



OUT20/15537

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Dear Ms Cole

**Stockton Sand Quarry (SSD 9490)  
Response to Submissions**

I refer to your email of 10 December 2020 to the Department of Planning, Industry and Environment (DPIE) Water and the Natural Resources Access Regulator (NRAR) about the above matter.

DPIE Water and NRAR have significant concerns about this project in its current form. We recommend that the project be modified to limit extraction to a height that maintains at least a 0.7 metre buffer above the groundwater table with the final landform to be a minimum of 1 metre above the groundwater table consistent with other approved projects of the area.

Given the insufficient evidence provided by Boral and outcomes observed at the nearby RZM project, DPIE Water believes that this proposal carries a significant water quality risk without an effective demonstrated preventative or remedial plan which could be difficult to implement as well as costly. The proponent also may not be able to acquire the necessary groundwater entitlement to offset the licensable take associated with operating a dredge.

DPIE Planning & Assessment should consider the risk that approval of this project in its current form would set a precedent for other subsequent dredging projects leading to more significant water quality degradation issues.

Please find our detailed advice in Attachments A and B.

Any further referrals to DPIE Water & NRAR can be sent by email to:

[landuse.enquiries@dpie.nsw.gov.au](mailto:landuse.enquiries@dpie.nsw.gov.au).

Yours sincerely

Mitchell Isaacs  
Chief Knowledge Officer  
**Water – Knowledge**  
5 March 2021

## ATTACHMENT A

### Detailed advice to DPIE - Planning & Assessment regarding the Stockton Sand Quarry (SSD 9490) RTS

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#### 1. Water Take and Licensing

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##### The calculation of the incidental take

The RtS presents the peak water demand at 1,341 ML/pa with the breakdown as shown in Table 1 below.

*Table 1: Stockton Sand Quarry Dredging Project Water Demand*

| Project component                            | Water use requirement<br>(ML/pa) |
|----------------------------------------------|----------------------------------|
| Dredge                                       | 873.2                            |
| Screen spray                                 | 262                              |
| Product (as a moisture content of sand)      | 3% of extracted material mass    |
| Evaporation losses (vary dependant on stage) | 0 – 191                          |
| Dust Suppression                             | 15 (maximum)                     |
| <b>Total (maximum)</b>                       | <b>1,341</b>                     |

The RtS advises the dredge water use requirement is based on a pump rate of 120 L/s extracting at a ratio of 2:1 water to sand. The volume of take is calculated over a given number of operational hours per year. At a 2:1 ratio, the sand product volume is half that of the water, i.e. 436,590 T/pa should the pump run to optimal efficiency. However, the project seeks approval to extract up to 750,000 T/pa and therein the dredge take reported in Table 1 represents only 58% of the intended sand capacity to which development consent is sought. To achieve the full 750,000 T/pa, either a larger pump is required (which may not run at the same efficiency of 2:1 water to sand ratio), or the activity will need to run on a near continuous 24/7 basis all year round. DPIE Water's estimate for the peak potential groundwater demand from the dredge at 2:1 ratio would be 1,500 ML/pa.

Evaporation estimates are provided based on a 23 ha lake at an annual evaporation rate of 1382 mm. As noted in the project overview, the final landform is to create an open water body across much of the 37 hectares site with a 29 hectare lake operationally. DPIE Water's estimate of evaporation losses for a 29 hectare lake at 1382mm annual evaporation equates to 40 ML/pa.

The product moisture is stated as being 3% within the product won by excavator and 5% within the dredged sand. DPIE Water estimates the dredged sand soil moisture causes a peak water loss of 37.5 ML per 750,000 tonnes extracted by the dredge.

Adding the dust suppression (15 ML) and screen spray (262 ML) volumes, the indicative peak licensable take is 1,817 ML/pa. The RtS advises the proponent has acquired a 100 ML licence via controlled allocation.

Hence DPIE Water estimates a peak of 1,817 ML/a will be required compared to 1,341 ML/a presented in the project documents. To achieve the production sought by the project, the water requirement appears much higher than presented by the Proponent.

### Licensing

The proponent acknowledges the groundwater source, Stockton Groundwater Source, has insufficient market available water to meet this water demand. The Stockton Groundwater Source is also over allocated as under the Water Sharing Plan for the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources 2016, the current allocation of 1038 unit shares exceeds its share component of 1008.5 units.

The project proposes to have incremental water demand and gradually build up the necessary credits to support the operation through a variety of water market products. In the event the water is not available to operate at maximum capacity, the proponent proposes that the operation of the dredge can be scaled to respond to the volume of water permitted to be taken under the *Water Management Act 2000*.

In summary, the project plans to do the following:

1. Take **3 ML/yr** of water as per the WAL exemption in the *Water Management Regulation (General) 2018* under Schedule 4, Clause 7. The water take must not be for the consumption or supply of water.
2. Acquire allocations through controlled allocation releases. Boral has **acquired only 100 ML** under the 2020 allocation process and has registered for the 2021 allocation process.
3. Acquire allocations through the market from existing entitlement holders.

The RtS states Boral will accept a condition of consent that no dredging activity will commence until Boral can demonstrate they have adequate water supply to support all stages of the development (as approved) or sufficient water to operate at a reduced scale to the satisfaction of the Secretary.

In summary Boral have only 100 ML/yr of water plus an exempt amount of 3 ML/yr of water. This is a significant commercial risk for the project. This amount is not adequate for the ongoing operations past three years. Note Table 2 in Appendix B which indicates the estimated annual demand for various rainfall scenarios with Decile rainfall 1 as the worst case scenario.

DPIE Water & NRAR have concerns with the project's ability to obtain the required water for the life of the project and continued water take at the conclusion of the dredging operations such as from evaporation. The project is currently investigating options to obtain the required WAL shares. It is recommended that the project obtains and provides evidence of adequate WAL shares prior to the commencement of work.

## 2. Groundwater impacts

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### Assessment of impacts against the 'minimal impact considerations' of the NSW Aquifer Interference Policy (2012).

The predictions should be based on complex groundwater modelling conducted in accordance with the Australian Groundwater Modelling Guidelines.

A two-layer numerical groundwater model was developed to inform the impact assessment and is presented in Appendix E of the RtS. The model is categorised as a Class 1 model with the outputs predicting minimal change in water levels and water quality and considers sea water intrusion and PFAS migration. A slight lowering in groundwater salinity due to the open lake water body is reported given the increased recharge. The report concludes that the modelling impacts are consistent with minimal impacts reported previously under the EIS analytical assessment.

Calibration statistics and other aspects of the groundwater model are not made transparent in the model report. An independent assessment of the model against the Australian Groundwater Modelling Guidelines would identify any limitations, uncertainties and risks. However, identifying

any limitations in the modelling and predicted water level impacts are secondary to the acid sulfate water quality risks. Thus, the discussion for the remainder of this advice focuses on the primary impact risk around water quality generated irrespective of whether water levels are or are not maintained.

### **Spatial and temporal groundwater level and water quality baseline data set and irreversible risk and impact to RAMSAR wetland from acid sulphate soils**

In its review of the EIS, DPIE Water expressed concern regarding potential water quality impacts. Water quality parameters of concern include iron, arsenic, manganese, chromium, lead, copper, zinc and aluminium. Appendix D Table 17 of the EIS reports on up to ten water quality sampling events covering the dissolved metals analytical suite. The sampling events span a one year period or less, captured from nine monitoring bores.

Of the baseline data available, results identify the presence of aluminium, iron and arsenic concentrations marginally above either drinking water health, recreation and/or ecological guideline criteria for some sites. The baseline data set is less than the two years required by the Aquifer Interference Policy (given the risk of harm to a reliable water supply) and does not capture the potential for seasonal variation. The limited temporal range and seasonal stresses do not adequately establish representative baseline conditions for evaluating water quality changes that may be brought about by the project. The relationship with either natural climate or anthropocentric impact could be questionable due to limited temporal scale.

DPIE Water's concerns are based on historical lessons from the former RZM sand dredge operations located in proximity to this project proposal which is explained further below. With regard to the Stockton Sand Quarry, DPIE Water indicated that the fines material rejected back to the pond will contain concentrated pyrite and organics. Oxidation of this pyrite leads to the release of metals and the organics and the generation of a sludge at the base of the pond. There is also a potential concentration of radioactive material. All three issues were issues for concern at the RZM operations.

DPIE Water also advised that the Acid Sulfate Soil investigation being limited to just four sites is insufficient given the scale and risk posed by the project to cause soil acidification. On these issues of concern the RtS advises:

- *“According to DPIE Water (August 2020), “material rejected back to the pond will contain concentrated heavy metals, waste products and organic sludge waste and even potentially radioactive material. Chemical reactions with the extracted and returned material or within the oxygenated pond itself has the potential to release soluble metals”. No evidence has been identified during the ongoing assessment and monitoring program at the site, to support this. Rather, based on available site information (refer information above), the likelihood of adverse chemical reactions at the site is deemed low (ref: RtS Volume 2 pg182).”*
- *“According to DPIE Water (August 2020), the ASS investigation was insufficient to rule out the interception of acid sulfate material and organic layers at depth across the project area as the assessment was limited to 4 test holes. However, Environmental Earth Sciences considers the information presented is sufficient and appropriate to classify the site as low risk for the reasons specified above – low probability of occurrence, high alkalinity and buffering capacity throughout the soil profile and maintenance of groundwater levels. It should be noted that PASS cannot oxidise and cause adverse chemical reactions while materials remain saturated.” (ref: RtS Volume 2 pg182)*

### **Existing Acid Sulfate Soils Impact from dredging operations**

Please note the discussion below relates to the following reports and attached Table 3 and Figures 1 and 2 in Attachment B:

- Report No. 1. Data Review and Assessment of Hydrogeological and Hydrochemical impacts of Heavy Mineral Mining of the Tomago Sandbeds, Newcastle, NSW (Coffey et al., Report No.G419/3-BP, submitted 22 February 1996)

- Report No.2. Management Strategy Study for Heavy Mineral Mining of the Tomago Sandbeds, Newcastle (Coffey et al., Report No. G419/5-BT) April 1996.
- Coffey 1998. Development of Post-Mining Groundwater-Monitoring Recommendations Tomago Sandbeds, NSW. Report No.G442/1-BC.

The aforementioned RZM project extracted ore between 1972 and 1999 with the deep mining operating from 1990. Towards the end of mining, a detailed data assessment and hydrochemical impact report was prepared (Coffey 1996 – Report No 2) along with a management strategy (Coffey 1996 -Report No 2), and an ongoing monitoring and management plan (Coffey 1998). Report No 1 advised the steering committee on the drivers for unforeseen water quality impacts and potential management options. Key findings of the assessments include:

- Low level concentrations in trace metals and sulfate existed pre-mining
- Pyrite is dispersed heterogeneously and predominantly in the deeper grey sands
- There was an average 100-fold increase in iron and sulfate concentrations following extraction within deep mining areas
- Elevated manganese and arsenic also occur with elevated iron.

The RZM Management Strategy (Coffey 1996 – Report 2) presented a case that the naturally high content of shell grit would provide buffering capacity to neutralise the acidity and presumption that iron and other dissolved metals would precipitate with the overall impact being temporary.

The results from the ongoing monitoring plan (Coffey 1998) has proven that natural buffering does not drive any significant decline in concentrations with monitoring still occurring to date. For example, RZM's annual report in 2006 (note Table 3 in Attachment B) show that average iron concentrations in 2006 were far in exceedance of an acceptable low level when monitoring would cease. We believe that the majority of the RZM management zones have still not achieved this set release criteria where iron and sulfate concentrations recovered to an acceptable low level relative to pre-deep mining conditions.

For RZM, the mitigation practices of lime dosing to manage pH levels in the pond was also evaluated and found to be cost prohibitive. Overall, the inferred natural buffering and acid management plan failed which has resulted in contamination of a high value water asset of the State and Hunter Water Corporation.

Returning to the current proposal, of the four acid sulfate soil test holes and the deeper monitoring bores constructed, the reported lithological profile is similar to that reported at Tomago RZM operations with light brown to yellow sands with the occasional discontinuous indurated dark sand layer transitioning into the deeper grey sand layers. Boral's proposal also includes extracting the deeper grey sands, separating the fines and returning the fines to the dredge pond. The return of concentrated fines to an oxygenated pond is a substantial water quality risk.

Boral's RtS statement relating to the return of segregated fines containing concentrated pyrite that *"PASS cannot oxidise and cause adverse chemical reactions while materials remain saturated"* is not supported by the evidence for the nearby RZM dredge operation.

#### **Site comparison Tomago RMZ and Boral proposed extraction site**

Figure 1 (in Attachment B) presents the acid sulfate soil probability mapping identifying that both the RZM site and Boral's proposed site occur within mapped low probability acid sulfate soil areas. Both sites have a very similar geological and soil landscape setting comprising aeolian dune and sandplain deposits. Both sites reported similar vertical lithological profiles with light brown and yellow sands transitioning to grey sands at depth. The pre-mining water quality for both sites reported quite low background trace metal concentration, albeit the RZM investigation was more comprehensive.

Both RZM and Boral proposals made/make the assumption that natural buffering will neutralise the risk of pyrite oxidation and risk of elevated metal concentrations. RZM was unable to mitigate the decline in the aquifers beneficial use with serious impacts to Hunter Water Corporation (HWC) asset and water strategy. The RZM Management Plan alerts the reader to potential

unknown ecological impacts with potential for trace metals like arsenic to accumulate in the vegetation consumed by local fauna. Boral has no remedial plan beyond that already considered by RZM which was unsuccessful.

Boral's EIS Appendix J - Acid Sulfate Soils Assessment, states:

*"Sample BH2\_2.0 reported CRS of 3.02 kg H<sub>2</sub>SO<sub>4</sub> per tonne of soil and NA of 4.008 kg H<sub>2</sub>SO<sub>4</sub> per tonne of soil which is considered as a moderate risk for PASS. All 25 samples except BH2\_2.0 and BH4\_9.0 reported Potential Acidity (CRS) of <1 kg H<sub>2</sub>SO<sub>4</sub> per tonne of soil and NA <1 kg H<sub>2</sub>SO<sub>4</sub> per tonne of soil"*

and

*"sulphides typically reside in the finer grained sediments (clays, silts or estuarine muds) which further reduces the risk for the potential for PASS to be present"*

The investigation into water quality impacts arising from RZM dredge extraction reported the pyrite distribution to be random, heterogenous and predominantly dispersed within the deeper grey sands layer. Measurements at the RZM site similarly reported low pyrite concentrations at <.05% by weight, however having conducted a more comprehensive spatial investigation concentrations ranged as much as 1% by weight.

### **Conclusions:**

- The risk of Potential Acid Sulfate Soils (PASS) is likely higher than indicated by the existing maps and has the potential to create non-reversible significant environmental impacts.
- DPIE Water reiterates that Boral's testing to date, limited to just four test holes at 50mm diameter each to represent PASS across 37 hectares, is insufficient for the risks identified above.
- The RtS does not present new information on water quality but reasserts interpretations collated to date and presented in the EIS. This information has already been assessed by DPIE Water and commented on in its EIS review. The weight of evidence and lessons learnt from RZM lead DPIE Water to conclude that the level of investigation is not commensurate to the risk. The ability to manage a water quality impact of a high-quality water asset remains in doubt.
- There are several adjacent sensitive receptors including a RAMSAR listed wetland where groundwater to the north-west of the proposed dredge stages is reported to flow in the direction of Fullerton Cove. The Hunter Water Corporation North Stockton Catchment Area (Drinking Water Reserve), the Worimi Conservation Park and a number of domestic bores are adjacent to the Boral project (Figure 2 Attachment B). Given their proximity and high aquifer permeability rates, these sensitive receptors could be impacted within a few years of operation.
- Previous local experience with the RZM project demonstrated the high impacts arising from acid sulphate soils. The two projects are comparable for the matter of PASS generation.
- In the case of the RZM project, Hunter Water Corporation received compensation for impacts to their assets. Boral's proposed dredge project does not include a demonstrated effective remediation plan and an unsupported assumption that the returned fines and pyritic within the disturbed landscape will not oxidise. Given the similarities with the nearby RZM dredge operation resulting in an unacceptable water quality outcome, the Boral dredge project poses significant risks to water quality with the resulting deterioration of a water asset.

The *Water Management Act 2000* includes the principle that cumulative impacts should be considered and minimised. This proposal is one of three in the local area with an interest in operating a dredge extraction project. Approval of this project in its current form would set an expectation/precedent for these proposals that will carry considerable risk and uncertainty in their

ability to comply with both licensing requirements and not have a significant environmental impact.

### Security Bond

The RtS states *“Boral is willing to accept a condition requiring of the payment of a security bond in the form of a bank guarantee prior to the commencement of dredging operations in stage 2 of the project.”*

DPIE Water acknowledge the commitment of a bond. The value of this security bond would need to be fully costed and would be very significant.

If the Project were to proceed, a compensation package to the State should apply when restorative actions do not achieve effective remediation of the water asset.

### 3. Recommendations

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- DPIE Water has significant concerns about this project in its current form. We recommend that the project be modified to limit extraction to a height that maintains at least a 0.7 metre buffer above the groundwater table with the final landform to be a minimum of 1 metre above the groundwater table consistent with other approved projects of the area.
- Should assessment of the project continue:
- Pre-approval:
  - Re-assess the water take requirements of the project as DPIE Water estimates a peak of 1,817 ML/a will be required compared to 1,341 ML/a presented by the proponent.
  - the proponent should be required to undertake an investigation into the water quality impacts to an adequate scale, commensurate with the identified level of risk; or demonstrate the project has restorative capacity should an outcome like that observed for the RZM dredge operation occur.
  - Arrange for an independent assessment of the groundwater model against the Australian Groundwater Modelling Guidelines
- Post Approval:
  - The project has not obtained or provided evidence of adequate Water Access Licence shares for works progressing past year three of operation. It is recommended that the project obtains and provides evidence of adequate WAL shares prior to the commencement of work.
  - NRAR would support the addition of a condition of consent detailing that no dredging activity will commence until Boral can demonstrate they have adequate water supply to support all stages of the development (as approved) or limit operations so that water take is within approved water entitlements already held by Boral.
  - Water taken under the Water Access Licence exemption under Schedule 4, Clause 7 of the *Water Management (General) Regulation 2018* must not be used for consumption or supply and water take is to be recorded in the appropriate form and manner as outlined here - <https://www.industry.nsw.gov.au/natural-resources-access-regulator/licensing-and-approvals/groundwater-wal>.

**END ATTACHMENT A**

## Attachment B

**Table 6:** Estimated annual water demand (source: South-East; September 2020).

| Project Stage       | Year of operation | Decile 1 rainfall | Decile 5 (median) rainfall | Decile 9 rainfall |
|---------------------|-------------------|-------------------|----------------------------|-------------------|
| <b>1</b>            | 1                 | -31.40            | -31.40                     | -31.40            |
|                     | 2                 | -31.40            | -31.40                     | -31.40            |
|                     | 3                 | -31.40            | -31.40                     | -31.40            |
| <b>2</b>            | 4                 | -1162.96          | -1159.00                   | -1151.32          |
|                     | 5                 | -1175.78          | -1167.86                   | -1152.50          |
|                     | 6                 | -1188.60          | -1176.72                   | -1153.68          |
|                     | 7                 | -1188.60          | -1176.72                   | -1153.68          |
| <b>3</b>            | 8                 | -1200.41          | -1184.88                   | -1154.77          |
|                     | 9                 | -1212.23          | -1193.04                   | -1155.86          |
|                     | 10                | -1224.04          | -1201.21                   | -1156.94          |
|                     | 11                | -1224.04          | -1201.21                   | -1156.94          |
| <b>4</b>            | 12                | -1234.51          | -1208.45                   | -1157.91          |
|                     | 13                | -1244.99          | -1215.68                   | -1158.87          |
|                     | 14                | -1255.46          | -1222.92                   | -1159.84          |
|                     | 15                | -1265.93          | -1230.16                   | -1160.80          |
|                     | 16                | -1265.93          | -1230.16                   | -1160.80          |
| <b>5</b>            | 17                | -1283.24          | -1242.12                   | -1162.40          |
|                     | 18                | -1300.56          | -1254.08                   | -1163.99          |
|                     | 19                | -1300.56          | -1254.08                   | -1163.99          |
| <b>6</b>            | 20                | -1320.77          | -1268.05                   | -1165.85          |
|                     | 21                | -1340.98          | -1282.02                   | -1167.71          |
| <b>Post closure</b> |                   | <b>-190.84</b>    | <b>-131.88</b>             | <b>-17.57</b>     |

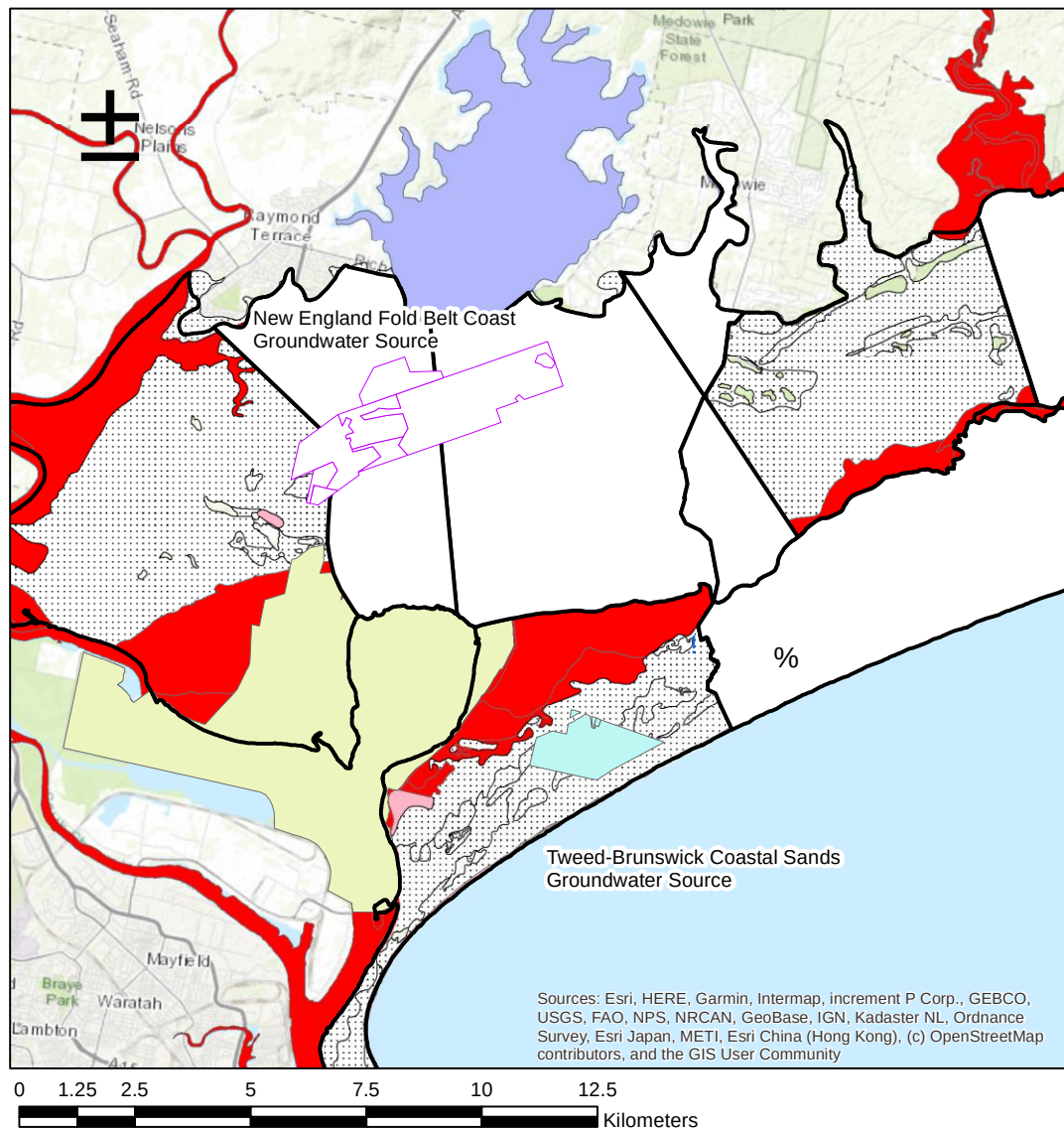
*Table 2 – Annual water demand showing water entitlements are held by Boral for only the first three years of operation*

**TABLE 3. 30 MONTHS AVERAGE GROUNDWATER IRON CONCENTRATION TO 30 JUNE 2006**

| <b>Zone</b> | <b>Last Mined</b> | <b>Premining Iron (mg/L)</b> | <b>Criteria Value (mg/L)<br/>(2.5 x Premining Iron)</b> | <b>Average* Iron Concentration to 30 June 2006 (mg/L)</b> | <b>Satisfies Criteria for Release from Monitoring</b> |
|-------------|-------------------|------------------------------|---------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------|
| <b>1</b>    | Aug-98            | 3.4                          | 8.5                                                     | 50.0                                                      | NO                                                    |
| <b>2</b>    | June-96           | 2.8                          | 7.0                                                     | 40.0                                                      | NO                                                    |
| <b>3</b>    | Dec-94            | 3.9                          | 9.8                                                     | 57.3                                                      | NO                                                    |
| <b>4</b>    | Dec-97            | 6.2                          | 15.5                                                    | 35.5                                                      | NO                                                    |
| <b>5</b>    | Nov-98            | 4.2                          | 10.5                                                    | 13.3                                                      | NO                                                    |
| <b>6</b>    | Sep-92            | 5.3                          | 13.3                                                    | 43.1                                                      | NO                                                    |
| <b>7</b>    | Dec-91            | 8.8                          | 22.0                                                    | 34.1                                                      | NO                                                    |
| <b>8</b>    | Jun-91            | 4.9                          | 12.3                                                    | 20.0                                                      | NO                                                    |
| <b>11</b>   | Apr-92            | 6.3                          | 15.8                                                    | 18.9                                                      | NO                                                    |

*Note: \* Averages taken over thirty month period*

*Table 3: Copy of Table 3 from RZM Pty Ltd Annual Report – Tomago Sandbeds Groundwater Monitoring Program*



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Data sources: DPIE - Water

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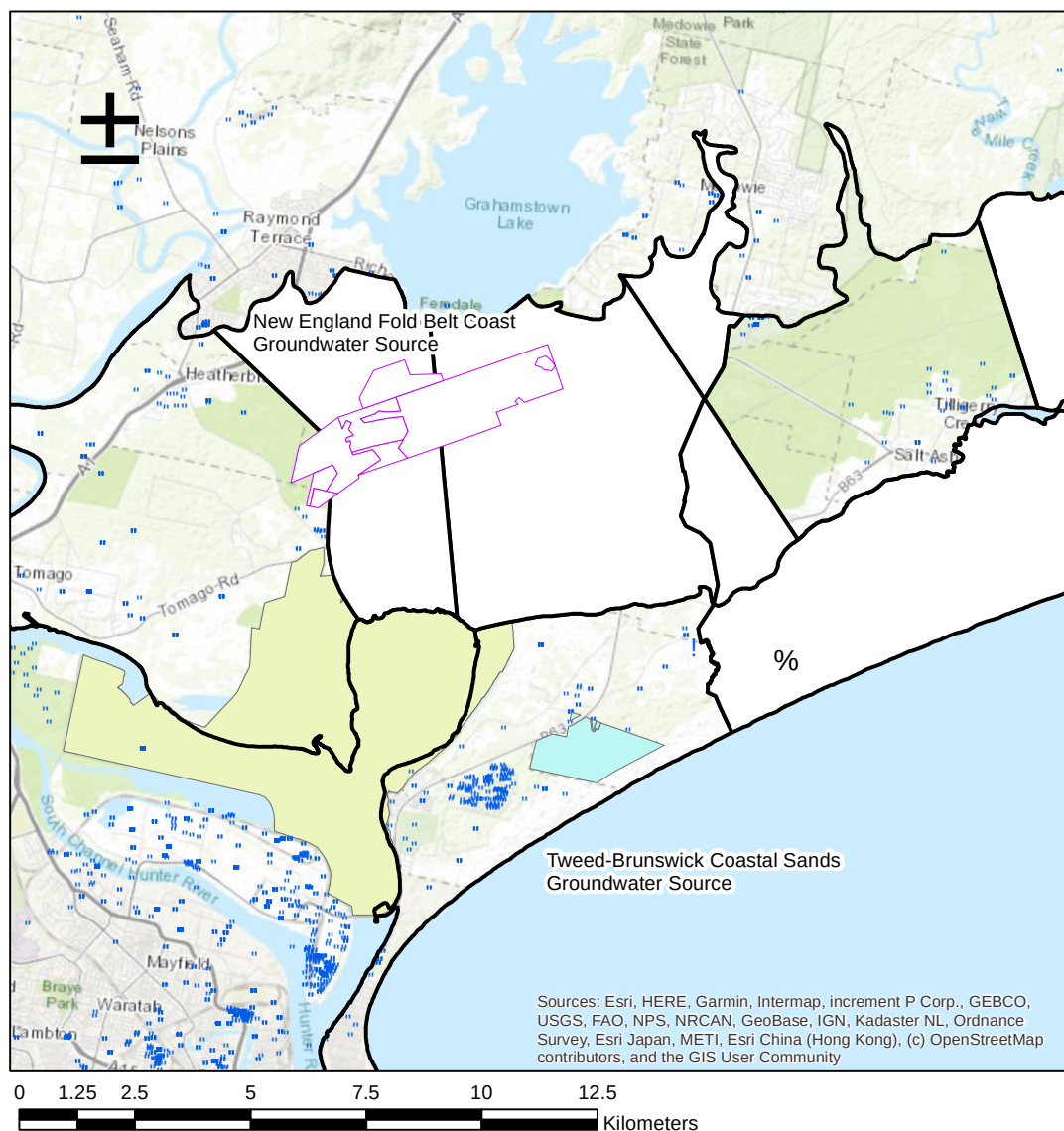
### Legend

- RZM Mineral Lease
- Boral Sands Project
- Water Source Boundary
- Ramsar Wetlands
- <all other values>

### PROBABILIT

- High probability of occurrence
- Low probability of occurrence
- No known occurrence
- na

Figure 1: Acid sulfate soil probability



Planning,  
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Environment

Data sources: DPIE - Water

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### Legend

- RZM Mineral Lease
- Boral Sands Project
- Water Source Boundary
- Ramsar Wetlands

Figure 2: Registered groundwater works