Summary Evidence of Shaw Mead for the EPA Hearing 23 February 2017

1 My evidence provides a review of the benthic ecology component of TTRLL's 2016 application, with the aim to assess whether predictions on the potential responses of benthic systems to the proposed activities are based on valid scientific evidence.

2 After having reviewed the current application, and relevant supporting documentation, and compared these to the information provided in the previous application (2013), my opinion is that updated predictions on the impacts of the mining activities on benthic systems are not based on a better understanding of the benthic ecology of the area, but mainly on revised models of sediment dispersion, optical effects and primary production.

3 The most significant improvement in the field of benthic ecology compared to the previous application is represented by the inclusion of an extensive monitoring and management framework which would be implemented if the consents are granted; although there are areas where the proposed monitoring could be improved. However, no effort has been made to gather more information about benthic habitats and communities of the STB and to combine the modelling information with field observation and experimental data.

4 As a result, many of the uncertainties and knowledge gaps about potential impacts on benthic ecology which affected the previous application still remain.

5 We know that the benthic organisms and the seabed material to be mined from the 65.76 km^2 will be successively ground and returned to the seabed as a homogeneous material in mounds resembling sand dunes during the mining operation, that there will be a large plume of suspended sediment generated by the operation and a large area of the seabed that will be covered by fine sediments settling out of suspension, and also that the material being returned to the seabed will be significantly different than that the pre-dredged material (i.e. it will ground up changed from a heterogenous substrate and returned to the seabed as a homogeneous material in mounds resembling sand dunes during the mining operation). However, due to the many knowledge gaps and lack of comprehensive investigations of the benthic ecology of the South Taranaki Bight (STB) and the various factors that influence it, it is my opinion that the actual impacts on biodiversity, benthic communities (both soft sediment and rocky reef), primary production, and ecosystem services/function are largely unknown and unquantified.

6 The best case scenario is that a large area of the STB benthos will be modified (changed seabed composition, reduced light penetration, increased sediment loads, changed community structure, etc., etc.) throughout the 35 year consent (the continual 'press' impact of the activity) and sometime after the cessation of seabed mining the area mined will have recovered (whether or not comprised of the same organisms and benthic communities is unknown), and that there will have been, and will be, little significant impacts on the marine environment. The worse-case scenario is that the operations will cause wide-spread ecological change that is disruptive, causes cascade impacts which change community structures and ecosystem function, reduces biodiversity, contributes to

cumulative impacts that displace key species (e.g. canopy-forming kelp), and results in a large reduction in productivity over a large area of the STB for the duration of the activity and potentially beyond (e.g. permanent changes to the benthic ecology of the mined area, permanent displacement of some species/communities, etc., etc.).

7 The main issues with respect to impacts on benthic ecology are:

- Uncertainty. We still know relatively little about the composition and temporal dynamics of the STB benthic communities under the present conditions. Inevitably, considerable uncertainties remain about the potential impacts of the proposed activities.
- Scale and duration. The uncertainty is also related to the scale and duration of the activity and the scale of the resulting impact on benthic ecology. Some 65 km^2 of the seabed will be completely reworked, with a plume impact of concern some 5 km in radius (as discussed in the JWS), or 78.5 km^2. The immediate and most intense impact on the benthic ecology is a very large area (the whole of the city Hamilton, or Lower Hutt, Wellington, Miramar, etc., to New Town combined), which is greatly reduced when considered within the model domain (13,300 km^2), which includes a great deal of benthic habitat unlike the target area (including land), and/or will not be impacted by the operation. It is unclear why benthic impacts are considered with respect to the model domain, rather than the area that will be effected by the mining operation.
- Recovery. The extraction process fundamentally changes the benthic habitats of the Patea Shoals, which suggests that there is a likelihood that the mined area will never recover to its pre-extraction. It is acknowledged that the re-deposited material will be worked by wave energy, although it is unknown whether habitats such as the bivalve shell-lag, bryozoan thickets, beds of large bivalves, etc., will re-establish in the area. Adequate investigations have not been undertaken to determine the effects on the benthic ecology at the extraction site. However, the removal of all benthic organism and the fundamental changes to the substrate/habitat over an area >65 km^2 cannot be considered negligible or minor, but rather major or catastrophic by the NIWA definition – some components may never recover/recolonize.
- Cumulative impacts. The EIA states that there are no cumulative impacts from the project, since no other mining operations occur in the STB. However, the most obvious impact of input of fine sediments into the marine environment is consistently measured against 'background' concentrations (usually at the coast), which are almost entirely anthropogenic. There are also the cumulative impacts on the wider ecology of the STB (e.g. marine mammals, fisheries, primary production, seabirds, etc.); the combination of these impacts due to the operation has not been evaluated, rather each has been treated individually. Are further impacts on an already impacted area of the coast justifiable?
- Press impacts and the change to the existing regime. It has been repeatedly stated that the site is highly dynamic and the species that inhabit it are accustomed to events that increase suspended sediments, re-work the seabed, etc. However,

these are pulse events that happen occasionally (an average of 10 days between events has been put forward, however, seasonally this is not applicable, several weeks to month can pass without an event in the summer/autumn months, while more frequent events occur in winter/spring). The mining activity will create an almost permanent change, with the extraction of 50 M tonnes of material and deposition of processed material resulting in a complete change in sediment type/grain size (which has a large impact on recolonization) and a plume that will have impacts on the benthic ecology at distances of at least 5 km from the extraction site. This is akin to moving the mouth of the Patea River (or 2x this according to the most recent modelling) to the location of the mining/deposition that has never previously experienced this level of disturbance. The background concentrations at the coast have been used to compare this impact, however, the background levels at the mining site over 20 km offshore are far lower (e.g. SSC at the proposed mining site was found to be <0.001 gm/l most of the time).