HR Wallingford
Working with water

Support to Trans-Tasman Resources

Laboratory testing of sediments

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October 2014

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Executive summary

Trans-Tasman Resources Ltd (TTR) plans to extract titanomagnetite sand (ironsand) from an area in South Taranaki Bight. As input to the Environmental Impact Assessment (EIA) for the proposed mining project, the National Institute of Water & Atmospheric Research Ltd. (NIWA) was commissioned by TTR to investigate the potential environmental impacts of the proposed extraction operation.

Following the refusal of consent by the Decision Making Committee in June 2014, TTR are re-assessing their scientific case as background for a possible appeal and re-hearing. One issue that arose was the need to re-assess the degree of uncertainty and conservatism in the NIWA sediment plume modelling studies and the interpretation of these results. In July 2014 HR Wallingford (HRW) undertook a review of the NIWA modelling work (HR Wallingford, 2014).

As a result of this review if became apparent that there was a degree of uncertainty as to how the tailings rejected from the ironsand extraction process might be expected to behave in a saline water environment. The assumptions for the NIWA plume modelling were that the materials released into the marine environment would remain in their particulate form (unflocculated) and would therefore have low settling velocities. It was also noted that the NIWA laboratory tests to support the assessment of the optical effects of the plumes had been carried out in fresh water.

HR Wallingford was commissioned by TTR to undertake a series of laboratory tests to investigate the behaviour of the tailings under both saline and fresh water conditions. Tests were carried out to look at settling velocity, flocculation and critical shear stress for deposition and erosion.

The results of the tests undertaken by HRW suggest that the mass of fine sediment that will be dispersed within the middle and upper parts of the water column upon release by mining will reduce by a factor of 3-5 (compared to the revised NIWA prediction) as the majority of released fine sediment will settle to the bed or near-bed waters because of higher rates of settling. It was also found that the critical shear stress for resuspension of freshly deposited material was likely to be in the range of 0.2 to 0.3Pa rather than the 0.1Pa assumed by NIWA.

The results of HRW's optical backscatter tests show that the sediment in suspension in the water column has different backscattering properties in saline water compared to that in de-ionised water. It is likely that the material will behave differently than that identified in the Optical Effects Study as a result of flocculation in saline (rather than fresh) water.

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1. Introduction

1.1. Background

Trans-Tasman Resources Ltd (TTR) plans to extract titanomagnetite sand (ironsand) from an area in South Taranaki Bight. As input to the Environmental Impact Assessment (EIA) for the proposed mining project, the National Institute of Water & Atmospheric Research Ltd. (NIWA) was commissioned by TTR to investigate the potential environmental impacts of the proposed extraction operation.

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1.2. Scope of Work

The following laboratory tests were carried out by HRW on the supplied tailing sediments:

- Sediment specific gravity;
- Sediment particle size distribution;
- Settling tests;
- Turbidity tests;
- Settling velocity measurements;
- Flocculation measurements;
- Critical shear stress for deposition and erosion.

1.3. Report Structure

The remainder of this report comprises a further three sections. Section 2 describes the materials supplied by TTR for testing. Section 3 presents the methodology and results of the various tests undertaken and Section 4 summarises the results of the investigations.

2. Source Material

TTR arranged for three samples of sediment arising from the ironsand extraction process to be delivered to HRW in two 25 litre airtight plastic containers. The accompanying covering letter from TTR stated that the samples are fine sediment that:

1. Originate from the west coast of New Zealand.
2. Are samples that have been obtained from depths greater than 2m below the seafloor.
3. Have been heated to 100°C.
4. Is clean and free of quarantine risk material.
5. Are for material properties testing.
6. Have a commercial value of $10.

The materials, which were received on 10 September 2014, are described in the sections below.

2.1. Container 1 of 2

Container 1 of 2 weighed 8.9 kg and contained two sediment types.

2.1.1. Sediment 1 (grip seal plastic bag)

Bag label: TTR. X451. 2 kg. Post-Grind Tailings. Composite Sample.

The contents of the Sediment 1 bag, which weighed 2.0 kg, are shown in Photograph 2.1. The material was a very fine grey powder, where there were smaller lumps these broke down very easily between the fingers leaving fingers with a fine covering of powder.

Photograph 2.1: Sediment 1 – TTR. X451. 2 kg. Post-grind tailings. Composite sample.

2.1.2. Sediment 2 (woven polypropylene bag)

Bag label: Bulk 503D. Pre Grind. Ultra Fines.

The contents of the Sediment 2 bag, which weighed 6.05 kg, are shown in Photograph 2.2. The material comprised large dense lumps of clay type material that could be reformed by squeezing between the fingers. There appeared to be fine metallic looking particles present on some of the exposed edges.

Photograph 2.2: Sediment 2 – Bulk 503D. Pre-grind. Ultra fines.

2.2. Container 2 of 2

Container 2 of 2 weighed 11.7 kg and contained one sediment type.

2.2.1. Sediment 3 (loose in sample container)

Container label: Bulk 501. L2. P1. IBC. Tails. 11.7 kg.

The contents of the Sample 3 container, which weighed 11.7 kg, are shown in Photograph 2.3. The material was largely a very fine powder with some lumps of various sizes, the largest having a width of about 60 mm. All lumps broke down very easily between the fingers leaving fingers with a fine covering of powder.

Photograph 2.3: Sediment 3 – Bulk 501. L2. P1. IBC. Tails. 11.7 kg.

3. Laboratory Testing

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3.5. Suspension Mass Tests

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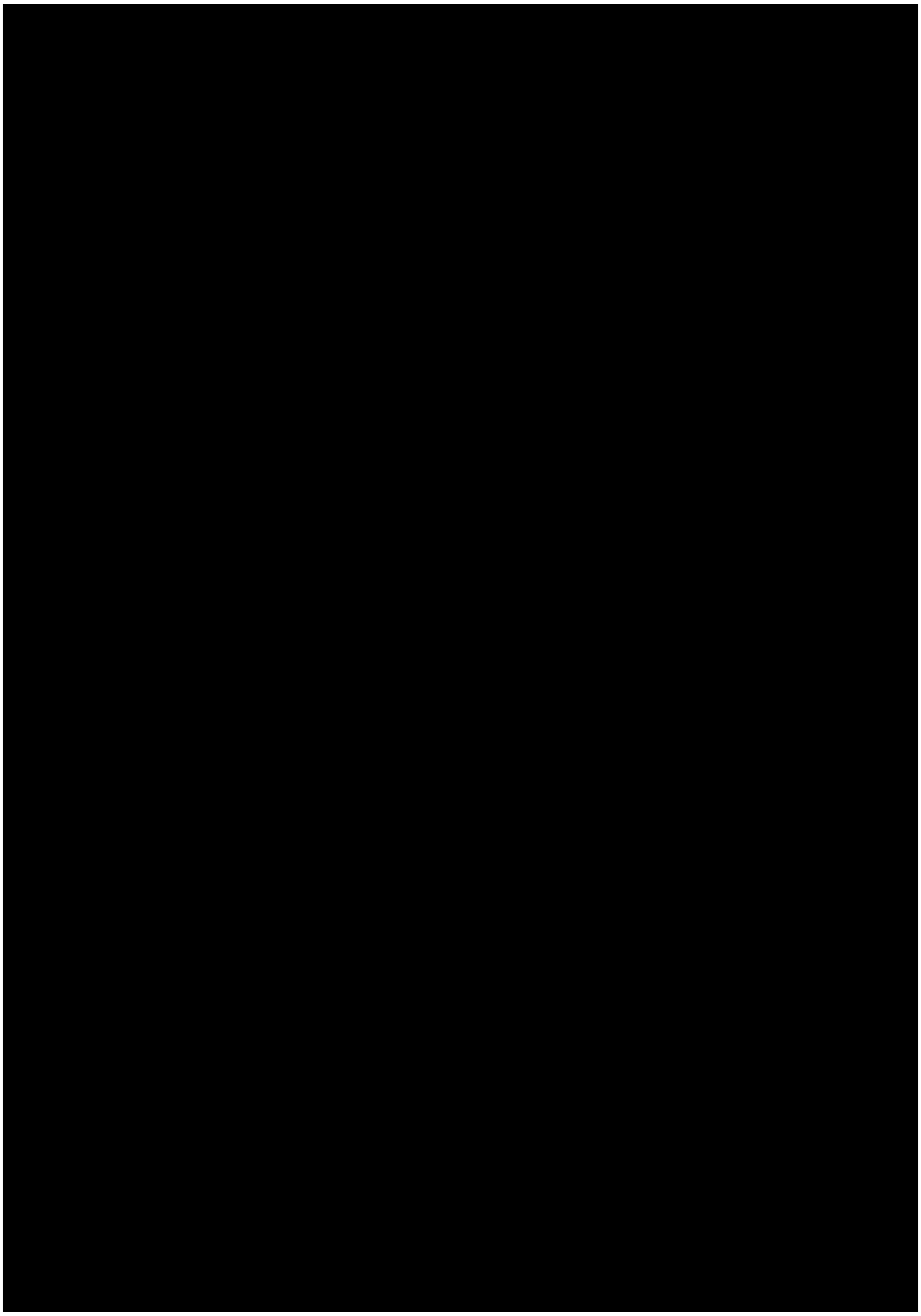

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4. Discussion of Results

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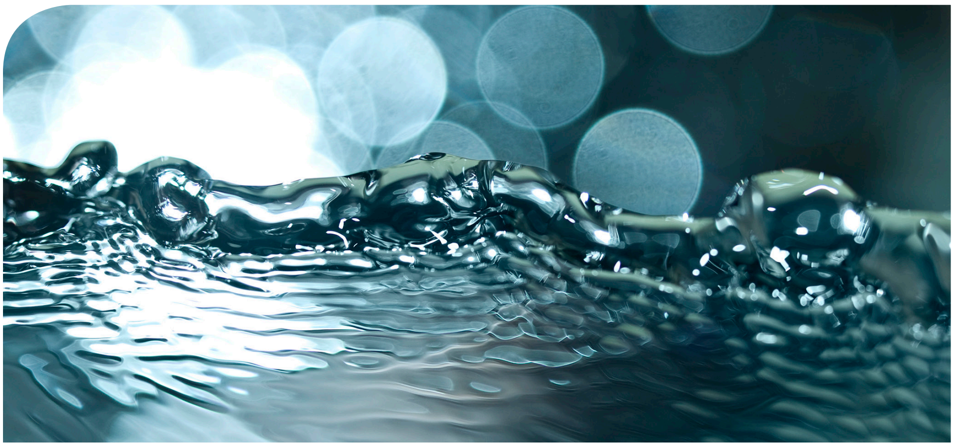

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