other zooplankton are very transient and can tolerate SSC of several hundred mg/L before they are impacted.

In other words the 10% increase, if it occurred, would not change any assessments made for benthic biota or animals (zooplankton and fish) found in the water column and effects would still be no more than minor as predicted. There also needs to be some level of tolerance to avoid insignificant exceedances resulting in non-compliance when they will not have an effect.

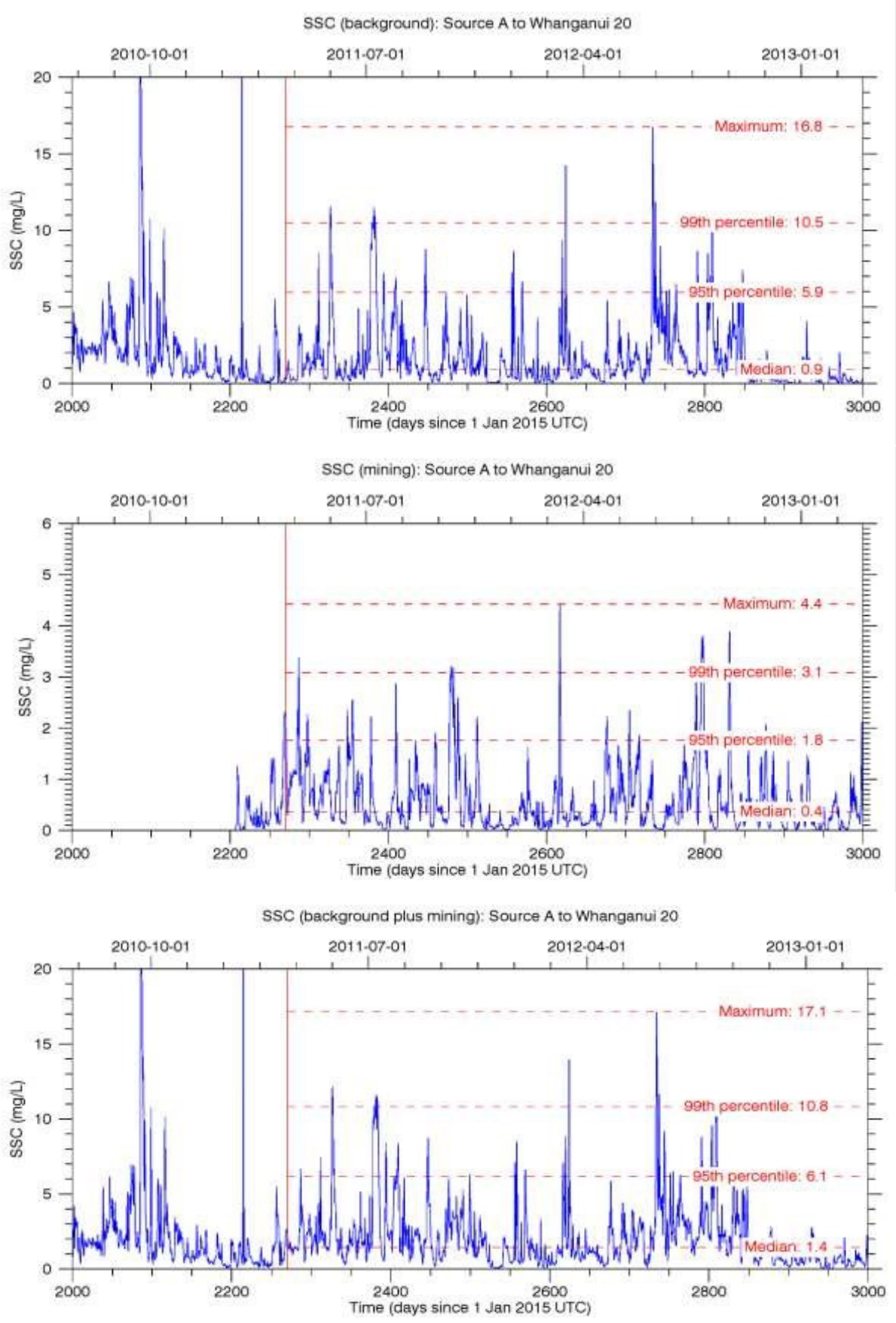
Benthic ecology

The proposed Condition 8 requires that the activities shall not result in more than a 5% reduction in various benthic metrics. The 5% change is consistent with my evidence where I do not consider the increases in SSC or sedimentation will have more than a minor effect on the benthic community. This is also consistent with Appendix One of my report (James 2016) and the consequence level in the report by MacDiarmid et al. (2014) for MFE on environmental risk where minor effects are where there is no more than a 1-5% change in population size or community composition (Table attached). Such levels may possibly be detectable but would not cause shifts in the community, impact on populations that would be ecologically significant or affect higher trophic levels.

I consider that the 5% level is an appropriate limit for change taking into account natural variability as measured before mining commences, background fluctuations at the sites and the gradient of effect which will be assessed during mining (effects will be less as one moves away). The mean value for replicates for a site would be compared with pre-mining and the variability associated with pre-mining and as may occur due to natural variability at the time, assessed from the gradient of sites away from the mining.

James, M.R. (2016) Trans- Tasman Resources Ltd consent application: Ecological assessment. Report prepared by AES for TTR.

MacDiarmid, A.; Boschen, R.; Bowden, D.; Clark, M.; Hadfield, M.; Lamarche, G.; Nodder, S.; Pinkerton, M.; Thompson, D. (2014). Environmental risk assessment of discharges of sediment during prospecting and exploration for seabed mineral. NIWA Client Report: WLG2013-66. Report prepared for Ministry for the Environment.



Time series for SSC at 20 km from the mining site when mining at Location A. Note that the changes due to mining are minor and very short-term for the peaks. The difference in the median will have no effect on the planktonic or benthic animals at this site.

Consequence levels for the intensity of an activity. Summary descriptions of the six sets of consequence levels for the proportion of the habitat affected, the impact on the population, community or habitat, and the likely recovery period. From MacDiarmid et al. (2014)

Consequence level	Proportion of habitat affected	Population/ community/ habitat impact	Recovery Period
1 - Negligible	Affecting <1% of area of original habitat area	Interactions may be occurring but unlikely to be ecologically significant (<1% changes in abundance, biomass, or composition) or be detectable at the scale of the population, habitat or community	No recovery time required
2 - Minor	Measurable but localized; affects 1-5% of total habitat area	Possibly detectable with 1-5% change in population size or community composition and no detectable impact on dynamics of specific populations	Rapid recovery would occur if activity stopped – less than 8 weeks
3 - Moderate	Impacts more common; >5-20% of habitat area is affected	Measurable with >5-20% changes to the population, habitat or community components without there being a major change in function	Recovery in >2 months to 1-2 years if activity stopped
4 - Major	Impacts very widespread; >20-60% of habitat is affected/ removed	Populations, habitats or communities substantially altered (>20-50%) and some function or components are missing/ declining/ increasing well outside historical ranges. Some new species appear in the affected environment	Recovery occurs in 2-[1] years if activity stopped
5 - Severe	Impact extensive; >60-90% affected	Likely to cause local extinctions of vulnerable species if impact continues, with a >50-90% change to habitat and community structure and function. Different population dynamics now occur with different species or groups now affected	Recovery period 1-2 decades if activity stopped

[1] Assessment of the scale of marine ecological effects of seabed mining in the South Taranaki Bight:

6 - Catastrophic	Entire habitat in region is in danger of being affected; >90% affected/ removed	Local extinctions of a variety of species are imminent/immediate. Total collapse of habitat, community or ecosystem processes. The abundance, biomass or diversity of most groups is drastically reduced (by 90% or greater) and most original ecological functional groups (primary producers, grazers etc.) have disappeared	Long term recovery to former levels will be greater than 1-2 decades or never, even if activity stopped