31 October 2016

Richard Johnson
Environmental Protection Authority
Private Bag 63002, Waterloo Quay
Wellington 6140
New Zealand

Dear Richard,

Request for Further Information from Trans-Tasman Resources Limited (TTR)

I refer you to your letter dated 13 October 2016, requesting TTR to address a number of questions as directed by the Decision-making Committee (DMC).

Enclosed to this letter are our responses to the questions the DMC have requested. TTR have answered these and we trust that the answers satisfy the DMC.

If the DMC request further information from TTR, we will be more than happy to provide this to them.

Yours sincerely

Shawn Thompson
Project Director

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Discharges of Sediment including its off-site dispersion

1. Have all the sediment sources likely to be generated by the activities (especially the crawler) been adequately accounted for as inputs in the NIWA sediment plume modelling?(relevant EPA expert - GHD)

Yes. This will be addressed by HR Wallingford in the evidence of Dr Mike Dearnaley.

Regarding the local disturbance of sediments around the crawler, this will be insignificant and any local disturbance caused at the suction head of the crawler will be entrained into the suction. This has been incorporated into the model considerations, noting also that the crawler is proven technology that has been used successfully by de Beers for many years.

2. Does the sediment plume model assume that no lenses of fine grained seabed or subsoil material is encountered during mining?

In the absence of any evidence of fine grained subsoil lenses TTR have, conservatively, increased the <31µm proportion of the run of mine sediment in the modelling to allow for the possibility of encountering a local increase in fine sediments.

3. What are the relevance of the 'net differences' (predicted increases) in median and 99th percentile suspended sediment concentrations (SSC) at the three locations discussed in section 4.4.2.3 of the Impact Assessment? (relevant EPA expert - GHD)

The important thing is that for 50% of the time the differences will be at or less than the median with increases of 0.4 to 1.5 mg/L depending on distance from operations, wind direction etc. The corresponding range for 99th%ile is 5.5 to 10.8 mg/L i.e. for 1% of the time or less the environment would receive these levels or higher. The time series shows that such levels would occur as spikes for less than 7-10 days (see time series data below noting the different scales for the mining plot. Note – the time series plots do not form part the technical reports referenced in the Impact Assessment however, they will be introduced in the evidence of Dr Mark James as part of the hearing process). The fauna present can tolerate such spikes as we also see in the natural background, noting that we have used 95%iles for the upper limit of background at which time a management response would be required. The median level net differences would not be ecologically meaningful for fauna found in the region.

Phytoplankton, macroalgae, and microphytobenthos found in the South Taranaki Bight are already well adapted to the scale and pattern of variability in light availability. They can adapt rapidly, particularly for the microscopic producers, and operate on the order of hours and do so on a daily basis. They have significant ability to respond to alterations in the light field at time scales greater than an hour or so. Macroalgae can also adapt over the longer term by storing photosynthetic products, which is an additional advantage of large body size. Thus the temporal patterns of light attenuation by mining activities at the modeled sites (not directly at the mining site itself) will be well within the bounds of adaptation and therefore not significantly driven by the mining-driven pattern of light availability.

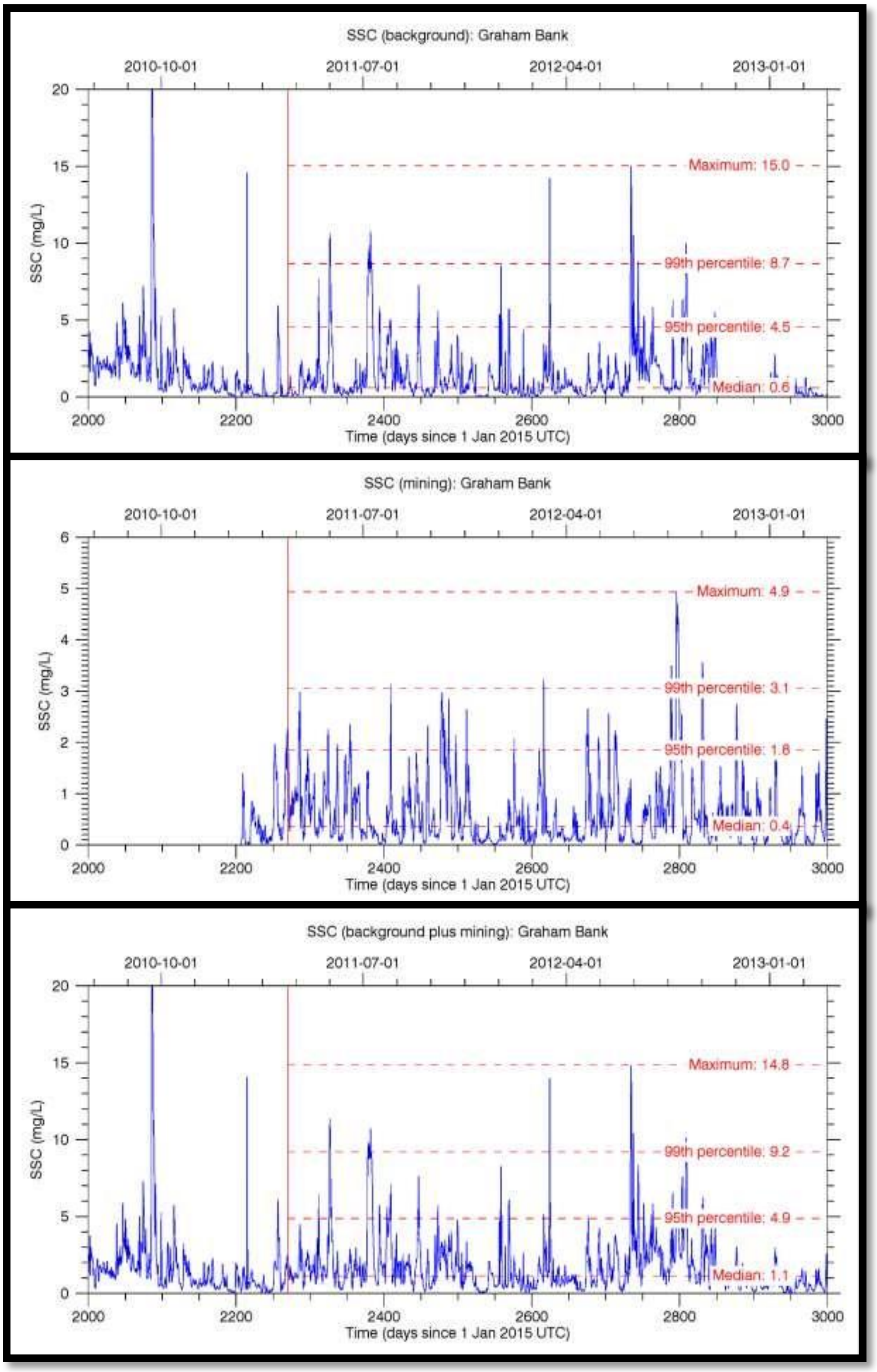

Figure 1: Time series graphs of SSC levels at Graham Banks

4. **What pattern exists in terms of the predicted number of days where light is predicted to be reduced - are they all contiguous or spread out and does this affect the primary production effects assessment? (relevant EPA expert - GHD)**

See response to #3 above. Also, because of adaptation at short time scales, the time pattern in light availability is longer than the time scale for adaptation. Thus that pattern does not affect the primary production effects assessment.

5. **In what way has TTRL demonstrated that the assumed sediment model domain (SMD) is a suitable area over which to average predicted results for optical and primary production effects given the strong likelihood of hydrodynamic gradients within the SMD?(relevant EPA expert - DHI)**

Sediment plume behaviour was predicted using a set of model domains, each informing the subsequent smaller domain. The outer domain covered Greater Cook Strait providing time varying hydrodynamic conditions around the boundary of the two inner domain models, a larger inner domain extending from Cape Egmont to just north of Kapiti Island, which addressed the river inputs and another smaller domain covering an area over Patea Shoals on which sediment processes are simulated.

The model outputs within all modelled domains have been verified with on-site measurements demonstrating the suitability of the domains used in the model to predict the effect of suspended sediment concentrations released from the mining site in both the mid and far-fields.

The appropriate area over which to average predicted changes to optical properties and effects on primary production was discussed in Section 2, Cahoon et al. (2015) [Effects on primary production of proposed iron-sand mining in the South Taranaki Bight region, October 2015; Report 16], as follows:

> *"Marine ecosystems generally have open boundaries, and defining the spatial scale on which to consider impacts on such systems can be difficult. In addition different components of ecosystems have different spatial footprints, with higher trophic-level organisms usually moving over a greater spatial extent than lower trophic-level organisms. In this report we are concerned primarily with primary production, the domain of phytoplankton and phytobenthos. Most phytoplankton and benthic phototrophs in the STB will live and die within a few km. However, some fish and other higher trophic-level organisms may move greater distances, and depend on a variety of food resources and locations. Impacts on primary production in one location can thus affect other places, and the STB ecosystem should be viewed as an interlocking matrix of the life ranges of different organisms."*

The statement above means that it is difficult to spatially bound "the STB ecosystem" or determine the appropriate area over which to average changes to primary production.

Where they are known, it is best to consider effects on specific organisms with respect to their characteristic spatial scales. So, for example, the impact of changes to primary production on blue whales should be considered at a much larger spatial scale than the South Taranaki Bight domain. In contrast, impacts on sessile benthos (e.g. kelp) should be considered at a "point-scale" as these do not move. Information was hence included in Pinkerton & Gall (2015) on optical effects at key sites (e.g. Traps, Graham Bank).

Because variations in ecosystems often follow variations in oceanographic conditions, the Sediment Model Domain chosen for the plume modelling is considered to be an appropriate surrogate for an "average" ecological domain.

Reference

Pinkerton, M.H.; M. Gall (2015). Optical effects of proposed iron-sand mining in the South Taranaki Bight region. NIWA client report WLG2015-26 rev 2 for Trans-Tasman Resources. Project TTR15301. September 2015.

6. What is the final particle size range of the discharged post-processing material (de-ored sediment) compared to the material extracted?

Figure 2 below shows the comparison between the 'run of mine sediment' and that of the 'discharged sediment' and shows that there is a significant difference with the particle size distribution of the discharged sediment. On average, over the particle size distribution range, there is a 6% difference for the 'run of mine sediment' and the 'discharge sediment', with the discharge sediment having a higher proportion of fines (very coarse silt and finer sediment).

The PSD has not changed from what was used for the first plume model generated for the 2013 TTR marine consent application.

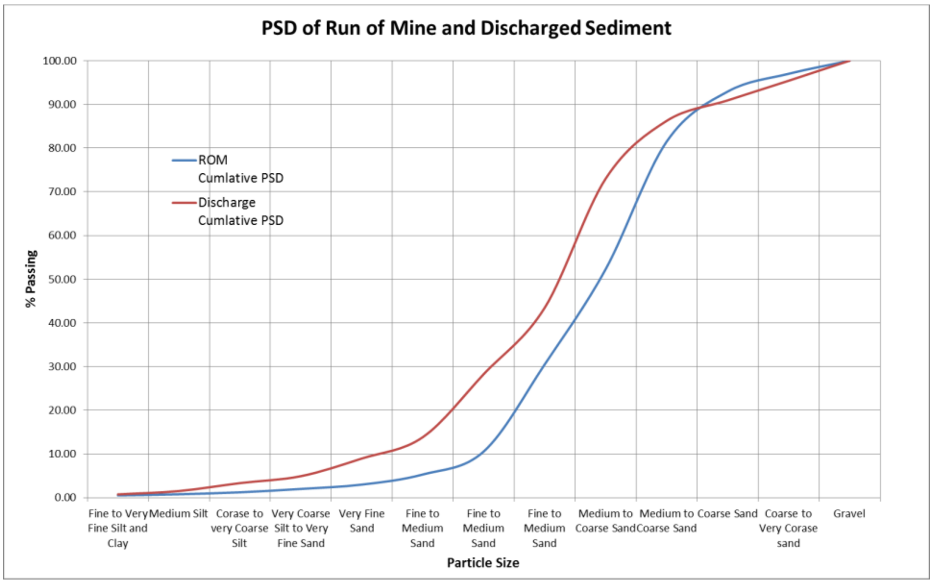

Figure 2: Particle size distribution graph of the run of mine and the discharge sediment

7. Why are the de-ored sediments discharged 4 m above the seabed? Can they be released closer to the seabed and would this reduce the size and subsequent effects of the sediment plume?

The primary objective for the re-deposition pipe depth control system is safety, encompassing the safety of the crew, the environment and equipment.

The energy of the offshore marine environment imparts a set of motions on all vessels, which include rolling, pitching, yawing and heaving. While the Integrated Mining Vessel's size and draft, and dynamic ballast control will serve to dampen the effect of these motions it will not *be eliminated. These motions and control system response times have dictated the set height of the re-deposition pipe's exit point above the seabed.*

The central principal behind the 4m is the re-deposition pipe's control system's operational response time, which is essentially "how fast" the system can safely respond to a change in the surrounding environment i.e. depth. The inherent delays within any process control system require sufficient time to facilitate safe and adequate responses.

8. How will the results of grade control drilling influence the mining activity, both horizontally and vertically? If the grade control drilling shows lenses of fine grained material will mining avoid these, and if so how will they be avoided?

The purpose of grade control drilling in all mine planning operations is to understand and plan for any variability in sampling of the sediment, prior to the extraction of the scheduled mining area or block. This is an ongoing process which takes place ahead of the mining operations and allows for adjustments of mining schedules and mineral grade projections.

Grade control drilling is the final step in defining the ore body boundaries, lithology changes, grades and tonnage before extraction takes place. This would include the identification of any localised potential increases in fine sediments and allows mining operations to adjust operational parameters to ensure any increase of fines in the plume is managed appropriately and within the limits of the marine permit conditions. These operational adjustments could include, but not be limited to, decreasing the depth of mining, reducing the run of mine extraction, processing plant configuration and even moving to a secondary pre drilled mining block area.

9. Section 2.3.3.1 of the IA states that grade control drilling will occur an average spacing of 100 metres. What mitigation measures will be put in place if you strike an unexpected lens of fine grained material when mining occurs?

See answer 8 above – In the unlikely event of them being required, operational mitigations could include, but not be limited to, decreasing the depth of mining, reducing the run of mine extraction, adjusting processing plant configuration and even moving to a secondary pre drilled mining block area.

10. Where were the three samples that HR Wallingford (HRW) tested collected from and do they reflect the nature (in particular the ranges of particle sizes) of the post-processing sediment proposed to be discharged? What was the chain of custody process associated with the collection and processing of these samples?

The three samples sent to HRW Wallingford, to be tested, were collected from post processed sediment samples, processed at TTRs pilot plant facilities at Porirua. These samples reflect the sediment that will be discharged.

The extracted bulk samples were taken from multiple drill holes over specific locations and consist of up to 3.2 tonnes per sample. The bulk samples were from three separate locations, as shown in Figure 3. These three samples are part of the 13 bulk samples taken within the *proposed project area and are representative of all the bulk samples tested and of the minable iron sand sediment.*

The samples are bagged and transported via bulker bags to the TTR warehouse where they were processed. As part of reporting a mineral resource, in accordance with JORC, TTR demonstrated that its procedures relating to the samples chain of custody were performing as expected and provided accurate and reliable data. This verification was undertaken by Golder Associates.

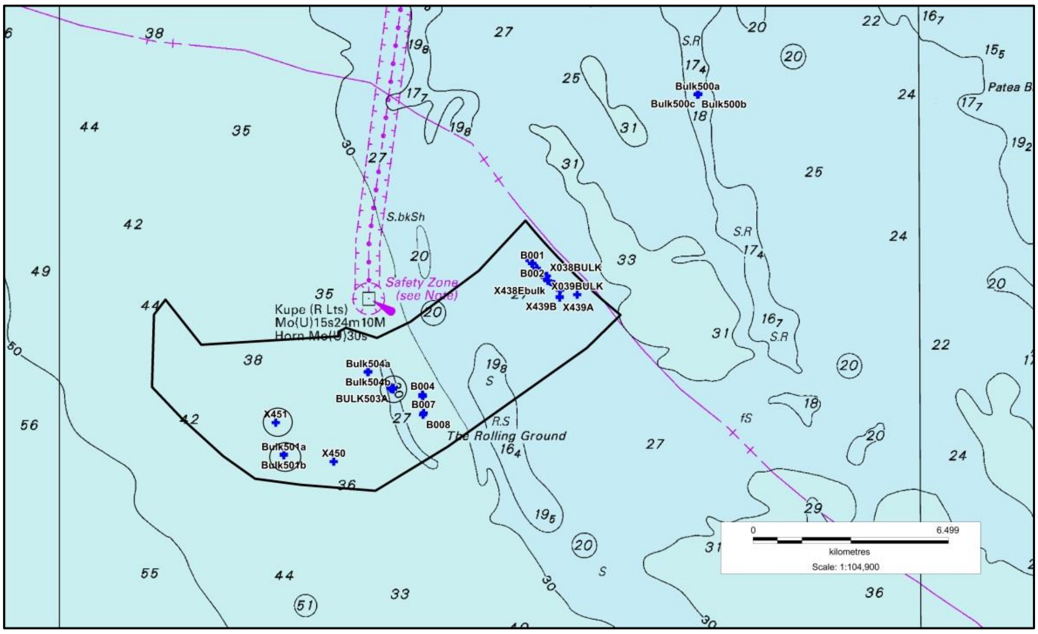

Figure 3: Locations of the bulk samples processed by TTR and the locations of the samples sent to HR Wallingford (circled)

11. Will there be any discharge of sediment (iron sand/ore) into the sea from the belt conveyors that are proposed to be used to transfer the iron ore from the floating storage and off-loading vessel (FSO) to the cape-sized export vessel (CEV)?

No. An important characteristic of the material transfer system fitted to the FSO is full containment of fugitive material releases from all transhipment operations.

Effects on Plankton (primary production), fish and marine mammals

12. What is the abundance, diversity, or likely impacts on cephalopods from your proposed activities? Are cephalopods a distinct group of fauna within the STB? (relevant EPA expert - DHI)

New Zealand has a diverse cephalopod (octopus and squid) fauna comprising 119 reported species representing 34 families in 5 orders (MacDiarmid 2007) with many additional species awaiting description. About 25% of reported species occur only in New Zealand waters (i.e. they are endemic to NZ).

Most cephalopods have a short lifespan, typically 12-18 months, growing very rapidly from egg to adult, spawning once, then dying. This makes for a difficult group to manage from a fishery or impact point of view because the biomass of each species naturally increases rapidly each year and then decreases to low levels as the animals spawn and die (MPI 2016).

Cephalopds are potentially highly mobile. Tagged arrow squid range 0.14- 5.6 km per day (MPI 2016).

The occurrence of cephalopods in the STB is not well known. One species, the arrow squid (Nototodarus gouldi) is a minor by-catch species in the jack mackerel mid-water trawl fishery in the STB with a total catch of 149 t over the years 2007-2015. In 2015 the mid-water trawl catch of arrow squid in the STB was 15 t. This catch history is reported in Table 3-5 in the NIWA report to TTR titled 'South Taranaki Bight Commercial Fisheries'. Almost all of this midwater catch of squid occurred in deeper water to the south-west of the proposed mining sight. Nationwide (excluding the southern Islands and Kermadec QMAs) the trawl catch of arrow squid (Nototodarus gouldi and N. sloanii) in the 2014-15 fishing year was 9,668 t (MPI 2016).

In the 1980s there was a significant squid jig-fishery in the south-western Taranaki Bight which was largely driven by upwelled water and temperature fronts that advect into the Bight from Kahurangi shoals. However, for market and commercial reasons jig fishing for squid in New Zealand waters has dramatically declined with just 513 t captured around mainland New Zealand during the 2014-15 fishing year. In the STB the squid jig catch since 2007 is:

Year	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Catch (t)	*2229.4*	*536.1*	*536.1*	*526.5*	*790.6*	*0*	*230.0*	*0*	*0.6*

Because the centre of distribution of arrow squid in the STB is in deeper water to the south-west of the iron sand mining area or the associated plumes, the potential for squid populations to regenerate very quickly each year, and their mobility, arrow squid is unlikely to be adversely affected by the proposed iron sand recovery operations.

<u>*References cited:*</u>

MacDiarmid, A. (ed) (2007). The treasures of the sea: Nga Taonga a Tangaroa. A summary of the biodiversity in the New Zealand marine ecoregion. WWF-New Zealand, Wellington, 193 p.

Ministry for Primary Industries (2016). Fisheries Assessment Plenary, May 2016: stock assessments and stock status. Compiled by the Fisheries Science Group, Ministry for Primary Industries, Wellington, New Zealand. 1556 p.

13. Will satellite based analyses be continued as a way of acquiring a full spatial understanding of sediment and other optical changes in the STB and allowing spatial validation of the operational sediment plume model (OSPM) as part of the Environmental Management and Monitoring Plan (EMMP)? (relevant EPA expert - DHI)

Optical monitoring using ocean colour satellite sensors will be used for spatial validation of the operational sediment plume model. TTR will use satellite data to characterise background conditions and observe patterns / intensities of optical effects and, *retrospectively, to validate the OSPM. Where feasible, TTR would assimilate satellite data into the OSPM.*

Proposed environmental triggers/limits and the adaptive management approach

14. Should the proposed response and compliance limits be based on 'exposure over time' (frequency and duration) in addition to intensity? (relevant EPA experts - AECOM and DHI)

TTR consider that 'exposure over time' is provided for in proposed consent condition 20(b) which states:

> *"to ensure that the activities authorised by these consents:*
>
> *……*
>
> *b. Do not result in any adverse effects that were not anticipated at the time of the granting of these consents.*
>
> *Without limiting the requirement of b. above, an adverse effect will be deemed to have occurred if the actual 25, 50, 80 and 95 percentile Suspended Sediment Concentration values during any six (6) month period (as calculated from observed turbidity measurements) are, for that same period and in the opinion of the EPA, significantly greater than the background (no mining) percentile values predicted by the validated Operational Sediment Plume Model (Condition 18) or the values specified in Schedule 2. [our emphasis]"*

15. Is measuring turbidity appropriate as a proxy for the proposed response and compliance SSC limits?

It is standard practice to measure turbidity continuously and then calibrating initially (or at regular intervals, if sediments are likely to change in character) for conversion to SSC. A similar approach has been taken with the Port Otago dredging programme and in numerous other dredging projects.

Physical seabed and subsoil disturbance effects

16. Section 4.6.5 of the IA discusses restoration and recolonization in terms of dredging. Are the effects on the environment from these two activities (dredging and your proposed mining approach that processes the material) comparable?

The disturbance of the seabed from the proposed iron sand mining programme is no different from other processes that remove sediments from the seabed and that are routinely undertaken around the world – for example routine dredging of navigation channels.

The same constituents, processes and effects will be present in dredging and the proposed extraction operations as both involve extracting sediments and disposing of them. Hence, TTR considers the effects observed with dredging are directly relevant.

17. Has TTRL considered stripping, saving, and replacing the top part of the seabed that contains surface soft body benthic organisms during the extraction of the material? If you have considered these options can you please explain why you have not decided to use relevant issues these approaches in the extraction of the material?

As part of TTR's early project assessments, the typical surface "overburden storage and respreading" strategy was considered and disregarded. The reasons for doing so include:

- *The method that would be used to extract or move this top part of the seabed would be a standard trailer suction hopper dredge which would be no different to the method of extraction proposed by the current crawler. The soft body benthic organisms would still be exposed to being "sucked up" and transported through a pump mechanism;*

- *The extracted sediment (overburden) would have to be placed on the seabed in the immediate area firstly creating an additional plume source and secondly exposing the raised mound to increased waves and current scouring;*

- *The soft body benthic organisms living on or in overburden storage area would be smothered, unless this area was firstly relieved of its own top layer;*

- *The overburden would then be extracted and relocated for a second time, once again creating an additional plume and exposing the soft body benthic organisms to mechanical agitation; and*

- *This strategy would only delay the rehabilitation of the benthic environment.*

18. Has TTRL investigated alternatives to the proposed excavation of seabed material in continuous strips adjacent to one another? For example, working in one strip, leaving the next adjacent strip undisturbed and then mining the next strip? Would such an approach be feasible and would it aid in the recovery rates of the benthic communities?

This approach is not feasible, either practically or economically.

The sediments on the seabed within the TTR permit area are free flowing sands. All surveys, sampling and breaching tests have shown that the sediment breaches easily, preventing the formation of any notable face, reverting very quickly to a natural angle of repose of approximately 30°. This precludes the retention of any undisturbed sediments on an "alternate" lane surface. The adjacent surface sediment will tend to naturally breach into the depression created by the extraction and if not extracted will only be covered by the re-deposition process, thus not contributing at all to any recovery process.

19. What period of time is required for the stripped/replaced material to become a suitable habitat for benthic organisms and communities if it is left to recover by itself?

Bacteria will start to recolonise the redeposited sand almost immediately after deposition and larval stages of benthic invertebrates will start colonising the sediments soon after. The timescale for full recovery of benthic communities is discussed in relation to question 21 below.

20. Are the benthic communities expected to recover to pre-mining levels and what factors will affect whether this will occur? For instance alternatives such as leaving material in stockpiles or mining in alternative strips etc.

Benthic communities are expected to recover to pre-mining levels, but, as discussed in response to question 21 below, the time it will take is not able to be stated with precision as recovery rates need to be inferred from studies undertaken in more sheltered locations. Active seabed process will tend to winnow any fine particles from redeposited surface sediments and transport unmined sediments into the area – both processes will drive the characteristics of surface sediment towards that originally present.

The change in iron content in the sediment will have no significant impact on community composition. Iron content had very little explanatory power in the analysis of the composition of benthic communities from the mining site. Material from the STB was used by NIWA to experimentally assess the impact of decreased iron sand content of re-deposited sands on recolonization. The experiments had to be conducted in Wellington Harbour because of the exposed nature of the STB, and showed that iron sand content had no significant effect on the benthic community composition (Beaumont et al. 2015).

Besides the reasons given in the answer to question 18, mining in alternative strips is expected to make little difference to recovery times as, for the majority of species, populations are expected to recover via settlement of planktonic larval stages that are likely to have originated many kilometres away. Mobile benthic invertebrate species are very uncommon in the proposed mining area and immigration from immediately adjacent areas to the strip being mined and sediment re-deposited is expected to be equally low.

21. What are the expected recovery scenarios (timeframes) in relation to benthic communities within the mining area? What does the expected recovery look like both spatially and temporally? Graphic illustrations of the temporal recovery of benthic communities are requested.

The benthic community in the STB where the iron sand recovery would take place occurs in a very exposed, high energy, highly dynamic sandy environment and is thus subjected to episodic disturbances from wave events and river inputs during high rain-fall events. The existing benthic community is dominated by short-lived, opportunistic and early successional or colonisation stages, with a very low abundance of longer lived organisms, indicative of an environment that is regularly disturbed.

There is now a good body of information available in New Zealand and overseas on benthic community recovery rates in more sheltered locations following sediment plume and sedimentation events as a result of dredging and other activities. For example, Port Otago studies have showed that it took up to 6 months for a disposal site in Blueskin Bay outside the harbour entrance to recolonise and have a similar community to a site protected from disposal.

Recolonisation following sand disposal, which is the main type of material to be considered with the TTR application, was much quicker with the community being similar to pre-deposition on a time scale of weeks. This is consistent with experimental studies undertaken in Menai Strait, North Wales that showed clean sand communities had the most rapid *recovery rate following disturbance, whereas communities from muddy sand habitats had the slowest physical and biological recovery rates (Dernie, et al. 2003).*

Surveys following dredging at the Port of Auckland and disposal of 262,000 m^3 in the Hauraki Gulf found there was an initial increase in species abundance and diversity of benthic communities, then a reversion to baseline conditions Early successional communities, which included the likes of tube-dwelling polychaetes, were evident immediately after disposal followed by an increase in longer lived successional stages 8 and 11 months after disposal.

Generally, communities associated with sand in high energy environments are very frequently disturbed and are likely to be continually in an early transitional stage. The longer lived species in these communities, such as large starfish (which were found at low densities of 6 per ha in the proposed mining area), could take several years to fully recover in the area where sands are extracted and re-deposited. But there is likely to be some movement of these mobile species into the area immediately after the iron sand recovery activities move to the next block.

In summary, the dominance by early successional stages in the area where the actual excavation and sand re-deposition takes place means that recovery should be relatively rapid and likely to be at the scale of months. Recovery of some taxa such as small polychaete worms would be expected to start within a few weeks of the ISR operations moving elsewhere within the consent area. However larger, long-lived biota could take months to several years to fully recover in the excavation area.

Confirming these details is an integral part of the proposed monitoring programme.

References:
Dernie, KM; Kaiser, MJ; Warwick, RM (2003). Recovery rates of benthic communities following physical disturbance. Journal of Animal Ecology 72: 1043–1056.

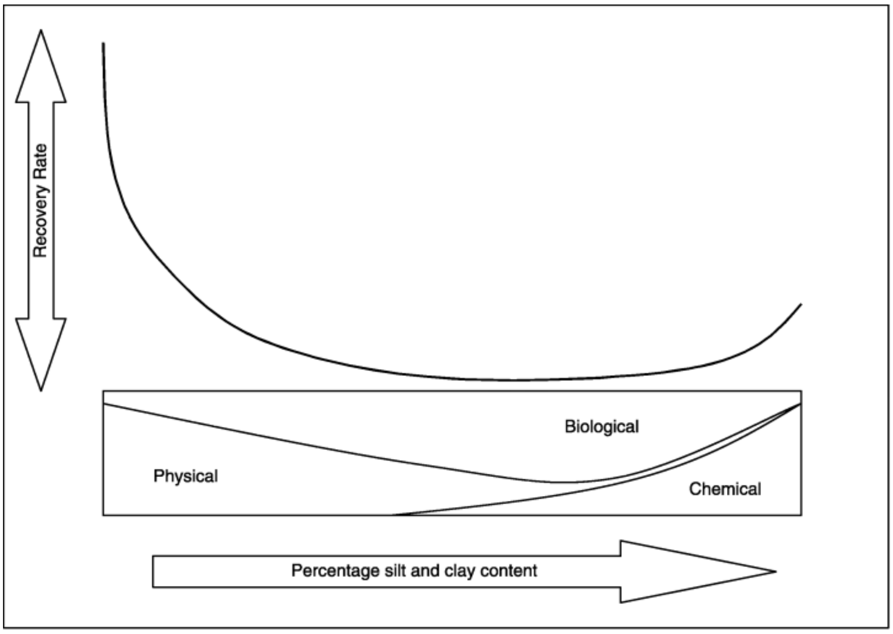

Figure 4: Schematic diagram of the recovery rates within disturbed sediments. Taken from Dernie et al (2003)

Bioaccumulation on benthic ecology

22. The IA discusses the effects of bioaccumulation effects of mercury but it does not specifically describe the bioaccumulation effects of other metals despite stating (section 4.6. 7 of the IA) that offshore biota can be affected through bioaccumulation into the food web. What are the risks of bioaccumulation of metals other than mercury within marine biota and what level of variation is there in concentrations across the sites?

We refer you to the report undertaken by Dr Kay Vopel "Iron sand extraction in South Taranaki Bight: effects on trace metal contents of sediment and seawater", provided as Report #42 in the 'Reports Referenced in the IA' package. This report addresses this question in detail. In summary Dr Vopel concludes the following [our emphasis added]:

> *"The concentrations of dilute-acid soluble cadmium, copper, lead and zinc in deep sediment were of the same order of magnitude as their maximum concentrations in surface (reference) sediment. For cadmium, copper and zinc, there was no evidence for consistent trend of increasing concentrations with increasing sediment depth below the seafloor. The sediment concentrations of lead decreased with depth below the seafloor at three of five sites.* ***Overall, we infer a low probability of adverse effects of these dilute-acid soluble metals on benthic ecosystem functioning.***
>
> *The concentrations of dilute-acid soluble chromium and nickel in deep sediment were often one order of magnitude higher than their maximum concentrations in surface (reference) sediment. Furthermore, at four of five sites, chromium and nickel concentrations increased with increasing depth below the seafloor. Additional analyses of sediment slurry collected to a maximum depth below the seafloor of 18 m, however, did not reveal evidence for such trend. We found no consistent increase with depth in the concentrations of dissolved nickel in the slurry. The concentrations of chromium in the slurry were below the detection limit.*
>
> *The concentrations of nickel in the seawater suspensions of deep sediments (all five sites) and surface (reference) sediment (three of five sites) were equal or larger than the ANZECC & ARMCANZ guideline concentrations for the protection of 99% of species. However, the nickel concentration never exceeded the guideline concentrations for the protection of 95% of species. Assuming that the nickel concentration in South Taranaki Bight seawater equals the detection limit for nickel,* ***it would only require an 83-fold dilution of the elutriate extract to decrease the highest nickel concentration measured to below guideline concentrations for the protection of 99% of species****"*

Effects of the Maori existing interests

23. What are the effects of the proposed activities on Maori who have had settlements under the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992?

Section 3.11.9, including Table 3.7, of the IA identifies those parties which are mandated iwi organisations under the Maori Fisheries Act 2004 which implemented the agreements made under the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992.

The potential effects on those parties who have fishing interests under the Maori Fisheries Act 2004 are considered to be:

- *Impact on customary and commercial fishing;*
- *Adverse effect from the sediment plume and increased sedimentation;*

- *Adverse effect on organisms in the Project area due to extraction and the rate of recolonisation;*
- *Impact on fisheries and life in the sea;*
- *Adverse effect on tuna (eel) and whitebait;*
- *Long term environmental sustainability of the coastal area; and*
- *Effect of an unplanned event such as an oil spill on the environment.*

These potential effects have been discussed in the relevant parts of Section 4 of the IA. Section 4.11 with specific reference to Section 4.11.3 (Te Tai Hauauru Fisheries Forum which the majority of the parties in Table 3.7 have representatives on) and Section 4.11.4 (Cultural Effects mitigation) which includes proposed consent conditions to ensure (amongst many other matters) that any effects on fishing interests are monitored and managed to ensure that the project related effects are avoided, remedied or mitigated. Overall, it is considered that the project will not result in any effects on the existing fishing interests of the parties identified in Section 3.11.9 of the IA.

Exclusionary effects in and around the project area and effects of the activity on existing interests

24. We note in the IA that surfing organisations and clubs (Surfing Taranaki, New Plymouth Board Riders, and Opunake Boardriders Club) are not listed in section 3.11.2.1, despite the fact that the Greenaway & Associates report (Report 29) identifies that potential effects on surfing may occur and summarises the consultation undertaken in 2013 with these clubs. If there are potential effects on surfing then an explanation should be provided as to why the IA doesn't identify surf groups as persons with existing interests.

For the reasons set out below, TTR considers that any parties with surfing interests, including individuals and surfing / board riding clubs, will not be adversely affected by the project.

Section 4.5.2 of the IA summarises the effects of the project on surf / wave characteristics. This section is based on the eCoast Marine Report - "Potential Effects of Trans-Tasman Resources Mining Operations on Surfing Breaks in the Southern Taranaki Bight, 21 July 2013 updated November 2015"

In respect of wave characteristics, eCoast's extensive modelling of the wave environment, predicted the following 'worst case scenario':

- *Increases in wave height in the order of 100 mm around the Manawapou River outlet.*
- *Decreases in wave height in the order of 100 mm around Patea.*
- *An increase in wave period of less than 0.5 seconds north of Patea.*
- *A decrease in wave period of less than 0.1 seconds at Patea.*

Overall, eCoast concluded that the impacts of the project operations, including the project related vessels, on the wave environment within the project area and at the coast are insignificant.

With regard to surf breaks, eCoast's assessment, which included extensive modelling of the wave environment, found that the principal changes in surf break characteristics arise from changes in the offshore wave climate. The modelling concluded that because the project area is located over 20 km offshore, the effects on wave characteristics, and therefore surf breaks, are insignificant.

These conclusions were accepted during the joint expert conferencing on waves and surfing for the previous application held on 20 March 2014.

25. Section 6.3.14 of the IA states that consultation was undertaken with representatives of the various recreation and tourism operators that were identified earlier in the IA as having existing interests that are likely to be affected by the activities. The nature of this consultation is described in general terms and it does not describe who TIRL consulted with. We also note that this consultation (and feedback) is not presented or discussed in the Greenaway & Associates report (on recreation and tourism effects) and it only covers consultation undertaken in 2013. Which recreational and tourism operators has TTRL consulted with?

TTR has undertaken consultation with the following recreation and tourism operators prior to lodgement of the application:

- *South Taranaki Charter Boats – 20/08/2015;*
- *Hy-jinks Fishing Charter – 20/08/2015;*
- *Patea Boat Club –29/07/2015 and 30/11/2015;*
- *Ohawe Boat Club –29/07/2015 and 30/11/2015;*
- *Opunake Boat Club 10/07/2015;*
- *Egmont Boat Club – 30/06/2015 and 1/12/15;*
- *South Taranaki Underwater and Dive Club - 29/07/2015 and 1/12/2015; and*
- *South Taranaki Volunteer Coastguard – 29/7/15 and 1/12/2015.*

26. What are the overlaps between the project area and commercial fishing and what species are present that could be affected. A graphic illustration is requested.

These are detailed in a report by NIWA titled 'South Taranaki Bight Commercial Fisheries' provided as Report #18 in the 'Reports Referenced in the IA' package.

The overlap of the mining area and sediment plumes with overall commercial fisheries effort (numbers of fishing events) and catch (t) is provided in Figure 3-1, (copy below) with this *overlap explored for each fishing method in subsequent figures. The commercial fisheries potentially affected are described in detail in the NIWA report, but in summary:*

- *The fisheries with the greatest overlap with the proposed iron sand extraction operations are the bottom trawl fisheries for leather jackets and trevally;*

- *The set-net fisheries for rig, carpet sharks, trevally, school shark, snapper, and spiny dogfish;*

- *Between 5% and 17% of the total catches in the study area for these species occur in the area where SSC exceeds the 2 mg/l threshold for fish avoidance 1% of the time; and*

- *The area where SSC exceeds the 2 mg/l threshold for fish avoidance 50% of the time is small and negligible compared to the scale of the fishery in this quota management area.*

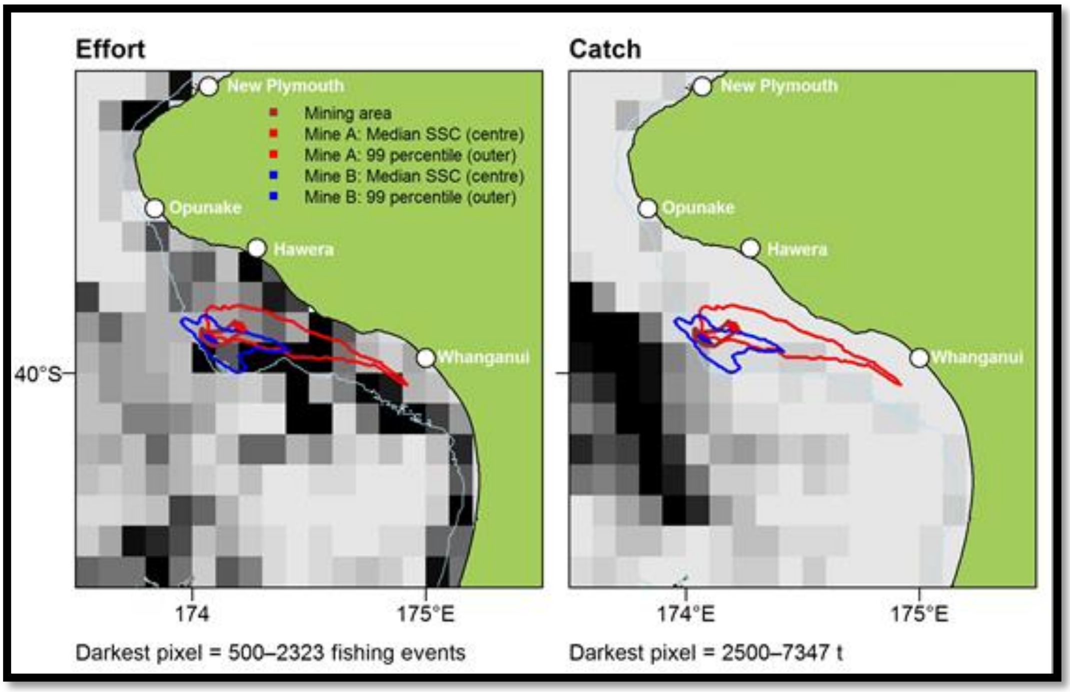

Figure 5: All commercial fishing methods - effort and catch where locational data were available from TCEPR, TCER, LTCER, LCER, and NCELR forms. Density plots showing the spread of commercial fishing effort (number of fishing events) and total catch within the study area between 1 October 2006 and 30 September 2015. Pixels are 0.1° x 0.1° rectangles. The light blue line represents the 50 m contour. Also shown is the proposed mining area, and the contours where SSC is above the threshold at which marine fish avoid sediments (2mg / l) 50% (median) and 1% (99th percentile) of the time when mining occurs at the innermost (A) and outermost (B) points of the mining area.

Economic benefits to New Zealand

27. Has any price sensitivity analysis been undertaken?

TTR has not considered it necessary to consider iron ore price sensitivity in its marine consent application process. The reasons for this are as follows.

TTR will only undertake this project once it is fully satisfied that it makes economic sense to do so. That is a decision for TTR's Directors to make at the appropriate time. As the Environment Court has stated on many occasions, these types of decisions are for "the Boardroom and not the Courtroom" (see, for example, Meridian Energy Ltd v Wellington City Council [2011] NZEnvC 232 at [39]). As counsel for the Environmental Defence Society stated at paragraph 4 of its closing submissions dated 18 November 2014 in the Chatham Rock case before the EPA:

> *"It is submitted that financial viability of this project is similarly a matter for the boardroom and should not influence the decision of the DMC which must be based on the statutory tests. It would be error of law to consider financial viability issues. There are no such constraints on the EPA's ability to impose consent conditions (for example, no limitation on the size and scale of staging) and it is not relevant to the decision whether to grant or refuse consent".*

That said, it needs to be made clear that the economic benefits to New Zealand from the TTR project arise from the company's expenditure on products and services in the New Zealand marketplace (both locally and nationally) and the royalties on the iron ore extracted that are paid to the New Zealand Government. Should the project proceed, then those social and economic benefits are unaffected by the market price for iron ore and will continue to be accrued for the life of the project.

A concern that is sometimes expressed when discussing large scale projects is "who will pick up the tab for environmental clean-up in the event that a project becomes uneconomic and the proponent ceases to trade"? Two such examples might be the ongoing monitoring and management of a hard rock gold mine's tailings impoundment and the management of leachate from a refuse landfill. These types of "legacy effects" (significant adverse effects that would fall on the Crown or local government to remedy in the event that the project proponent cannot) do not arise with the TTR proposal. In the unlikely event that the TTR project were to cease prematurely, the only residual effect would be that an area of the seabed would need to complete its recolonization with benthic organisms from the surrounding area before all trace of the development was erased.

For these reasons, TTR has not considered it necessary to consider iron ore price sensitivity in its marine consent application process

Measures to avoid, remedy or mitigate the adverse effects (conditions)

28. There is a discrepancy between the IA and the Environmental Monitoring and Management Plan (EMMP) in respect of when monitoring is to commence. In the draft EMMP (Appendix 5.2 of the Impact Assessment) it is stated that monitoring will commence "within one month of the iron sand extraction activities commencing". However, in Section 5.5.4 of the IA it is stated that monitoring will be implemented "one month prior to the commencement of the iron sand extraction activities". Which of these two statements is correct? (relevant EPA expert - AECOM)

*TTR confirms that the monitoring associated with the extraction activities is to commence **one month prior** to the commencement of the extraction activities.*

Other information

29. A full assessment of why the hydraulic fluid is not regulated under the EEZ Act is requested.

As stated in Section 1.4.2 (specifically pg 9), TTR considers that biodegradable hydraulic fluid (which includes Biohydran TMP 68 or similar product), is not regulated under the EEZ Act and its associated regulations, and no consent is required.

Further to those reasons stated in Section 1.4.2, the reasons for this view are set out below.

EEZ Act

Section 10 of the EEZ Act confirms the purpose of the Act as being to:

> *a) to promote the sustainable management of the natural resources of the exclusive economic zone and the continental shelf; and*
>
> *b) in relation to the exclusive economic zone, the continental shelf, and the waters above the continental shelf beyond the outer limits of the exclusive economic zone, <u>to protect the environment from pollution by regulating or prohibiting the discharge of harmful substances and the dumping or incineration of waste or other matter</u>. [our emphasis]*

This indicates that not all activities within the exclusive economic zone and continental shelf, and in particular not all discharges, are regulated under the EEZ Act. It is just those discharges which involve harmful substances that are regulated.

This is reinforced by sections 20B and 20C of the EEZ Act which only require consent for discharges of harmful substances from a structure or a ship (and the latter only if the discharge is a mining discharge). Further, even if the discharge involves harmful substances, consent is only required if the discharge is not classified as a permitted activity under the Act. At present there is only one such permitted activity being harmful substances discharges down petroleum wells.

What is a harmful substance?

Section 4 of the EEZ Act states that "harmful substance means any substance specified as a harmful substance by regulations made under this Act."

The Exclusive Economic Zone and Continental Shelf (Environmental Effects – Discharge and Dumping) Regulations 2015 (2015 EEZ Regulations) contains the following definition of harmful substance in Regulation 4:

> *For the purposes of the Act, unless the context otherwise requires, harmful substance means any of the following:*
>
> *a) a substance that is <u>ecotoxic</u> to aquatic organisms <u>and</u> is <u>hazardous</u> for the purposes of the Hazardous Substances (Minimum Degrees of Hazard) Regulations 2001:*
> *b) <u>oil</u>:*
> *c) <u>garbage</u>:*
> *d) <u>sediments</u> from mining activities other than petroleum extraction. [our emphasis]*

Is the hydraulic fluid a harmful substance?

<u>Not ecotoxic and hazardous</u>

In order to come within the first category for a harmful substance, the substance needs to be <u>both</u> ecotoxic and hazardous. The proposed hydraulic fluid is neither.

While the term "ecotoxic" is not specifically defined in the EEZ Act or its associated regulations, it is commonly understood to mean something that is harmful to animals, plants or the environment. As noted in section 1.4.2 (and Appendix 1.2) of the Impact Assessment, the proposed hydraulic fluid has no ecotoxic properties and is biodegradable.

In order for a substance to be considered hazardous under the Hazardous Substances (Minimum Degrees of Hazard) Regulations 2001 (Hazard Substances Regulations), it first needs to be ecotoxic, which the proposed hydraulic fluid is not.

<u>Not an oil</u>

The proposed hydraulic fluid is not an "oil". The term "oil" is defined in regulation 3 of the 2015 EEZ Regulations as follows:

> *a) means petroleum in any form, including crude oil, fuel oil, sludge, oil refuse, and refined products (other than petrochemicals subject to the provisions of Part 140 of the Marine Protection Rules); and*
> *b) includes any substance declared to be oil in the Appendix to Part 120 of the Marine Protection Rules and any oily mixture.*

The proposed hydraulic fluid does not come within this definition as it is not:

a. a form of petroleum – it is a "biodegradable synthetic hydraulic fluid";

b. included in the list of substances which is declared to be an oil under part 120 of the Marine Protection Rules; and

c. It is not "an oily mixture" given it is a biodegradable and synthetic fluid.

<u>Not garbage</u>

The proposed hydraulic fluid is not "garbage". The term "garbage" is defined in regulation 3 of the 2015 EEZ Regulations as follows:

> *a) means any food waste, domestic waste, operational waste, plastic, incinerator ash, or cooking oil that is generated during the normal operation of the offshore installation and is liable to be disposed of continuously or periodically; but*
> *b) does not include—*
> *(i) any substance that is defined or listed in any annex to MARPOL other than Annex V; or*
> *(ii) fresh fish, and parts of fresh fish, generated as a result of—*
> *A. fishing activity undertaken during a voyage; or*
> *B. aquaculture activity that involves the transport of fish (including shellfish) for placement in an aquaculture facility and the transport of harvested fish (including shellfish) from the facility to shore for processing*

The proposed hydraulic fluid does not come within this definition as it is not:

a. a food or domestic waste, plastic, incinerator ash or cooking oil; and

b. a substance defined in Annex V to MARPOL (which are basically the same as (a)).

It is also not an operational waste. "Operational waste" is defined in the 2015 EEZ Regulations as:

> a) *means any solid waste (including slurry) not covered by any annex to MARPOL other than Annex V that is collected on board during normal maintenance or operations of an offshore installation, or used for cargo stowage and handling; and*
>
> b) *includes any cleaning agent or additive contained in cargo hold and external wash water; but*
>
> c) *does not include grey water, bilge water, or other similar discharges essential to the operation of an offshore installation*

The proposed hydraulic fluid is not:

a. *a solid waste collected on board – it is a residual fluid associated with the use of the crawler and other operational equipment; and*

b. *a cleaning agent or additive contained in wash water.*

Not a sediment from mining extraction

Nor is the proposed hydraulic fluid a "sediment". The term "sediments" is defined in the 2015 EEZ Regulations as "the organic and inorganic material extracted from the seabed by mining activities, and includes tailings". Such a definition would obviously exclude synthetic products.

Conclusion

The EEZ Act does not regulate all discharges. It only regulates discharges of "harmful substances" as that term is defined in the Act. As the proposed hydraulic fluid is not an ecotoxic substance, is not oil, garbage or sediment, it does not come within the definition of a harmful substance and is therefore not a discharge regulated by the Act.

30. The EPA's technical experts (AECOM) on benthic ecology have noted that section 2.3.6 of the IA (page 26) refers to the discharge from the hyperbaric pressure filter aboard the FSO vessel as *'clean resalinated water',* however they note that discharges from this filter may be a further source of fine sediments, depending upon the maximum size of sediment particles that can pass through the filter. Will the discharge from the hyperbaric filter on the FSO contain sediment? (relevant EPA experts -AECOM and EPA)

The discharge from the hyperbaric filter on the FSO vessel will not contain any "hard won" concentrate sediment particles. The verified analysis of the produced concentrate particle size distribution shows no particle below 20 micron.

The hyperbaric disc filters on the FSO will make use of ceramic vacuum disc filters to dewater the iron sand slurry. The construction and operation principle of ceramic disc filters is similar to the conventional disc filters but the difference is that the filter cloths are replaced by microporous ceramic segments with a pore diameter of 10µm. The specified segments will provide a dewatered concentrate with a moisture content of less than 8%.