TNT MINES LIMITED

ABN 67 107 244 039

T11MEL

RINGAROOMA BAY

ANNUAL AND FINAL REPORT TO 23 APRIL 2013

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ABSTRACT

TNT Mines acquired six exploration licences in Ringarooma Bay in north-east Tasmania to explore for offshore placer tin; T11MEL, T12MEL, T13MEL, EL4/2011, EL17/2011 and EL46/2011. Historical drilling and offshore geophysical work has indicated the presence of significant amounts of alluvial tin both on and at shallow depths beneath the sea floor.

A desktop scoping study showed that a cutter suction tin dredging operation on the current JORC Indicated Resource of 16Mm^3 at 0.227 kgm^3 tin would be marginal at a tin price of $20,000 per tonne. TNT Mines exploration proposals were to carry out a geophysical test work program comprised of sidescan sonar, pinger and boomer acoustic sub-bottom profiling, detailed bathymetry and marine gradiometer surveys to define higher grade strand lines or palaeochannels to be followed up by vibracore drill sampling. No field work was carried out on the tenement. An environmental plan for exploration was prepared by SEMF Pty Ltd and an EPBC referral was submitted.

TNT Mines has decided to surrender all six project licences. Although the licences in State waters were granted in early January 2012, the Commonwealth licences were not granted until late April and May in 2012 and the first geophysical field season (January-April) was lost. Funding difficulties associated with the general downturn in investment in exploration in Australia over the past 12 months has left the company in a position where it cannot effectively fund the project at the level required to achieve acceptable technical success.

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1.0 INTRODUCTION

The ancestral Ringarooma River has deposited alluvial tin and other heavy minerals into what is now Ringarooma Bay. Previous exploration work, predominantly in the late 1960s through to the 1980s has demonstrated the presence of potentially economic tin mineralisation within the palaeochannels and terraces associated with the submerged river. A previous explorer estimated a JORC Indicated Resource of 16Mm^3 at 227g/m^3 of tin and a larger Inferred Resource of 194Mm^3 at 150-250g/m^3. The resource lies within water depths in the bay of 5-25m and further into Bass Strait the tenements cover water depths of up to 40m.

Modern exploration drilling techniques can comfortably drill in these water depths using vibracoring techniques to obtain samples of the unconsolidated tin bearing sediments to allow TNT Mines to confirm the JORC resource and rapidly evaluate the potential for additional higher grade 'tin leads' in the offshore sediments. There is also prospectivity for zircons, sapphires, and other heavy minerals.

The alluvial mineralisation would be amenable to a cutter suction dredging operation using "off the shelf" equipment similar to that used in south-east Asian tin dredging operations

1.1 Location and tenure

Ringarooma Bay is located in the north eastern tip of Tasmania (Figure 1). It forms a broad semi-circular bay which faces broadly north towards Bass Strait. It is flanked to the east by Cape Portland and to the west by Waterhouse Point and Waterhouse Island. The bay is fringed predominantly by white sandy beaches, with several small intervening headlands, such as at Tomahawk on the western side of the bay.

Much of the land area surrounding the bay is managed by agricultural practices, with most coastal plains having been heavily modified by agriculture (grazing and dairy). The landforms consist of sandy floodplains, sand dunes, lagoons and wetlands. The latter occur along a line parallel to the shore. Several reserves and Ramsar wetlands occur near Ringarooma Bay.

Published bathymetric contours of Ringarooma Bay show that the bay consists of roughly even contours to depths of around 30 metres below mean sea level. Linear depressions occur which represent palaeochannels from the Ringarooma River.

The area around Ringarooma Bay is home to a small population occupied predominantly with farming-related activities (sheep, cattle, dairy, grain, etc). Tourism is also a significant seasonal input to the region, with between half to two thirds of the private dwellings not being permanently occupied, and having the potential to accommodate holidaying visitors.

T11MEL was granted on 24/04/2012 and covers an area of 23 blocks. The tenement is one of six tenements that make up the Ringarooma Bay Project.

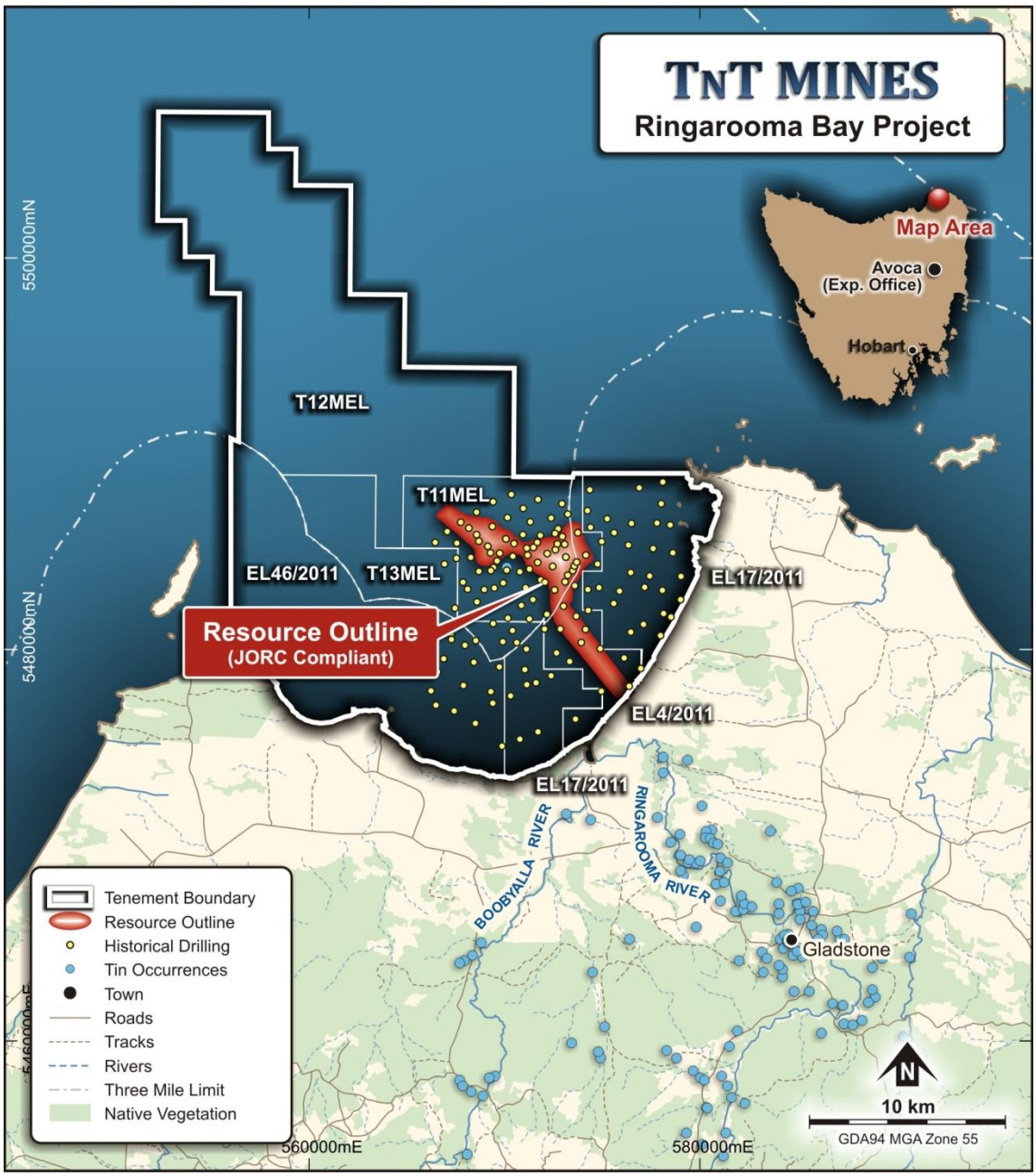

Figure 1: Location plan of Ringarooma Project tenements

1.2 Geology overview

TNT Mines' projects in northeast Tasmania are located within the Eastern Tasmanian Terrane.

The pre-Carboniferous geology of northeast Tasmania is dominated by a folded and faulted package of early possibly Cambrian - Ordovician to Devonian turbidites, the Mathinna Supergroup, into which several batholiths of both I-type and S-type granite have intruded.

The Mathinna Supergroup typically comprises fining-up Bouma sequences of less than two metres thickness and have been subdivided into two associations; an older shale-dominated succession to the west and a younger shale-sandstone succession. The older one has experienced an extra deformation which has produced recumbent folding suggesting a

faulted or unconformable contact with the younger succession which displays upright, open to closed folding resulting from two Devonian deformations. Gold mineralisation is associated with Devonian deformation and magmatism.
Three separate composite I-type and S-type granitoid batholiths intrude the Mathinna Supergroup rocks at relatively high crustal levels and are composed of hornblende-biotite granodiorite, biotite granite/adamellite and alkali feldspar granite. There is a statistical compositional trend towards more felsic, fractionated granite and monzogranite with decreasing age and a regional westward younging across northern Tasmania.

Tin and tungsten mineralisation is associated predominantly with strongly fractionated alkali-feldspar granites and includes tin greisens at Anchor and Royal George and quartz vein tin and tungsten deposits at Aberfoyle and Storey's Creek.

Mathinna Supergroup and granitic rocks are unconformably overlain by relatively flat-lying Permo-Triassic sediments, the Parmeener Supergroup, into which sills of Jurassic dolerite have been intruded. Uplift and faulting is associated with basaltic volcanism in the Tertiary and placer cassiterite deposits formed in parts of northeast Tasmania, including Ringarooma Bay. Minor sedimentation followed in Pleistocene to Recent times producing extensive lowland plains, coastal deposits and dunes typically consist of Quaternary and Tertiary materials overlain by sandy soils'

Local Geology

The geology around Ringarooma Bay (Figure 2) consists broadly of the following units:

- Ordovician Mathinna Group micaceous greywacke turbidite sequences;
- Devonian adamellite granite;
- Permian glaciomarine sequences of mudstone, pebbly mudstone and sandstone, minor limestone and Tasmanite oil shale;
- Jurassic dolerite with locally developed granophyre;
- Tertiary basalt and associated pyroclastic rocks; and
- Quaternary coastal sand, mud and gravel of lacustrine and littoral origin.

There are only minor occurrences of the Ordovician greywacke and the Permian glaciomarine sequences in the area. The Tertiary basalt and associated pyroclastic rocks have only been mapped on the eastern portion of Cape Portland. The Devonian adamellite-granite forms a significant part of Waterhouse Point and the bedrock in other inland areas around the south of Ringarooma Bay. The Jurassic Dolerite forms significant parts of the bedrock in eastern areas of Ringarooma Bay and outcrops on the western side of Cape Portland and other headlands and islands west of Cape Portland, including Petal Point. The Tomahawk area and headland also consists of Jurassic Dolerite.

A veneer of Quaternary sand, mud and gravel sediments has covered much of the older rocks, with deposition occurring through lacustrine, fluvial, littoral wave and wind action. Flood plain deposits occur along the drainage lines and in particular the Ringarooma River flood plain. Extensive dune fields have developed. Dune crests are typically oriented along a roughly east-west axis, with the exception of the coastal dune line perpendicular to the shore along the bay.

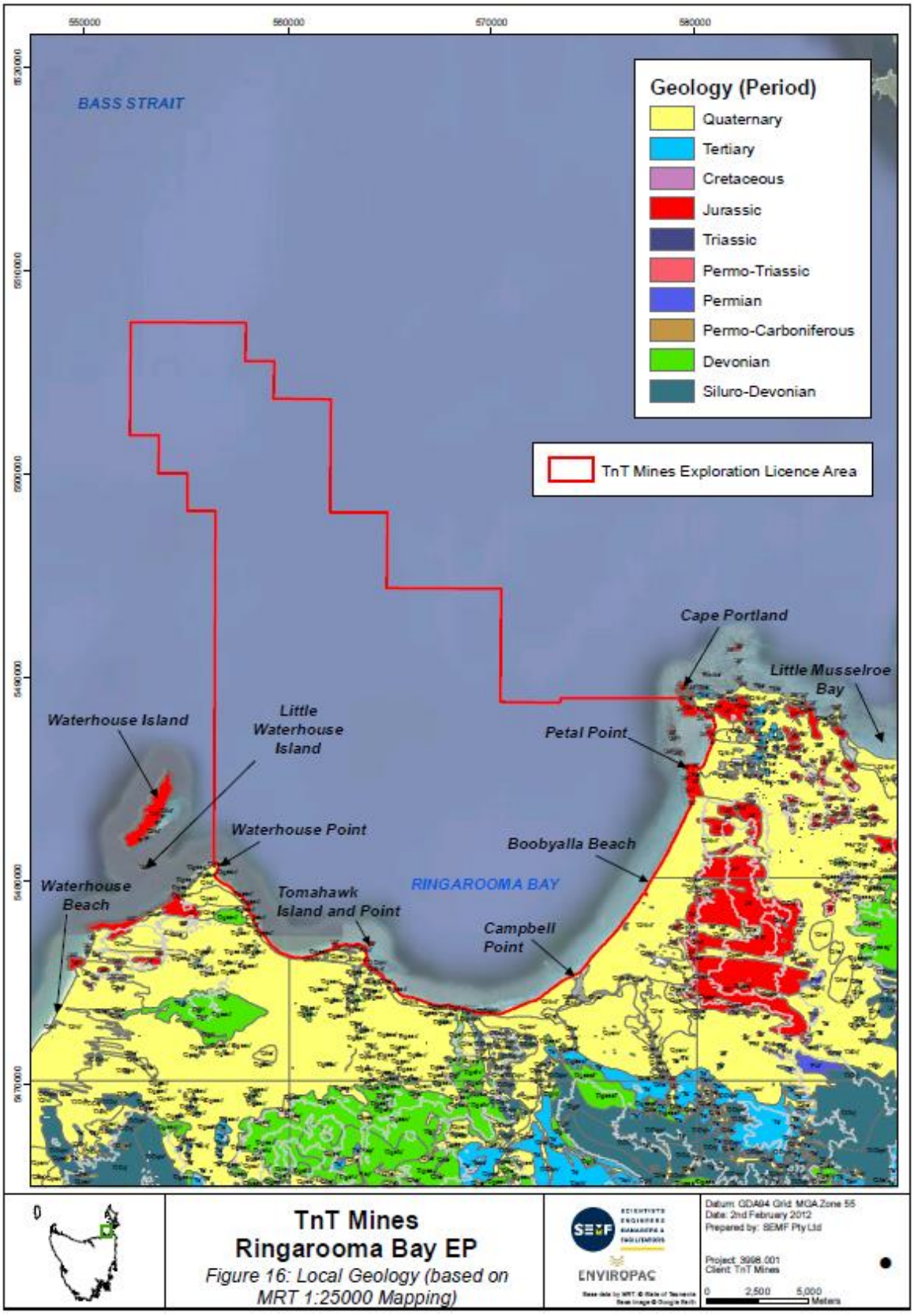

Figure 2: Onshore geology in Ringarooma area

Seabed Composition (from Keserue-Ponte, 2012)

The near-shore bathymetry of Ringarooma Bay has been mapped as part of the Seamap Tasmania – Mapping the Gaps Project (Lucieer et al. 2009). The project included mapping the seabed composition, within 1.5km of the shore, including distribution of cobble, reef, sand and seagrass. The report (Lucieer et al. 2009) notes that their acoustic mapping method made it difficult to distinguish between cobble and seagrass, particularly due to the intermixed nature of these habitats at the 1:25,000 mapping scale used, as such, it was 'impossible' to cartographically represent these habitats using linear boundaries.

The following can be noted:

- *reef and cobble dominate the 1.5km zone at either end of Ringarooma Bay, i.e. from Foster Islands and Cape Portland to Baynes Island, at the eastern end, and the area west, northwest, and northeast of Waterhouse Island, at the western end, with sand occurring only in restricted patches;*
- *a small reef area occurs around Petal Point;*
- *the eastern half of the Bay between Petal Point and Boobyalla Inlet is dominated almost exclusively by sand in the 1.5km zone from the coast; this also included the Ringarooma River lower floodplain with the RAMSAR site;*
- *from Boobyalla Inlet, west to Waterhouse Point, the seafloor is dominated by sand and seagrass, with some cobble areas and a range of small isolated reefs, including west of Murdoch's Beach (west of the Boobyalla Inlet), and at Tomahawk Point.*

The sand has been characterised as 'fine sand' (Lucieer et al. 2009). The reefs in the area were reported as predominantly 'low profile'.

Mineral Deposits (from Keserue-Ponte, 2012)

The following offshore minerals deposits summary is based on Mason (2000).

TIN

- *the tin wash commonly lies directly on the seabed or with less than 2 m of cover;*
- *MHA has defined an area of 4 sq km containing shallow alluvials with high concentrations of tin up to a maximum of 694 g/t of tin, using 100 g/t cut off – this area is interpreted to correspond to reworked placers which have formed a thin and wide blanket perpendicular to the palaeochannel and parallel to the shore, likely along an old strand line;*
- *Less frequently, tin wash occurs under up to 10m of cover; this is more common deeper in the bay;*
- *The best grades are in medium to coarse sands to fine gravels, often with well-rounded granules or pebbles to 75mm diameter. Many of the richest intersections are underlain by a sticky silt/clay bottom. This may correspond to the onshore "Marine Bottom" or may be a false bottom.*
- *In comparison with most alluvials where the grade decreases away from sources the tenor of the offshore tin wash, of 150 to 250 g/cu.m, is not significantly different from the onshore sheet wash.*

SAPPHIRE

Sapphire concentrations in the offshore environment are uncertain, but it is considered that the main channel could contain high quality stones as they are potentially extensions of the known concentrations in the onshore areas.

HEAVY MINERALS

- *Ilmenite and rutile: recent offshore exploration by Mineral Holdings Australia (MHA) has defined a zone of higher concentrations of heavy mineral sands associated with*

the "Near Shore Sediment" build-up. This represents a palaeo shore line, 500m to 2km from the present shore.

- *Zircon concentrations are more wide spread than ilmenite, and are associated with both the tin and the other heavy mineral sand concentrations.*

Duncan et al (2002) associated the tin placers in Ringarooma Bay with the palaeochannel of the Ringarooma River and considered the plateau structure in Ringarooma Bay, which hosts most of the indicated resource, to be an ancient strand line formed at a time of stable sea level by reworking of the palaeochannel deposits, which have formed an east-west trending resource.

1.3 Exploration Rationale

There has been a significant body of work done over several decades on potential mineral deposits within Ringarooma Bay. Tin resources are known for the bay. Furthermore, the bay also hosts other minerals of commercial value. One of the main reasons the resources have not already been mined, or have not been defined in more detail, is because of high upfront costs of carrying out the work in a marine environment.

Exploration drilling activities were carried out predominantly between 1966 and 1968 and this sampling formed the basis for the estimation of a JORC Inferred Resource in 2000. The resource is estimated to comprise approximately 194Mm^3 with a concentration of 150-250g/m^3 of tin (with approximately 29,100 – 48,500t of contained). The Indicated Resource is in the order of 16Mm^3 at 227g/m^3 of tin. The resource area (see Figure 1) also contains zircon, ilmenite, rutile, and other potential commodity minerals. The extent and locations of past exploration drilling is also shown in Figure 1.

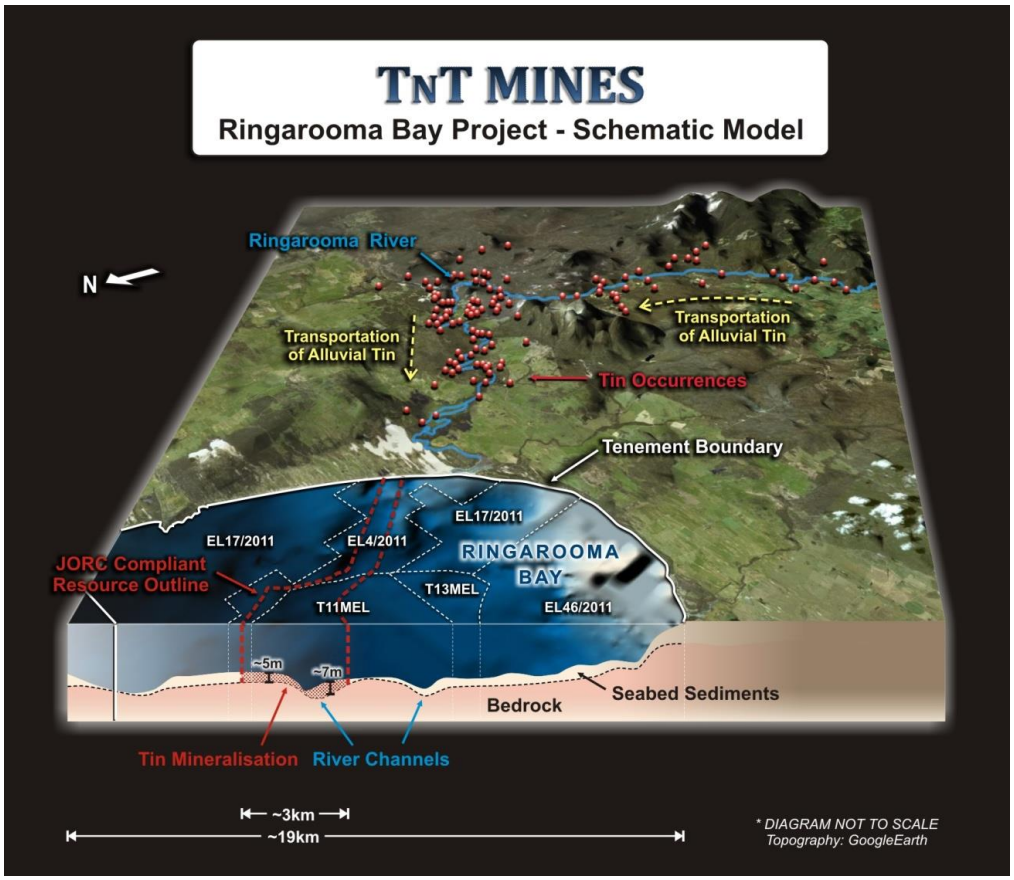

Figure 3: Schematic model – Ringarooma Bay

Although past exploration results are encouraging, additional information is required on the resource in order to develop the project. In particular, it is necessary to better evaluate the resource from an economic, metallurgical, and mining feasibility perspective.

To this end, TNT Mines proposes to carry out geophysical and sediment sampling surveys for the purpose of better defining the extent and characteristics of alluvial tin and heavy minerals resources within Ringarooma Bay.

Advances in both geophysical and soft sediment sampling techniques have been substantial since the early exploration of Ringarooma Bay 40 years ago. In particular, the availability of low energy sub-bottom acoustic profiling techniques such as pinger and boomer, side-scan sonar, marine magnetometry and differential GPS accuracy make it possible to construct accurate profiles of the soft sediment stratigraphy and maps of seafloor bathymetry that are vastly more detailed and accurate. The delineation of high grade strand lines and palaeochannel deposits is crucial to the success of TNT Mines venture.

2.0 REVIEW OF PREVIOUS WORK

The inland area south of Ringarooma Bay is a well-known alluvial tin province which has produced in excess of 40,000 t of tin since discovery in the 1870's, from mines such as the Briseis, Arba, Pioneer, Endurance and others.

Tin-rich minerals have also been transported by river over millions of years from the tin-bearing rocks surrounding Ringarooma Bay and upstream of the Ringarooma River. Tin-rich alluvial sediments transported by the Ringarooma River settled within the Pleistocene course of the river which is now partly submerged beneath Ringarooma Bay. Tin-bearing minerals also occur along buried or submerged strandlines within the bay, parallel to the current coastline.

A number of exploration companies have carried out mineral exploration activities in Ringarooma Bay since 1966. A summary of this work is provided below, extracted from Bucci et al (2012).

- Between 1966-1968, Tasmanian Offshore Exploration Company (TOEC) conducted a regional bathymetric, seismic and sampling programme, followed by a 138-hole drilling programme in the areas of interest. Of these holes, TOEC considered that 27 holes yielded encouraging mineralised intervals. Sixteen of the holes had "*grades over their total depths*" above a cut-off grade of 75 g/m^3 Sn. The grades of the 192 analysed samples ranged from 37 to 815 g/m^3 Sn (Featherstone 2011 and references therein);
- In 1968, Utah Development Corporation together with BHP drilled 15 holes to 18 m water depth up to 4.3 km offshore. The best intervals included 2 holes that were drilled within 600m of shores and contained averaged grades of 50 to 85 g/m^3 Sn (Featherstone 2011 and references therein);
- In 1981-1982, Hellyer Mining and Exploration Pty Ltd (Hellyer) completed a programme of bathymetric, seismic and magnetic surveys and a review of works completed by TOEC;
- In 1983, Conzinc Riotinto of Australia Exploration Pty Ltd (CRAE) undertook a review of the works completed by the previous owners and concluded that the quantum of mineralisation in the area ranged 14-21 MCM @ 175 – 200 g/m^3 (Mason 2000 and references therein);
- In 1995, Mineral Holdings Australia Pty Ltd completed a "pre-feasibility review" of the historic works (Macarthur 1995). In 2000, the review was updated by Mason (2000). Based on the historic drilling data by TOEC, and geophysical surveys undertaken by Hellyer, Mason (2000) re-estimated the quantum of mineralisation in the Project area and concluded that the major palaeo-channel and four other prospects together host up to 199 MCM @150-250g/m^3 Sn of "*inferred materials*", which included 16 MCM @ 227g/m^3 Sn of "*indicated Resource*". In addition to the potential tin mineralisation, Mineral Holdings considered the Project area might have potential of containing gemstone quality sapphire, and economic concentrations of rutile, zircon and ilmenite. Mason (2000) concluded that the area is prospective for a large scale dredging operation.

3.0 WORK COMPLETED DURING THE REPORTING PERIOD

3.1 Environmental

3.1.1 Environmental plan for exploration

An environmental plan for exploration was prepared by SEMF Pty Ltd (SEMF) with input from TNT Mines. The plan is included as Appendix 3.

3.1.2 EPBC referral

SEMF advised TNT Mines that it would be prudent to lodge an EPBC referral (under the *Environment Protection and Biodiversity Protection Act* 1999 (EPBC Act)) with the Commonwealth for proposed exploration work in Ringarooma Bay. The referral was recommended on the basis of potential impacts on Matters of National Environmental Significance (MNES). The EPBC Act applies to seven MNES:

a. World heritage sites;
b. National heritage places;
c. Wetlands of international importance (including Ramsar wetlands);
d. Nationally threatened species and ecological communities;
e. Migratory species;
f. Commonwealth marine areas;
g. Nuclear actions.

TNT's proposed exploration work has the potential to impact on NES matters d, e, and f, and possibly even c, due to the nearby Ramsar wetlands. The EPBC referral should be finalised in early in 2013.

3.2 High level scoping

A basic desktop study with indicative CAPEX and OPEX for Ringarooma Bay was prepared by Roger Bastone of Vanston Pty Ltd in August. Roger has extensive experience in alluvial tin operations in south-east Asia including working for PT Koba Tin in Indonesia. The report is included as Appendix 1.

Figure 4: Cutter suction dredge operating in south-east Asia

3.3 Acoustic test work

TNT Mines selected Marine GeoSolutions to carry out the bathymetric and geophysical survey work in Ringarooma Bay. The survey was planned to be run off the Dell Richey II, a fishing vessel out of Devonport owned by Richey Fishing Company. Because the vessel is not set up for surveying it was deemed necessary for some test work to be carried out to determine if there would be any acoustic interference that might compromise the survey work and that the vessel and crew were suitable. Dr Peter Ramsay from Marine GeoSolutions travelled to Tasmania from Perth in the first week of December 2011 and conducted a successful assessment. His summary is attached as Appendix 2.

4.0 DISCUSSION OF RESULTS

4.1 Environmental

4.1.1 Environmental plan for exploration

The plan is attached as Appendix 3.

4.1.2 EPBC referral

SEMF lodged an EPBC referral with the Commonwealth on the 14th August outlining the proposed work programs. The referral was made to give TNT Mines protection from potentially draconian penalties should exploration activities have an unforseen deleterious effect on any Matters of National Environmental Significance within the exploration tenements.

On the 10th September, the Commonwealth implemented a "stop the clock" on the referral process and requested the following additional information:

- *An assessment of the potential impacts of the action to any Indigenous heritage values of the Commonwealth marine environment, as defined under Section 528 of the EPBC Act; and*
- *Any proposed mitigation measures to manage identified impacts to the indigenous heritage values of the Commonwealth marine environment.*

Subsequently, TNT Mines began a process of consultation with the Tasmanian Aboriginal Sea and Land Council. Following provision of relevant information to Colin Hughes from TASLC all subsequent attempts to communicate with him have been unsuccessful. TNT Mines understands that there may be a boycott on heritage clearance work imposed by the Tasmanian Aboriginal community and that the Ringarooma Bay process may be subject to this.

The Commonwealth have indicated that there are no other issues with the EPBC Referral.

4.2 High level scoping

The purpose of the study was to gain a "ball park" idea of the economics of a dredging operation in Ringarooma Bay. The desk-top scoping study used the current JORC Indicated Resource and suggests that although CAPEX would be relatively low, a higher grade or higher tin prices would be desirable. The conclusions from Bastone's study are included below:

> *Based on the limited information available there are sufficient Indicated Resources (16Mm3 at 0.227kg/m3) to establish a four year dredging operation at 500m3/hour or 3.6Mm3/year. If further exploration activity upgrades the Inferred Resources there is opportunity for more than one dredge unit to operate in the area*
>
> *Alternatively a smaller dredge unit 300m3/hour or 2.2Mm3/year could be considered in the Indicated Resource area at marginally lower capital and operating cost. In this case dredging income would be available over a seven year timeframe during which time further exploration could be undertaken. However the lower throughput in low grade ground and*

therefore lower production would not be sufficiently offset by cost savings and the operating profit at the lower tin price of AUD$20000 would at best be marginal.

The recommended mining option is a cutter suction unit. A 500m3.hour unit operating for 20 hours/day would mine 3.6Mm3 per annum and produce 816 tonnes of tin assuming a recovery on bore value of 100% and a grade of 0.22kg/m3.

Capex for setup would be in the order AUD$7.1M assuming a new self-propelled dredge was purchased with an on board concentrating plant, associated work boats, a wharf, breakwater and onshore office facility.

Operating profit from the sale of wet ore at 74%tin in concentrates would be in the order of AUD$3.0M/annum before overheads, tax, interest and royalties; assuming a wet concentrate sale price of AUD$14800 on an LME Tin Price of AUD$20000/Tonne.

Cost/m3 mined would be in the order of $2.

5.0 CONCLUSIONS AND FUTURE WORK

The desk-top scoping study has shown that a dredging operation in Ringarooma Bay would be an essentially low capital cost operation but would require definition of a higher grade resource to ensure profitability. The exploration work that TNT Mines has planned in the first two years of the licence is designed to delineate high grade strand lines and palaeochannels. That proposed work is outlined below, extracted from Keserue-Ponte (2012)

TNT Mines has decided to surrender all six Ringarooma Bay licences and there are several reasons for this decision. The State licences were granted in early January 2012 but the Commonwealth licences were not granted until late April and May 2012. Geophysical exploration is only really possible in the period January- April, so a complete field season was lost due the lengthy period taken by the Commonwealth to grant exploration licences. TNT Mines was reasonably well funded in early 2012 and had the means to carry out at least some of the proposed work. By early 2013 however, TNT Mines was experiencing difficult financial circumstances and that, combined with delays in the EPBC referral process which may relate to political circumstances beyond the companies control, led TNT Mines to a position where it needed to rationalise its tenement position. Although still keen on the concept of exploration in Ringarooma Bay the company has regretfully decided to relinquish the project.

<u>Proposed exploration work (now cancelled)</u>

Exploration work proposed by TNT Mines for Years 1 and 2 of the Exploration Licences will comprise:

- *an initial round of gravity coring and grab sampling;*
- *an initial remote sensing / geophysical survey stage; followed by*
- *another sampling stage, including drilling and grab sampling.*

The remote sensing work will be undertaken from a vessel on Ringarooma Bay. The vessel will follow pre-determined survey lines, indicated in Figure 5, which will overlap the known resource areas, and will include the use of:

- *Multibeam echosounder;*
- *Side-scan sonar;*
- *Boomer*
- *Pinger;*
- *Magnetic gradiometer;*
- *GPS, tide gauge and barometer.*

Gravity coring will occur in the interpreted extension of the defined resource area. Sediment sampling locations will be chosen after the interpretation of the geophysical survey work has been completed. Placement of sampling locations will enable infill of previous historic sampling locations, and will also target those areas identified by the geophysical surveys to most likely contain tin and other economic minerals deposits. The sediment sampling methods proposed are as follows:

- *vibracore sampling (100 locations x 6m long x 75-100mm diameter cores);*
- *grab sampling (100 x 2-5L samples);*
- *gravity coring (120 x 1 to 1.5m long x 75mm diameter cores) and*
- *diver sampling (100 x 5L samples).*

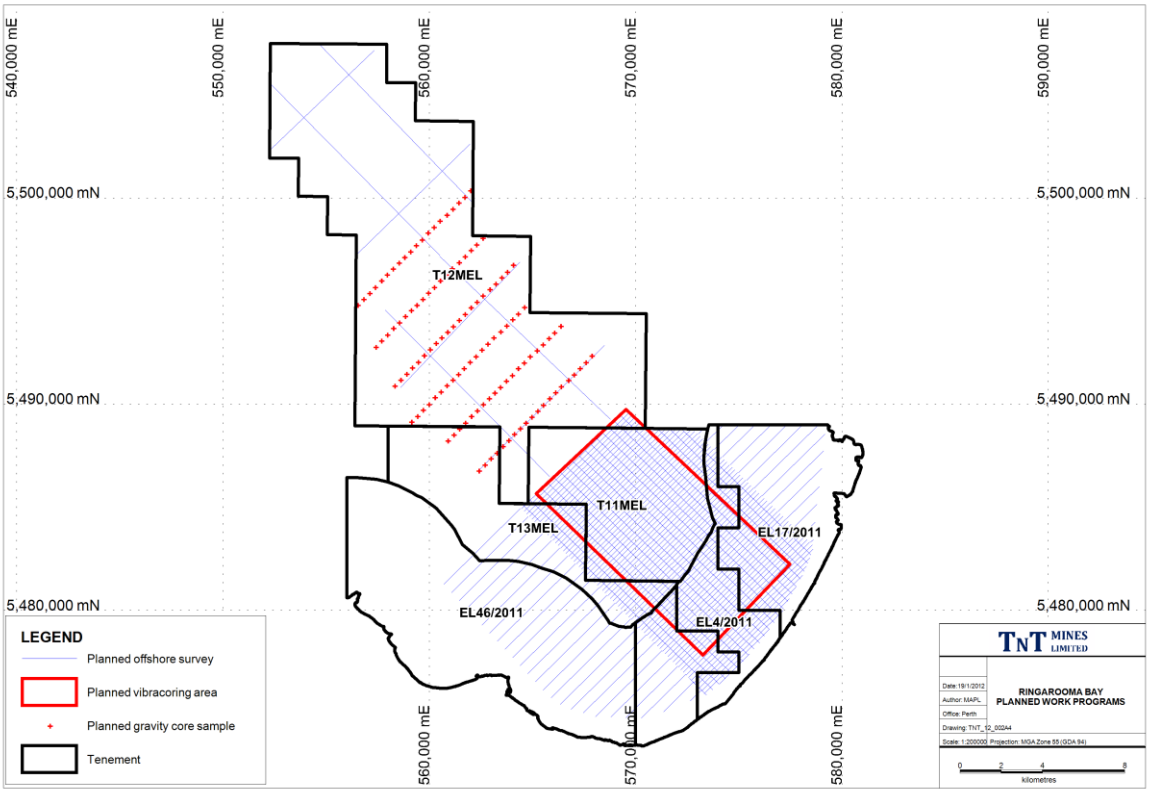

Figure 5: Indicative Location Map of Geophysical Survey Lines and Sampling

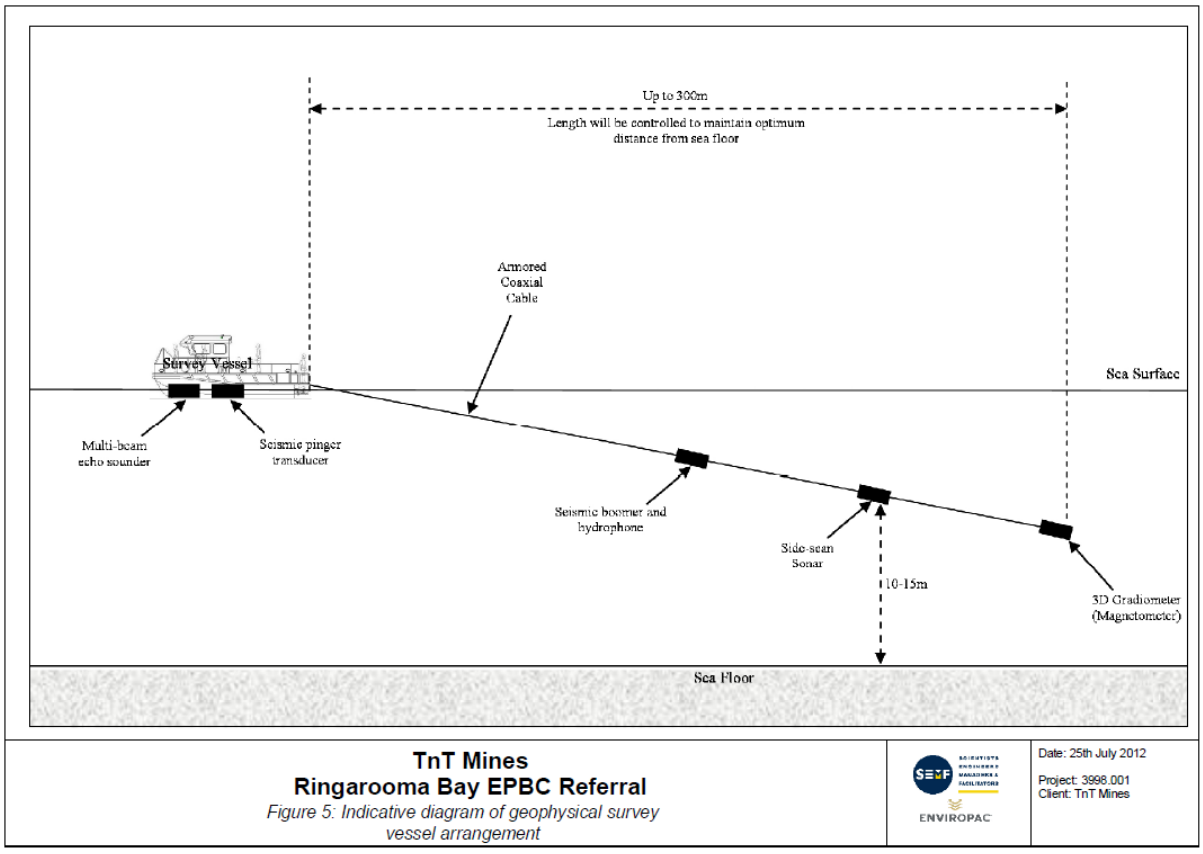

Figure 6: Indicative diagram of geophysical survey vessel arrangements

All subsequent testing, gravity separation, analysis and other determinations will be conducted on shore at suitably licensed laboratory facilities.

Indicative locations of gravity coring sampling and survey lines (based on the current inferred extent of the resources) are indicated in Figure 5. As noted above, vibracoring, grab and diver sampling locations will need to be informed by geophysical survey interpretations and may therefore be modified prior to being carried out.

Geophysical Survey

The geophysical survey will be undertaken by experienced marine geophysicists, and hydrographic surveyors using a specially equipped vessel.
The following equipment will be used during the survey:

- *A tide gauge will be deployed underwater at Ringarooma Bay to monitor tidal levels to a defined datum for the duration of the survey operations; a calibrated barometer will be deployed to correct the tidal data for barometric pressure variations;*
- *Real Time geographic positioning system (GPS);*
- *Multibeam transducer: generates bathymetry data to measure the tidally corrected water depth. This will enable production of a highly accurate digital terrain model of the seafloor and a contour bathymetry map;*
- *Side-scan sonar: produces an aerial 'photograph' of the seafloor showing rock outcrops, different sediment types and shipwrecks or debris;*
- *Pinger transducer: generates sub bottom profiling data to approximately 10m depth into the unconsolidated sediments. This will enable a high resolution map of the upper sediments in the bay to be generated;*
- *Boomer: generates sub bottom profiling data to approximately 40m depth into the unconsolidated sediments. This will enable a map of the deeper geological layers and channels to be generated; and*
- *Magnetic Gradiometer: This will detect magnetic minerals such as magnetite which can be associated with the cassiterite and can be used as proxy data for ilmenite and cassiterite concentration.*

The side-scan sonar towfish will be towed on a 300m armoured cable approximately 10-15m above the seafloor. Both 100kHz and 500kHz data will be recorded.

The sub-bottom profiling survey will involve the collection of boomer and pinger profiling data at a combination of two different frequencies to enable collection of an accurate dataset. The pinger transducer will be hull-mounted whilst the boomer transducer and hydrophone array will be "tethered and towed" at a fixed distance behind the vessel.
The magnetic gradiometer will be towed behind the side-scan sonar using a tandem tow array and the magnetometer elevation off the seafloor will be controlled by adjusting the tow cable length using a sonar winch. Gradiometer positioning will be accomplished using an ultra-short baseline (USBL) positioning system.

As well as providing an excellent dataset on bathymetry, seafloor vegetation coverage, sediment distribution, underlying geology and potential mineral resource distribution, the geophysical survey will also enable underwater hazards (e.g. rocky reefs or shipwrecks) to be identified prior to sediment sampling in the areas of interest.

An indicative vessel and equipment array is given in Figure 6.

Approximately 1000 line kilometres of geophysical surveying will be undertaken in consecutive lines parallel to the coast. Lines will begin approximately parallel to and at a distance of at least 500 metres from the coast and will then be spaced between 200 and 500 metres from each other (Figure 5). Between half to over ¾ of each of the licence areas will be covered by the geophysical survey lines.

The survey work will be undertaken during daylight hours at an estimated rate of approximately 40km per day. This will enable the survey to be completed over approximately 19 days. In inclement weather the survey may be delayed and the vessel may seek safe anchorage in Bell Bay or Ringarooma Bay. Weather permitting; the vessel will anchor at night in a safe area in the vicinity of Waterhouse Point or in the lee of Waterhouse Island.

The vessel will resupply with fuel, water, food and other survey requirements, in Bridport, Bell Bay or Whitemark (Flinders Island). Small supplies may also be brought in to the jetty at Tomahawk.

Sampling Methods

Figure 5 shows the proposed gravity core locations, proposed vibracoring area and the proposed geophysical survey lines. The following percent areas are covered with proposed exploration survey and sampling work within each licence:

- *EL4/2011: geophysical and vibracoring cover approximately 84% of the licence area;*
- *EL17/2011: geophysical and vibracoring cover approximately 79% of the licence area;*
- *EL46/2011: geophysical survey lines cover approximately 40% of the licence area;*
- *T11MEL: geophysical and vibracoring cover approximately 100% of the licence area, some of it with broad spaced geophysics;*
- *T12MEL: broad spaced geophysical and gravity coring cover approximately 90% of the licence area;*
- *T13/MEL: broad spaced and closed space geophysical and gravity- and vibracoring cover approximately 55% of the licence area.*

The details of these methods are provided in the following sub-sections.

Vibracore Sampling

Vibracore sampling will be undertaken using a vessel with an open back deck. The vessel will typically be equipped with an A-frame, winches, a crane and a four-point anchoring system. An example of a sampling vessel is given in Figure 7.

The vessel will position itself within 20m of the pre-determined drilling site. If the vessel has dynamic positioning capability, vibracoring will begin as described below. If the vessel has a four-point mooring system, this will be laid out over the site to ensure that the vessel doesn't drift offsite during the coring operation. It can take about two hours to set out the mooring system. Using this method it is estimated that 3 to 4 vibracores could be collected each day depending on the ground conditions and distance between sites.

Once the vessel is dynamically positioned or suitably anchored, the vibracoring unit is lowered into the ocean. The coring system comprises a 6.5m aluminium tripod fitted with a steel core barrel attached to a vibrating head. The hammer and core barrel rotate freely within the frame allowing the core barrel to penetrate difficult substrates.

The vibrating hammer (vibrohammer) operates at a variable frequency from 0 to 6000Hz enabling frequency to be matched with sediment types. A 75 to 100mm sediment core is extracted. Vibracore samples will be lifted intact with the barrel of the sampler to the deck of the vessel. The cores will then be stored upright to facilitate the drainage of water from the sediments prior to being extracted from the barrels and placed in core trays. An example of a deployed vibracoring unit is given in Figure 8.

No drilling fluids are used in the process of vibracoring. No drill cuttings or sediment discharge occurs during vibracoring; Figure provides an excerpt of a video taken from the operation of a vibracorer, showing that no sediment is discharged during the vibracoring process (a full video of the operation of a vibracorer is provided in digital format on the CD accompanying this EP).

The resulting drill hole is expected to slowly collapse onto itself as vibracoring will only penetrate through unconsolidated sediments. The unconsolidated sediment profile is expected to rapidly settle into the drill hole upon retraction of the vibracorer head and barrel. A minimal amount of turbidity will be generated immediately at the collar of the drill hole by the displacement of water from within the drill hole during infilling by surrounding sediments.

Figure 7: Example of a vessel equipped for vibracoring

Figure 8: Vibracorer being deployed

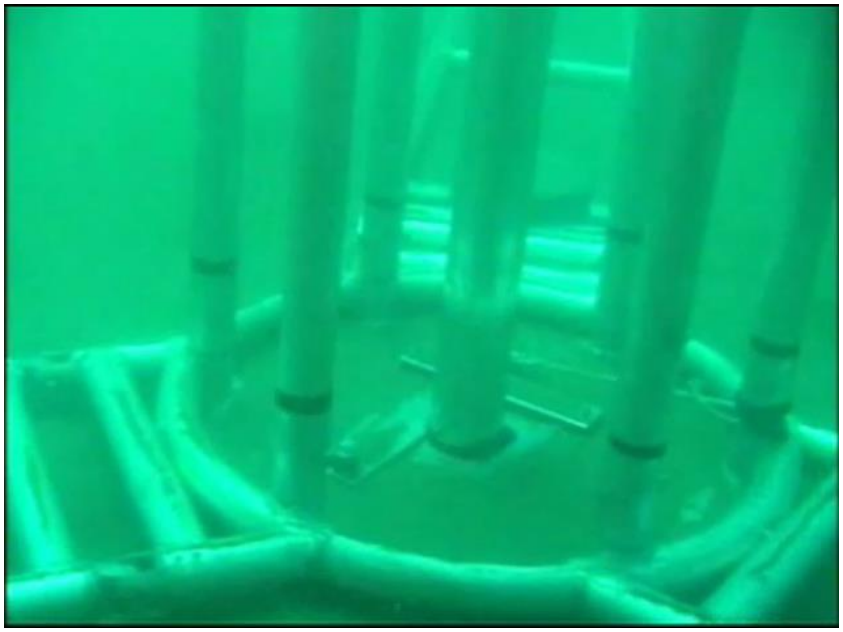

Figure 9: Underwater picture of vibracorer in operation
Source: vibracoring video by Marine GeoSolutions

The core trays will be stored on the vessel until demobilisation in port. The vibracorer will penetrate up to 6m and has a maximum diameter of 10 cm (=0.0078 m^2). Approximately 165 x 6 metre long samples will be taken. Sampling will be undertaken no closer than 500m from the shore. Where drilling penetration encounters refusal shallower than 4 metres depth, then an alternative nearby location will be drilled as a replacement drill hole.

At a rate of 3 to 4 vibracore samples per day. Sampling could take between 25 and 34 days. In inclement weather the survey may be delayed and the vessel may seek safe anchorage in Bell Bay or Ringarooma Bay. Weather permitting; the vessel will anchor at night in a safe area in the vicinity of Waterhouse Point or in the lee of Waterhouse Island.

The vessel will be resupplied with fuel, water, food and other survey requirements, in Bridport, Bell Bay or Whitemark (Flinders Island). Small supplies may also be brought in to the jetty at Tomahawk.

Total surface disturbance area from vibracoring will be approximately:

- *Drill hole areas: 165 x 0.0078 m^2 = 1.29 m^2*
- *Tripod areas: 3m x 0.5m x 3 = 4.5 m^2 x 165 locations = 742.5 m^2*
- *Anchor areas (if no dynamic positioning vessel is used): 0.5 m^2 x 2 x 165 = 165 m^2*

Total worst case disturbance area for 165 vibracore holes, with a vessel requiring anchoring at each location would be of the order of 910 m^2.

Vibracoring will occur predominantly within EL4/2011, EL17/2011 and T11MEL, with a few samples being in T13MEL, T12MEL and EL46/2011. The vibracore sampling grid will cover approximately 50% of EL4/2011, approximately 1/8th of EL17/2011, approximately ¾ of T11MEL, approximately 10% of T13MEL and a very small proportion of T12MEL and EL46/2011.

Grab Sampling

Grab samples will be collected using either a Van Veen or Shipek grab. The Shipek grab collects a 3.0L sample and the Van Veen collects a 20L sample in two bucket halves deployed from the boat by line and hauled back on board. The samples will be bagged on the vessel and will be taken ashore at vessel demobilisation. Approximately 220 samples will be taken.

Grab sampling will be undertaken at similar locations used for vibracoring and as a tool for assessing the geology and sediment composition across the project area.. Sampling would be undertaken a minimum of 500m from the shore.

The aim of these samples will be to better quantify and characterise the near surface resource concentrations within delineated target economic resource areas and to map the sea floor.

A Van Veen grab image is shown in Figure 10 and a Shipek grab being deployed from a vessel is shown in Figure 11.

Figure 10: Image of a Van Veen Grab sampling bucket

Figure 11: Image of a Shipek Grab being deployed from a vessel

Gravity Coring

Cores will be collected with the aid of a gravity corer. The corer samples are designed to test for the presence of tin further out into Bass Strait along the palaeochannel of the Ringarooma River. A total of around 120 core samples will be taken along six lines, two kilometres apart, with samples taken approximately 400m apart (refer to Figure 5). Another 100 gravity core samples will be taken across other parts of the project area, yet to be located exactly. The gravity corer equipment will be run off the same vessel as the geophysical survey work. Examples of gravity coring work are provided in Figure 12, Figure 13 and Figure 14.

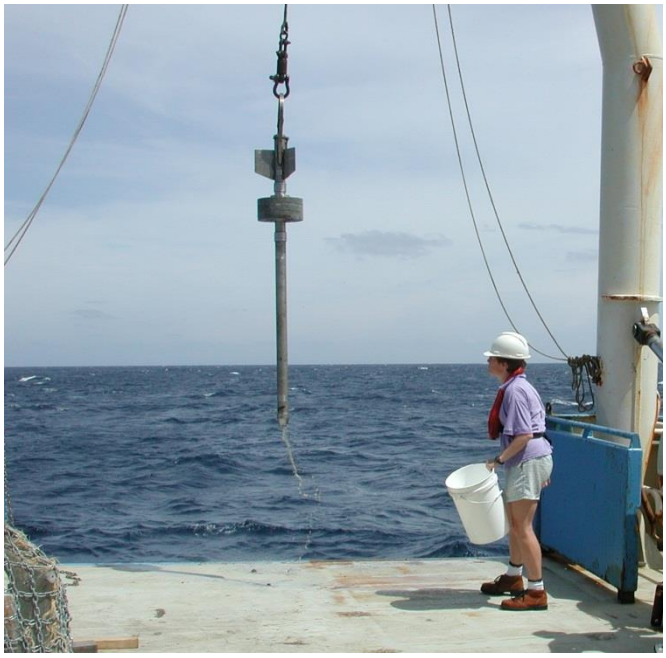

Figure 12: Gravity corer retrieval

Figure 13: Gravity corer disassembly for core removal

Figure 14: Gravity corer sample

Diver Sampling

Diver samples will be collected with a lower amount of disturbance in comparison to the grab sample and with more geological control over the sample medium. A 5L bucket would be filled with a scoop, capped and hauled to the surface. Approximately 100 samples will be taken.

Diver sampling may be undertaken using the same vessel used for gravity coring.

Sampling would be undertaken a minimum of 500m from the shore.

The aim of these samples will be to characterise the near surface geology and mineralogy of target economic resource units and to collect mineralised material for metallurgical studies.

Sample Handling

Vibracorer Core Samples

After completion of the survey, the cores will be discharged and transported to a suitable existing storage facility at TNT Mines' Avoca shed. Cores will be split (using a plasma cutter), sampled and photographed in high resolution. The unsampled half of the core will be stored in plastic core boxes, with a lid and labelled. The core boxes will remain in the Avoca shed, for reference during the project. The sampled half of the cores will be sent off to a laboratory for testing. The cores will be analysed to determine their sedimentology, grain size statistics, organic carbon content, carbonate content, mud content and mineralogy. Detailed core logs indicating sediment types, grainsize statistics, calcium carbonate contents, organic carbon contents, gravel contents, mud contents and geochemical analyses will be produced. Core samples will also undergo testing via physical separation with test gigs which will allow for heavy media separation and estimation of tin, zircon, titanium and other accessory mineral and metals concentrations.

Grab Samples
Samples will be allowed to drain off seawater prior to being bagged. All bagged samples will be stored on the vessel until its final return to port. Bagged samples will be sent to a laboratory for testing. The grab samples will undergo testing via physical separation with test gigs which will allow for heavy media separation and estimation of tin, zircon, ilmenite. rutile and other accessory mineral and metals concentrations.

Gravity Corer Cores
Cores retrieved from the gravity coring equipment will be handled and processed similarly to the vibracore samples described above.

Diver Bulk Samples
Diver bulk samples will be handled and tested similarly to the grab samples.

Drainage Water
Seawater draining out of core barrels, grab or diver samples on the deck of the vessel will be channelled to a sediment collection pit which will allow fines to settle prior to discharging the decanted seawater back to the sea. Sediment generation from the grab and diver bulk samples is expected to be minimal as the sampling locations will target the coarse fractions of the seabed and are therefore unlikely to shed much material during seawater drainage.

It is estimated that a sediment collection pit which could process up to 50L of fine sediment laden seawater may be required. This is based on the maximum daily coincident sampling case of:

- *4 core barrels / day x 3 L drainage per barrel +*
- *10 grab samples / day x 5 L drainage per grab +*
- *4 diver samples / day x 2 L drainage per diver sample =*
- *which total a maximum of **70 L** of potentially sediment-laden seawater per day.*

6.0 ENVIRONMENT

No field work was carried out in the reporting period.

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APPENDIX 1 – Ringarooma offshore tin mining project. Options and indicative costings

TNT MINES LTD

RINGAROOMA OFFSHORE TIN MINING PROJECT
OPTIONS AND INDICATIVE COSTINGS

1. INTRODUCTION

This review of possible mining options and indicative costing for the Ringarooma Project in North East Tasmania was undertaken at the request of Mr Russell Fulton of TNT Mines. The briefing documents included a revised budget for marine survey together with printouts of location maps. Included in the printout was information that 'previous explorers (Mason 2000) estimated JORC compliant resources as:

Inferred: 194Mm3 at 150 – 250g/m3 of tin

Indicated: 16Mm3 at 227g/m3 of tin.'

This report has been prepared based on the limited information provided; the personal experience of the writer and his associates; and through contacts with suppliers and operators. For reasons of speed and economy no studies have been undertaken at the site and this will be crucial to any final selection of equipment and infrastructure as conditions offshore in Bass Strait can be severe, particularly during the Spring Equinox (Sept – Dec). Furthermore projected operating costs are based on historical Indonesian and Australian data (2006 – 2011) and considerable research would be required to develop a detailed working budget.

2. SUMMARY AND CONCLUSIONS

Based on the limited information available there are sufficient Indicated Resources (16Mm3 at 0.227kg/m3) to establish a four year dredging operation at 500m3/hour or 3.6Mm3/year. If further exploration activity upgrades the Inferred Resources there is opportunity for more than one dredge unit to operate in the area

Alternatively a smaller dredge unit 300m3/hour or 2.2Mm3/year could be considered in the Indicated Resource area at marginally lower capital and operating cost. In this case dredging income would be available over a seven year timeframe during which time further exploration could be undertaken. However the lower throughput in low grade ground and therefore lower production would not be sufficiently offset by cost savings and the operating profit at the lower tin price of AUD$20000 would at best be marginal.

The recommended mining option is a cutter suction unit. A 500m3.hour unit operating for 20 hours/day would mine 3.6Mm3 per annum and produce 816 tonnes of tin assuming a recovery on bore value of 100% and a grade of 0.22kg/m3.

Capex for setup would be in the order AUD$7.1M assuming a new self-propelled dredge was

purchased with an onboard concentrating plant, associated work boats, a wharf, breakwater and onshore office facility.

Operating profit from the sale of wet ore at 74%tin in concentrates would be in the order of AUD$3.0M/annum before overheads, tax, interest and royalties; assuming a wet concentrate sale price of AUD$14800 on an LME Tin Price of AUD$20000/Tonne.
Cost/m3 mined would be in the order of $2.50.

3. CHARACTERISTICS OF THE DEPOSIT

The deposits of cassiterite are contained in approximately 6 – 8m of offshore alluvium which originated in the Ringarooma River Catchment in North East Tasmania. According to the information provided the deposit extends for some 10kms offshore and varies in width from 1 – 3kms. The depth of water overlying the alluvium is in the order of 25 – 30m. The Ringarooma Catchment was extensively mined onshore in the late nineteenth and early twentieth centuries. The alluvium is likely to be fine grained unconsolidated sand and silt as the deposits are downstream effluent from the river system; and probably include tailings from early mining. There is little likelihood of vegetation other than seaweed, and possibly a few logs carried offshore during periods of heavy rain. It is also highly unlikely that heavy clays will be a problem, either for the cutter and pump or in terms of suspended solids.

The work done to date to define measured resources falls considerably short of that required to define mineable reserves. TNT mines Ltd have a stated intention to further define traps for mineralisation by geophysical and hydrographic surveys and by drilling programs.

The main issue from a mining standpoint will be the need to ensure that mining operations take cognisance of the adverse weather patterns that can result in strong winds and heavy seas.

4. MINING METHOD

When dealing with a large volume and low unit value deposit a low cost bulk mining method is required. The fact that the deposit is also offshore limits the selection to some form of dredging equipment. There are hydraulically operated submersible pump units available on the market. Sykes stock the ‘Dragflow’ series which have proved successful in many applications involving desludging of dams and estuarine harbours. However the depth of the Ringarooma offshore alluvium and difficulties in precise manoeuvrability of the pump under sea conditions precludes the consideration of ‘Dragflow’ type units for this project.

There are only two methods to consider: bucket line and suction cutter.

Bucket Line

This traditional form of dredger was developed in the nineteenth century and large numbers were manufactured in Europe for use in Asia, Australasia, and South America. At one stage

more than fifty units were in operation in Malaysia. Indonesia still employs a number of bucket ladder dredges in offshore locations near Bangka Island. These units operating in the Asian environment were characterised by high volume throughput; high capital and low operating costs. Because of the huge breakout forces available at the cutting tumbler they were able to cope with stiff heavy clays. Second hand units are probably available ex Indonesia or Malaysia at bargain basement second hand prices. However in the current Australian industrial environment heavy spare parts will be difficult to procure in timely fashion and it will be expensive to find and train crews to undertake heavy bucket ladder maintenance on exposed decks in Bass Strait. Indonesian labour costs are significantly lower than those in Australia and bucket ladder dredges are a labour intensive option. The larger units capable of operating to depths of 40m will be in the order of 6000 tonnes displacement, have to be towed by a large seagoing tugboat and will therefore be difficult and expensive to move quickly should weather conditions deteriorate rapidly. Offshore dredgers of this type in Indonesia are relocated bi-annually to more sheltered locations as the monsoonal wind shifts occur.

There are also economies of scale in Indonesia with sufficient numbers of bucket ladder dredgers operating to allow for the provision of seagoing tugs; and for dry dock and foundry facilities to operate economically within the company framework.

Cutter Suction

These units have been successfully operated in the Australian environment for a number of decades. They have been used for harbour channel dredging all around the coastline, and for landfill and mining projects. There are a number of companies in Australia that construct cutter suction units for civil engineering projects in which the slurry is pumped to a tender barge for relocation away from the excavated trench; and for mining projects where the slurry is pumped ashore for treatment or to a nearby floating treatment plant connected to the dredger by floating pipeline.

There would be problems with utilising a satellite floating treatment plant in Bass Strait. It would be difficult to disconnect the plant from the dredge in deteriorating weather conditions and the dredge and the plant would have to be relocated separately should the situation require a move. Frequent moving and anchoring the two units and maintaining control of the pipeline at sea would be much more difficult than in a landlocked and sheltered lake. The configuration of the deposit precludes the construction and maintenance of a pipeline to convey the slurry to shore when the dredger could be up to 10kms from the coast. Such an installation even if possible would necessitate the construction of a system to treat and contain the huge volume of slurry on shore and to return the treated material to the seabed thereby significantly adding to the cost.

The depletion of resources and the decline of onshore tin mining industry in S.E.Asia have led to the development of a large offshore dredging industry located in Indonesian waters off Bangka Island in the South China Sea. Initially the industry utilised the services of the large

bucket ladder dredges adapted for offshore work and P.T.Timah (the State owned mining company), operated some twenty such units. Increasingly and with some privatisation of the industry there has been a move to purchase a number of cutter suction units for this work. Shipyards in Thailand have undertaken contracts to build and deliver large self-propelled cutter suction units with onboard treatment plants to upgrade the concentrates prior to removal to a shore based treatment plant by barge.

The cutter suction units have a number of advantages over the traditional bucket ladder dredges:

- They are smaller, self-propelled and therefore easier to relocate
- Fewer large mechanical drives and less heavy equipment; leading to lower operating and maintenance costs and smaller spare part inventories.
- Smaller crew requirements, lower labour costs.
- Lower capex

Thai shipyards have led the development of these units for the Indonesian offshore dredging industry and a copy of a quotation and photographs are attached to this report.

From the quotation it may be seen that the construction period for a large dredger is one year from the placement of the order.

Alternative options would include the purchase of a second hand unit and subsequent modification of that unit to include an onboard treatment plant. Perusal of the websites of dredger brokers worldwide indicates there are many units available of the capacity required for Ringarooma. Investigation of these options, plant design and negotiations with shipyards would take considerable time and are beyond the scope of this report. Should further exploration prove considerable additional reserves/resources, the option for modification of a suitable second hand unit should be considered. However if more than one dredger unit were to be contemplated it would seem sensible for logistical and training purposes for the two or more units to be from the same stable.

Preparations for Dredging

It will be necessary to undertake onshore work at the site prior to the arrival of the dredge.

The coastline of N.E.Tasmania is rugged and Bass Strait is notorious for the rough weather that prevails when depressions and troughs move in from the west and South West particularly during the Spring Equinox (Sept – Dec).

On existing information the dredge could be operating up to 10kms offshore, necessitating the provision of workboats and a barge to ferry supplies, crews and concentrates between the shore and the dredge. There would have to be provision ashore for the workboats to load and offload, and this provision should include a wharf and craneage. In addition Ringarooma Bay is exposed to the North West onshore winds and it is considered that a breakwater should be provided on the western side of the bay to protect the workboats and provide shelter for the dredge should severe weather conditions prevail.

Without the benefit of detailed site surveys to locate a suitable location and hard rock resource,

preferably at the western end of the bay, it is difficult to accurately cost this work. A simple provision has been made in the Capex costings for a 200m breakwater and a wharf with onshore storage for concentrates.

5. CAPEX

A copy of a quotation prepared for an Indonesian contract operator by Kriansek – Tomas Lew shipyards of Sumatsakorn in Southern Thailand for a 85m long self-propelled cutter suction unit with onboard concentrating plant is attached to this report. The quote is for Thai baht 85,000,000 (Eighty five million) which at the current (2012) rate of exchange equates to $2.6 million AUD.

This quotation is for a dredge to operate off the coast of Bangka Island and such a unit may have to be modified to work in Tasmanian waters where it will be subject to Marine and Safety Tasmania regulation. To this cost must be added the requirements for the voyage to Tasmania and for crew training. Crew accommodation onboard will have to be upgraded to suit the Tasmanian climate. An additional provision of AUD1.4M is made for the upgrades.

The dredge that is the subject of the quote is equipped with screens, distributor and a jig plant for recovery of concentrates. This equipment is tried and tested for coarser grained, higher grade deposits in offshore Indonesian waters. There is limited information available on the nature of the Ringarooma deposit and it may be necessary to modify the circuitry for the Bass Strait operation.

In addition it will be necessary to purchase two workboats and a barge to act as tenders to the dredge. It will also be necessary to find a suitable location in Ringarooma Bay to construct a wharf and a breakwater in order that concentrates, crew and supplies may be loaded and offloaded safely and to provide a sheltered location for the mooring of the dredge for heavy maintenance and safety in the event of violent weather.

Subject to further sampling of the deposit decisions will have to be taken on whether or not to construct a further treatment plant on shore but in any event a storage facility will have to be constructed to safely house the concentrates prior to shipment.

Of these ancillary projects the wharf and the breakwater will be the most expensive. Even if materials are available locally the cost/m3 for earthmoving is unlikely to be less than $18 per tonne. Assuming an average water depth of 15m, a 10m crest, and a forty five degree rill angle a total volume of rock in excess of 75000m3 will be required for a 200m long breakwater. A further Capex requirement of AUD 1.85m should be allocated for this work.
The total Capex Requirement will therefore be in the order of AUD 7.15 million

- Basic Dredge 2,600,000
- Adaptions for Bass Strait/transfer to site and training 1,400,000
- Allowance for modifications to plant (See notes) 500,000
- Construction of breakwater and Shore Infrastructure 1,850,000
- Purchase of two workboats one barge and cranes 800,000

Note: These Capex requirements do not include figures for the provision of an onshore treatment plant (if required) nor do they include any land acquisition charges, all of which are beyond the scope of this report.

6. PRODUCTION CAPACITY

For the purposes of this exercise a single 500 m3/hr dredge has been used. Obviously and if future exploration programs increase the reserve/resource base additional units could be employed.

Production for a single unit operating for 20 hours/day, 365 days/year, in an average grade of 0.22kg/m3, is estimated at 816 tonnes per annum.
Mining recovery has been assumed at 100% throughout. Wet plant recovery on the dredge has been assumed at 74% tin in concentrates. In practice wet plant recovery varies from deposit to deposit. Indonesian bucket ladder dredges with primary, secondary and tertiary jig banks, with experienced crews and operating in relatively high grade coarse grain size deposits (>1kg/ m3 and 80 – 120#) typically offloaded concentrates at 35 – 55% tin. In practice it is doubtful that a dredge operating in Bass Strait with lower grades; and probably fine downstream grain sizes will better the grade of concentrates produced by the Asian dredges without significant metallurgical input; possibly a consideration for spirals instead of jigs, and probably some form of concentrate upgrade on shore prior to shipment to the smelters. Such deliberations will require detailed analysis of samples taken from the deposit.

7. OPERATING COSTS

Attached to this report is a simple spreadsheet illustrating the main operating costs against production for a single unit operation.

Some basic assumptions that have been accepted are:

- The inferred Resource Figure (Mason, 2000) of 0.227kg/m3 is accepted for all material mined.
- Currency Exchange Rates for July 2012 are used.
- Projected LME tin price range is USD 20000 – 25000/tonne

Detailed research into the latest labour and spare parts inventory costs have not been within the scope of this report. Costs are based on recent (2007 – 2010) historical data for Indonesian and Australian operations and would have to be updated should there be a decision to proceed with the dredging program.

As expected the spreadsheet identifies that tin price, m3/hour dredged, grade, and exchange rate fuel price fluctuations are the variables with the most influence on the bottom line. Labour and spare parts inventories are likely to remain fairly constant. For a tin price in the range $20000 – 25000 the operating profit (before overheads, interest, royalties and tax) is likely to be in the range AUD$2.7m – AUD$5.7m per year.

As tax calculations have not been included in the spreadsheet the payback period on Capex can only be crudely assessed at approximately3 years

The projected cost/m3 mined is in the range AUD$2.3 – 2.5.

Roger Bastone
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5th August

Cutter suction dredge

Cutter suction head

			Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
General								
	USD to AUD Exchange Rate	AUD	1	1	1	1	1	1
	Days Per Month	Days	31	31	31	31	31	31
		18000						
Sales Prices								
	Base LME Tin Cash Sales Price USD	USD$ / Tonne	20,000	20,000	20,000	25,000	20,000	20,000
		AUD$/Tonne	20,000	18,000	21,000	25,000	20,000	20,000
	Tin Ore Concentrates - Wet Sales Price (74% of Base LME Cash Tin Sales Price)	US$ / Tonne	14,800	14,800	15,000	18,500	14,800	14,800
		AUD$/Tonne	14,800	13,320	15,750	18,500	14,800	14,800
Tin (Sn) Production	Number of Suction Cutter Dredgers Operating	Number	1	1	1	1	2	1
	Cubic Meters of Ore Processed Per Hour per Dredger	Cm / Hr	500	500	500	500	500	300
	WHO Grade	Kgs Sn / Cm	0.22	0.22	0.22	0.22	0.22	0.22
	Dredger Operating Hours per Day (per Dredger)	Hours / Day	20	20	20	20	20	20
	Tin (Sn) Production per Day per Dredger	Tonnes Sn/Day	2.20	2.20	2.20	2.20	2.20	1.32
	Sn Production per Month per Dredge	Tonnes Sn/Month	68	68	68	68	68	41
	Total Sn Production per Month - All Operating Dredgers	Tonnes Sn/Month	68	68	68	68	136	41
	Total Value Wet Sales Tin Ore Concentrates/Month	AUS$	1,009,360	908,424	1,074,150	1,261,700	2,018,720	605,616
Operating Costs								
Dredgers	Fuel Consumption per Hour (Cummings 895) - continuous power	liters / hr	250	250	250	250	250	180
	Cost of Fuel (Solar)	AUD / liter	1	1	1	1	2	1
	Total Fuel Cost per dredge	$ / Month	217,000	217,000	217,000	217,000	263,500	111,600
	Total Fuel Cost - all operating dredges	$ / Month	217,000	217,000	217,000	217,000	527,000	111,600
	Personnel per Dredge							
	Dredge Master	AUD / Month	16,000	16,000	16,000	16,000	32,000	16,000
	Dredge Captain	AUD/Month	14,000	14,000	14,000	14,000	28,000	14,000
	On-board Maintenace Supervisor	AUD/Month	12,000	12,000	12,000	12,000	24,000	12,000
	On-board Operating & Maintenance Crew (4 X 4 - shifts)	AUD/Month	240,000	240,000	240,000	240,000	480,000	180,000
	Day Crew (x 3)	AUD/Month	58,000	58,000	58,000	58,000	58,000	58,000
	Mess Cost	AUD/Month	40,000	40,000	40,000	40,000	80,000	30,000
	Maintenance Cost	AUD/Month	40,000	40,000	40,000	40,000	80,000	30,000
	Operating Supplies	AUD/Month	24,000	24,000	24,000	24,000	48,000	30,000
	Supply / Concentrate Offload Costs - 2-boats - 2 personnel per boat - 1 shift	AUD/Month	40,000	40,000	40,000	40,000	40,000	40,000
	On Shore Administration - 2 personnel (includes office supplies)	AUD/Month	18,000	18,000	18,000	18,000	18,000	18,000
	Shipping Charges Wet Concentrate	AUD/Month	50,000	50,000	50,000	50,000	100,000	50,000
	Insurance	AUD/Month	12,000	12,000	12,000	12,000	24,000	10,000
	Total operating Cost Per Month		781,000	781,000	781,000	781,000	1,539,000	599,600
	Profit/Month before tax/royalties/interest etc		228,360	127,424	293,150	480,700	479,720	6,016
	m3/Month		310,000	310,000			620,000	
	Cost/m3/Month		2	2			2	

APPENDIX 2 – Report on the suitability of the MV *Dell Ritchie II* for survey work in Ringarooma Bay

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8 December 2011

REPORT ON THE SUITABILITY OF THE *MV DELL RICHEY II* FOR SURVEY WORK IN RINGAROOMA BAY

A thorough assessment on the suitability of the vessel *MV Dell Richey II* for survey work in Ringarooma Bay was carried out on 6-7 December 2011 at Devonport, Tasmania. The vessel is a 25 m long fishing trawler with a beam of 7.6 m and a draft of 2.6 m. The propulsion system is via a single fixed-pitch propeller. The vessel has accommodation for twelve people in total and three crew members will be required to safely operate the vessel. The vessel owner, master & crew have an intimate knowledge of the conditions in Ringarooma Bay, which is highly advantageous. Based on the master's past experience of weather conditions in the area, it seems like February to May are the best months for survey work.

The survey scope of work will involve the collection of multibeam bathymetry, side-scan sonar, pinger sub-bottom profiling, boomer sub-bottom profiling and magnetic data over at least a three week period in Ringarooma Bay to provide baseline geophysical information on the seafloor tin mineralisation.

Discussions were held with the vessel's owner (Mr Stuart Richey) regarding the proposed survey scope of work, the vessel's capabilities and the fabrication of specialised brackets, booms and A-frame for the deployment of the geophysical systems. Various bracket designs and requirements were discussed together an estimated cost of fabrication & modifications. The following is a list of the items that will require fabrication prior to the survey:

- Multibeam transducer bracket (mounted midships)
- Pinger sub-bottom profiling transducer bracket (mounted forward of midships)
- Boomer catamaran boom system (stern mount)
- Hydrophone array boom system (stern mount)
- GPS antenna brackets
- A frame for side-scan sonar & magnetometer
- Space to mount survey winch
- 2.4 m x 1 m & 1 m x 1 m benches on bridge for survey acquisition instrumentation.

An estimated budget of $4,000 to $5,000 will be sufficient for the fabrication requirements and it seems like the vessel can be converted into an effective survey vessel with the fabrications mentioned above.

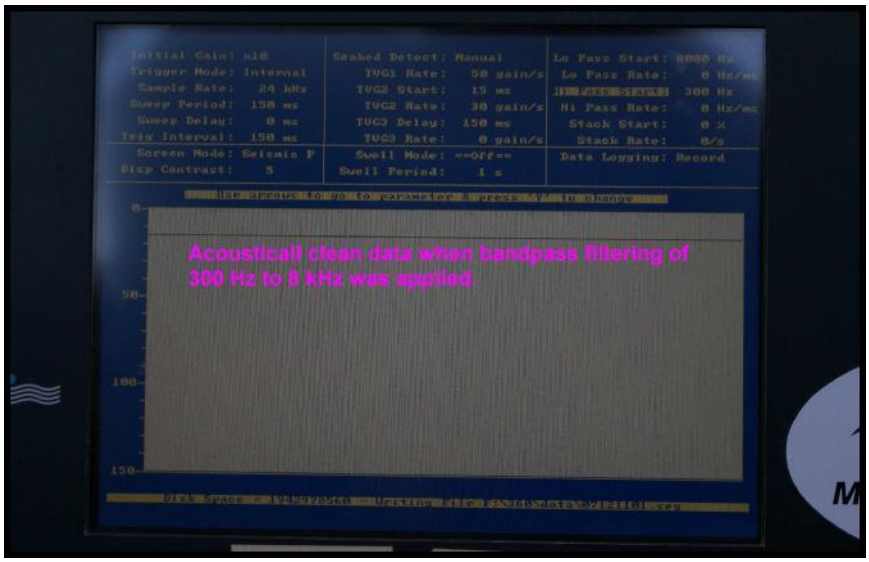
ACOUSTIC NOISE TEST

An acoustic noise test was conducted on the vessel offshore of Devonport. This involved towing a 20-element hydrophone array off the starboard rear quarter of the vessel and extending the active section of the array to 20 m astern of the vessel. This will be the typical position for a boomer sub-bottom profiling hydrophone array to be towed during survey operations . The main prerequisite is that the vessel is acoustically quiet between the frequencies of 300 Hz and 8 kHz, which are the ranges of the sub-bottom profiling instrumentation. The hydrophone acquisition was set to record the entire frequency spectrum but bandpass filtering was applied to the visual screen output.

Hydrophone array (orange cable) being towed astern of the vessel.

Measurements of the acoustic signature of the vessel were made at various speeds and engine RPM ranges between 4-5 knots, as these are typical of survey speeds. **The vessel produced 300-500 kHz noise at idle (700 RPM) at a speed of 4 knots but this cleaned up completely once the engine speed was increased to 800 RPM. At 800 RPM the vessel sails at 5 knots which is satisfactory for survey work.**

Acquisition system screen capture showing raw (unfiltered), noisy data in the middle of the screen flanked by clean bandpass filtered data on either side.



Acquisition system screen capture showing clean data with a bandpass filter of 300 Hz to 8 kHz applied.

SUMMARY

The acoustic characteristics of the vessel are suitable for the envisaged survey work within the engine RPM range to achieve a speed of 5 knots. The power supply on the vessel is more than sufficient for all the instrumentation. The careful configuration of various brackets and facilities onboard will ensure that the vessel is suitable for all the envisaged survey operations. There is sufficient space for MGS's staff, the vessel crew and a client representative onboad the vessel for the duration of the survey. The vessel master & crew seem to be very competent and hard-working and I don't anticipate any problems. **On a final note, I feel that the vessel could also be used for the vibracoring programme with minor modifications to the anchoring system and the placement of winches.**

APPENDIX 3 – Ringarooma Bay Mineral Exploration Environment Plan (see final report for T11MEL for hard copy)

Sustainable Consulting Solutions

Ringarooma Bay Mineral Exploration
ENVIRONMENT PLAN

For
TNT Mines Limited

July 2012

Project No: 3998.001

SCIENTISTS | ENGINEERS | MANAGERS | FACILITATORS

Integrated Management System
QUALITY AS/NZS ISO 9001 | ENVIRONMENT AS/NZS ISO 14001 | OH&S AS/NZS 4801

DOCUMENT ISSUE AUTHORISATION

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1. EXECUTIVE SUMMARY

1.1 Scope of Document

TNT Mines Limited (TNT Mines) is proposing to undertake a program of mineral exploration within Ringarooma Bay in the north-east of Tasmania. The exploration target area is situated within State and Commonwealth waters. Applications for exploration licences were lodged with Mineral Resources Tasmania (MRT), which, under the *Offshore Minerals Act 1994*, is the Designated Authority for the proposed Ringarooma Bay minerals exploration work in Commonwealth waters and the authority for exploration work in State waters, under the *Mineral Resources Development Act, 1995*. At the date of this document, the three State licences and three Commonwealth licences have all been granted. The State licences extend from the low water mark to the boundary of the outer limit of Tasmanian Coastal Waters. Areas excluded from the State licences include:

- Baynes Island, off Petal Point, and
- The marine portion of the Lower Ringarooma Floodplain Ramsar site, which is contained within less than 400m beyond the low water mark.

The exclusion areas from State Licences are shown in Appendix A. There are no known exclusions from the Commonwealth licences.

Table 1: Exploration Licences

Licence Id	Jurisdiction	Size	Held By	Product category
EL17/2011 (granted)	State	69 sq km	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances 5 – Industrial Minerals, Semi/Precious Stone
EL4/2011 (granted)	State	24 sq km	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances 5 – Industrial Minerals, Semi/Precious Stone
EL46/2011 (granted)	State	99 sq km	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances 5 – Industrial Minerals, Semi/Precious Stone
T11MEL (granted)	Commonwealth	23 blocks	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances
T12MEL (granted)	Commonwealth	71 blocks	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances 5 – Industrial Minerals, Semi/Precious Stone
T13MEL (granted)	Commonwealth	21 blocks	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances 5 – Industrial Minerals, Semi/Precious Stone

A standard condition of an exploration licence includes the requirement that a “plan of proposed activities and a program to safeguard the environment” be submitted to the

Designated Authority for assessment and approval prior to proceeding with any activities on the exploration licence.

This Environment Plan (EP) provides the "plan of proposed activities and a program to safeguard the environment", as required by condition of exploration licences issued by MRT as the Designated Authority.

This EP is designed to serve two purposes:

1. as a document to support the works approval process for the activity (operations described in Section 5, and listed specifically in Section 5.3.1); and

2. as a practical Environment Plan to be used by operators in the field.

1.2 Proposed Activity

1.2.1 Rationale

The inland area south of Ringarooma Bay, in the north-east of Tasmania, is a well known alluvial tin province which has produced in excess of 40,000 t of tin since discovery in the 1870's, from mines such as the Briseis, Arba, Pioneer, Endurance and others.

Tin-bearing minerals have also been transported by river over millions of years from the tin-bearing rocks surrounding Ringarooma Bay and upstream of the Ringarooma River. Tin-rich alluvial sediments transported by the Ringarooma River settled within the Pleistocene course of the river which is now partly submerged beneath Ringarooma Bay (refer to Figure 3 and Figure 4). Tin-bearing minerals also occur along buried or submerged strandlines within the bay, parallel to the current coastline.

A number of exploration companies have carried out mineral exploration activities in Ringarooma Bay since 1966. Exploration drilling activities were carried out predominantly between 1966 and 1968 and this sampling formed the basis for the estimation of a JORC Inferred Resource in 2000. The resource is estimated to comprise approximately 194Mm^3 with a concentration of 150-250g/m^3 of tin (with approximately 29,100 – 48,500t of contained tin) (TNT Mines Limited, Pre-IPO Investor Presentation, May 2011). The Indicated Resource is in the order of 16Mm^3 at 227g/m^3 of tin. The Joint Ore Reserves Committee (JORC) – compliant Inferred Resource is estimated as 29,000 to 48,000t of tin (TNT Mines Limited, Pre-IPO Investor Presentation, May 2011). The resource also contains zircon, ilmenite, rutile, and other potential commodity minerals.

One of the main reasons the resources have not already been mined, or have not been defined in more detail, is because of high upfront costs of carrying out the work in a marine environment.

TNT Mines proposes to carry out geophysical and sediment sampling surveys for the purpose of better defining the extent and characteristics of alluvial tin and heavy minerals resources within Ringarooma Bay. The information gained during TNT Mines' exploration will be used to undertake a financial evaluation of potential future mineral extraction.

1.2.2 Proposed Exploration Work

Exploration work proposed by TNT Mines for Years 1 and 2 of the Exploration Licences will comprise:

i. an initial round of gravity coring and grab sampling;

ii. an initial remote sensing / geophysical survey stage; followed by

iii. a sampling stage, including drilling and grab sampling.

The remote sensing work will be undertaken from a vessel on Ringarooma Bay. The vessel will follow pre-determined survey lines, indicated in Figure 5, which will overlap the known resource areas. The survey work will be undertaken within the licences listed in Table 6, and will include the use of:

- Multibeam echosounder;
- Side-scan sonar;
- Boomer;
- Pinger;
- Magnetic gradiometer;
- GPS, tide gauge and barometer.

Gravity coring will occur in the interpreted extension of the defined resource area. Sediment sampling locations will be chosen after the interpretation of the geophysical survey work has been completed. Placement of sampling locations will enable infill of previous historic sampling locations, and will also target those areas identified by the geophysical surveys to most likely contain tin and other economic minerals deposits. The sediment sampling methods proposed are as follows:

- vibracore sampling (100 locations x 6m long x 75-100mm diameter cores);
- grab sampling (100 x 2-5L samples);
- gravity coring (120 x 1 to 1.5m long x 75mm diameter cores) and
- diver sampling (100 x 5L samples).

All subsequent testing, gravity separation, analysis and other determinations will be conducted on shore at suitably licensed laboratory facilities.

Indicative locations of sampling (based on the current inferred extent of the resources) are indicated in Figure 5. These locations will need to be informed by geophysical survey interpretations and may therefore be modified prior to being carried out. Gravity coring and grab sampling is likely to occur around November-December 2012. All other geophysical and sediment sampling work will occur in 2013, with the latter starting around April 2013.

1.3 Existing Environment

1.3.1 Geography and Bathymetry

Ringarooma Bay is located in the north eastern tip of Tasmania. It forms a broad semi-circular bay which faces broadly north towards Bass Strait. It is flanked to the east by Cape Portland and to the west by Waterhouse Point and Waterhouse Island. The bay is fringed

predominantly by white sandy beaches, with several small intervening headlands, such as at Tomahawk on the western side of the bay (refer to Figure 2).

Much of the land area surrounding the bay is managed by agricultural practices, with most coastal plains having been heavily modified by agriculture (grazing and dairy). The landforms consist of sandy floodplains, sand dunes, lagoons and wetlands. The latter occur along a line parallel to the shore. Several reserves and Ramsar Wetlands occur near Ringarooma Bay.

Published bathymetric contours (Hydrographic Chart) of Ringarooma Bay (Figure 18) show that the bay consists of roughly even contours to depths of around 30 metres below mean sea level. Linear depressions occur which represent palaeochannels from the Ringarooma River.

The area around Ringarooma Bay is home to a small population occupied predominantly with farming-related activities (sheep, cattle, dairy, grain).

Tourism is also a significant seasonal input to the region, with between half to two thirds of the private dwellings not being permanently occupied, and having the potential to accommodate holidaying visitors.

1.3.2 Listed Flora and Fauna

In terms of flora and fauna, the EPBC Matters report for the Ringarooma Bay proposed survey area noted the possible occurrence in the area of:

- 1 x threatened ecological community, namely the Lowland Native Grasslands of Tasmania;
- 44 x threatened species;
- 49 x migratory species;
- 83 listed marine species;
- 11 whales and other cetaceans; and
- 7 invasive species.

1.3.3 Reserves and Conservation Areas

In terms of reserves and conservation areas, the EPBC Matters report noted the possible occurrence in the area of the following matters:

- No Commonwealth reserves;
- Relevant to the Commonwealth Marine Area;
- 2 Ramsar Wetlands / wetlands of international significance;
- 8 Nationally Important Wetlands;
- 12 places on the Register of National Estate (RNE) (for Bio-conservation); and
- 10 State reserves, including Baynes Island.

1.3.4 Ramsar Wetlands

Two Ramsar Wetlands occur near Ringarooma Bay (refer to Figure 23):

- Lower Ringarooma Floodplain, situated immediately south of Ringarooma Bay and comprises 3520 hectares; and
- Little Waterhouse Lake, situated 7 kilometres south-west of Waterhouse Point and Ringarooma Bay and comprises 56 hectares.

None of the proposed exploration work is likely to impact directly on these Ramsar Wetlands, as the work will be undertaken at sea, and anchoring will occur offshore.

1.3.5 Geoconservation

The land around Ringarooma Bay is surrounded by the:

- Northeast Tasmania Pleistocene Aeolian System.

This system consists of terrestrial remnants of the largest Pleistocene desert dune complex in Tasmania that formally covered Bass Strait, and includes a range of aeolian landforms such as extensive sand sheets and longitudinal dunes. It is a listed geoconservation area and is shown in Figure 24.

Other listed geoconservation sites around Ringarooma Bay include:

- Waterhouse Dunefield, south and west of Waterhouse Point;
- Waterhouse Island Cuspate Foreland, on the southeastern coast of Waterhouse Island;
- Cape Portland Cretaceous Andesites, Appinites and Lamprophyres, near Petal Point and Fosters Inlet, which are listed as including the best documented Tasmanian example of surficial rocks of Cretaceous age.

None of the proposed exploration work is likely to impact directly on these sites, as the work will be undertaken at sea, and anchoring will occur offshore.

1.3.6 Aboriginal Heritage

From RNE, discussed earlier, the following three sites are listed or registered as Aboriginal places or sites (refer to Figure 25):

- Cape Portland Aboriginal Area (Indicative Aboriginal place);
- Campbells Point Site (Registered Aboriginal site); and
- Waterhouse Point Area (Registered Aboriginal site).

None of the proposed exploration work is likely to impact directly on these sites or places, as the work will be undertaken at sea, and anchoring will occur offshore.

1.3.7 European Heritage

The township of Boobyalla and its cemetery are local historic sites which are relics from the nineteenth century mining activity in the region.

None of the proposed exploration work is likely to impact directly on these sites, as the work will be undertaken at sea, and land-based activities will use existing built up service areas.

1.3.8 Shipwrecks

A search of the Commonwealth Shipwrecks Database for Ringarooma Bay returned five vessels, listed in Table 12. However, the first ship listed, the Howard, was refloated and therefore only four known shipwrecks occur within Ringarooma Bay.

Since all four shipwrecks and their associated artefacts were lost over 75 years ago all of their remains are automatically protected under the Commonwealth *Historic Shipwrecks Act 1976* and the State *Historic Cultural Heritage Act 1995*.

None of these four shipwrecks have been included in a declared “no-entry zone”. These zones may cover an area up to a radius of 800 metres around a wreck site, and may be declared where circumstances place it at particular risk of interference.

Locations of these shipwrecks appear to be mostly near-shore. Given most of the exploration work will occur at more than 500m from shore, they are unlikely to be encountered. However management measures have been provided in the unlikely event that these are found during exploration activities.

1.3.9 Fisheries

The Bridport to Cape Portland area is home to the following popular species:

- rock lobster,
- flathead,
- couta,
- snook,
- striped trumpeter,
- bream,
- Australian salmon,
- Kingfish, and
- snapper.

Many of these species are targeted by recreational fishers. Commercial fishing operators also fish in and around Ringarooma Bay. Exchanges regarding this project with some of the operators which use the area have highlighted that:

- scallops beds grow and are fished periodically from the seabed within Ringarooma Bay;
- gummy shark and other shark species are fished within approximately 500m of the shore of Ringarooma Bay;
- Australian salmon is also fished within the bay.

Exploration activities may cause some disturbance to the habitat of these species. Management measures have been devised to minimise any potential impacts.

1.4 Environmental Risk Assessment

The components of the exploration survey that could result in environmental effects to local residents and users, as well as flora and fauna within Ringarooma Bay, have been

determined through an evaluation of the proposed activity, the surrounding environment and legislative requirements.

Activities with potential to cause significant environmental effects to the amenity and flora and fauna within Ringarooma Bay include:

- Operation of the vessel(s);
- Use of local accommodation and supply outlets;
- Storage, disposal and spills of fuel, oil and waste hydrocarbons;
- Introduction of exotic species;
- Storage, treatment and disposal of liquid wastes;
- Chemicals, detergents or hazardous materials storage and disposal;
- Solid and putrescibles waste storage and disposal;
- Drilling and grab sampling on seafloor;
- Disposal of wastewater and rainwater from vessel;
- Towing of geophysical arrays on long lines through the survey area;
- Anchoring of vessel(s);
- Discharge or 'firing' of the acoustic energy source arrays;
- Accidental loss of materials and equipment overboard;
- Vessel breakdown, capsizing, running aground; and
- Collision of vessel(s) with large marine mammals.

Although the risk presented by each of these is generally considered to be low to very low (refer to Table 19), particularly with appropriate mitigation and management measures in place, each of these activities has the potential to result in detrimental impacts on the physical, biological and socio-economic environment of the area.

1.5 Management Plan

1.5.1 Implementation and Overarching Responsibilities

Table 2 outlines the Implementation Guide for all Avoidance, Mitigation and Management measures outlined in Section 8. The table lists all environmentally relevant activities, as listed in Table 19 and:

- allocates responsibilities for management of each activity;
- lists the relevant procedures to be implemented;
- lists the tools (e.g. report) through which performance will be assessed.

Overarching responsibilities will lie with:

- Mr Mike Woodbourne, TNT Mines' Marine Manager; and
- The Vessel Master.

Additional and delegated responsibilities are detailed in Table 3.

Performance criteria, avoidance, mitigation and management are detailed throughout Section 8 of the EP.

The main assessment tools will include:

- The Ordinary Report to the DA;
- The Waste Log Form;
- Incident report(s) to the DA; and
- Sighting report(s) to the DA (as per Appendix B and use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au).

1.5.2 Roles and Responsibilities

Roles and responsibilities will be allocated to individual proponent representatives and crew members according to Table 3. Overarching responsibility for the implementation of the EP will lie with **Mr Mike Woodbourne, TNT Mines' Marine Manager**. The Vessel Master and survey crew will also have their responsibilities clearly outlined in their **Contracts**, by which they will be bound by mutual agreement.

Table 2: Implementation Guide

Environmentally Significant Activities	Responsible Person(s)	Relevant Procedure or management measures	Measurement / assessment
Physical operation of vessel	Vessel Master & TNT Mines' Marine Manager	Section 8.3 of EP	**Ordinary report** to DA; community complaints
Use of local accommodation and supply outlets	Vessel Master & TNT Mines' Marine Manager	Section 8.3 of EP	**Ordinary report** to DA; community complaints
Fuel, oil and waste oil on board	Vessel Master & TNT Mines' Marine Manager	Section 8.4 and Section 8.10 of EP	**Ordinary report** to DA; **Waste Log Form**; **Incident report** to DA
Refuelling	Vessel Master & TNT Mines' Marine Manager	Section 8.4 and Section 8.10 of EP	**Ordinary report** to DA; **Incident report** to DA
Ballast water and unwanted marine pests	Vessel Master & TNT Mines' Marine Manager	Section 8.5 of EP	**Ordinary report** to DA; **Waste Log Form**
Liquid wastes, such as grey water and sewage	Vessel Master & TNT Mines' Marine Manager	Section 8.4 of EP	**Ordinary report** to DA; **Waste Log Form**
Chemicals, cleaning detergents and hazardous wastes	Vessel Master & TNT Mines' Marine Manager	Section 8.4 and Section 8.10 of EP	**Ordinary report** to DA; **Waste Log Form**; **Incident report** to DA
Solid wastes, such as packaging, domestic wastes, putrescibles, equipment consumables	Vessel Master & TNT Mines' Marine Manager	Section 8.4 of EP	**Ordinary report** to DA; **Waste Log Form**
Vibracore, gravity core, grab samples	Vessel Master & TNT Mines' Marine Manager	Section 8.6 of EP; Section 8.9 of EP	**Ordinary report** to DA; **Incident report** to DA
Disposal of waste water from the deck of the vessel (water from drilling, or rain, etc.)	Vessel Master & TNT Mines' Marine Manager	Section 8.3 of EP	**Ordinary report** to DA
Geophysical survey work – long armoured coaxial cable	Vessel Master & TNT Mines' Marine Manager	Section 8.7 of EP; Section 8.9 of EP	**Ordinary report** to DA; **Incident report** to DA; **Sighting Report** to DA (use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au)
Vessel anchoring	Vessel Master & TNT Mines' Marine Manager	Section 8.3 of EP; Section 8.9 of EP	**Ordinary report** to DA; **Incident report** to DA

Environmentally Significant Activities	Responsible Person(s)	Relevant Procedure or management measures	Measurement / assessment
Geophysical survey work - release of sound from acoustic source	Vessel Master & TNT Mines' Marine Manager	Section 8.7 of EP; Section 8.8 of EP; reference to DEWHA 2008 copied in EP Appendix B	**Ordinary report** to DA; **Incident report** to DA; **Sighting Report** to DA (use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au)
Dropping of objects overboard	Vessel Master & TNT Mines' Marine Manager	Section 8.10 of EP	**Ordinary report** to DA; **Incident report** to DA
Vessel breakdown, capsize, running aground	Vessel Master & TNT Mines' Marine Manager	Section 8.10 of EP	**Ordinary report** to DA; **Incident report** to DA
Vessel bulk	Vessel Master & TNT Mines' Marine Manager	Section 8.3, 8.8, 8.9 of EP	**Ordinary report** to DA; **Incident report** to DA; **Sighting Report** to DA (use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au)

Table 3: Roles and Responsibilities

Role	Responsibilities	Tasks
TNT Mines' Marine Manager	Overarching responsibility to report to the DA and other regulators.	- **Ordinary report** to DA (as per Section 9.2.1); - **Incident report(s)** to DA (as per Section 9.2.2); - Review of EP 12 months after approval by DA.
	Meet the objectives listed in Section 8.2 of the EP.	Ensuring that the proposed avoidance, mitigation and management measures outlined in Table 19, and Sections 8.3 to 8.10 are implemented.
	To implement any additional conditions of approval.	Ensure all additional conditions of approval (of exploration licences) are implemented.
	Verifying that operations are being undertaken according to the EP.	Review any reports provided by the Vessel Master(s) and remain in regular contact to ensure the EP measures and any relevant conditions of approval are being complied with. Keep an **Internal Daily Log** of all exploration and related vessel activities.
	Ensure that the vessel masters(s) and survey crew(s) follow all avoidance, mitigation and management measures relevant to their work.	The **Contract** with vessel master(s) and with survey crew(s) will include their requirement to comply with the relevant requirements of the approved EP, as outlined in Table 19, and Sections 8.3 to 8.10. Any other relevant conditions of approval will also be included in their contractual requirements.
	Ensure the EP and procedures are updated	Update the procedures and EP as required, if significant changes are made, submit to DA for approval
TNT Mines' Marine Manager and Vessel Master	Delegating responsibilities to relevant crew and survey staff as appropriate.	Delegate tasks to crew members or survey staff, provide the information relevant to the tasks and provide any training or induction needed. Maintain a **Training Log**.
Vessel Master	Safe operation of the vessel. Responsible for health, safety and environmental matters on the vessel.	Operate vessel safely with due regard to crew health and to all applicable environmental matters and measures as outlined in Table 19, and Sections 8.3 to 8.10 of EP, and any additional conditions of approval, as detailed by TNT Mines and agreed in contractual terms. Maintain a **Daily Vessel Log**.
Vessel Master	Overarching responsibility to report to TNT Mines management on all environmental matters, and in particular any matters delegated to the vessel master and his crew.	- Implement all tasks allocated; - Delegate to relevant crew; - Provide environmental induction and training as required, complete Training Log maintained by TNT Mines Marine Manager; - Report all environmental matters to TNT Mines' management. - Report any environmental incidents to TNT Mines (Refer to Section 9.2.2).

Role	Responsibilities	Tasks
Vessel Crew and Survey Crew	Implement the responsibilities allocated to them	- Carry out all relevant tasks allocated; - Report on all relevant tasks allocated to the vessel master; - Complete any written reports or logs if required for a particular task; - Remain proactive regarding environmental matters as induction will provide general awareness of the key issued in Ringarooma Bay; - Survey crew to abide by their conditions of **Contract**

1.5.3 Records

The following records will be kept during the exploration works on Ringarooma Bay:

- A **Training Log** of all staff working on the exploration vessel will be kept by TNT Mines' Marine Operations Manager;
- An **Internal Daily Log** of all exploration activities will be kept by TNT Mines' Marine Operations Manager;
- A **Waste Log form** will be kept by the Vessel Master of all wastes disposed to sea or land by the vessel during the exploration activities ;
- The Vessel Master shall keep his **Daily Vessel Log** of vessel activities;
- Copies of all **Incident reports, Sighting reports** or other correspondence during the vessel's exploration activities will be kept by TNT's Marine Operations Manager.

An **Ordinary Report** will be issued on completion of the exploration works at Ringarooma Bay. This report will provide a synopsis of all activities, logs, incidents, sightings and other relevant information.

1.5.4 Routine Reporting

Routine reporting will include the following items.

BEFORE undertaking the survey work:
TNT Mines' Marine Operations Manager will Notify DA, EPA and AMSA (details in Section 9.1.5);

DURING the survey work:

- Internal reporting, including Daily Vessel log and Internal Daily log for the exploration crew (refer to Section 9.1.6);
- Waste logs (refer to Section 9.1.6, Table 19, Section 8.4 and Section 8.5);
- Sightings Reports for whales and seals (use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au);
- Reporting of shipwrecks (refer to Section 8.9.3);

AFTER the survey work:
Ordinary Report (on completion of the marine exploration works) (refer to Section 9.1.4).

1.5.5 Incident Reporting

Incidents will be reported according to the requirements outlined in Table 4 and Section 9.1.5.

Table 4: Incident Reporting Requirements and Timing

Type	Requirement	Timing
Reportable	The operator must notify the DA of any unplanned event identified as having a 'moderate to catastrophic' consequence level during the exploration survey work e.g. breach of quarantine procedure, disturbance to a particular sensitivity associated with the project, etc.	Notify the DA verbally, as soon as practicable, but **within 12 hours; then in writing, within 3 days**
	80L or more of hydrocarbon or hazardous chemical discharged to sea	
	Death or injury to individual(s) from a Listed Species (Refer to Table 11 and Appendix F and Appendix B of the EP) during an activity	
	Unplanned impact caused to a matter of national environmental significance (NES) during an activity (as per the EPBC Act) (Refer to Table 11 of the EP).	
Recordable	Any incident arising from the activity that breaches a performance objective or standard identified in the EP e.g. small spill of hydraulic fluid (<80L), inadequate waste management, loss of equipment to the ocean, etc.	Notify the DA monthly, **on or prior to the 15th day of each month**

1.5.6 Emergency and Incident Response

The emergency and incident response process will follow the steps:

Detection => Response and Communication => Reporting

As soon as an emergency or incident situation is detected during vessel operations, initial response steps will be followed; once the emergency or incident is controlled, corrective actions and reporting will be instigated, as detailed below.

EMERGENCY AND INCIDENT RESPONSE

INITIAL RESPONSE

1. Determine exact location of emergency / incident
2. Alert all vessel and survey crew of emergency / incident
3. Determine whether people or animals have been injured and make safe where possible
4. Determine source of incident and rectify if possible
5. Phone **1 800 641 792 (RCC of AMSA)** if external emergency help is required

WHEN EMERGENCY / INCIDENT IS CONTROLLED, THEN:

6. Stabilise and monitor any affected crew
7. Instigate assistance to injured animals if practicable
8. Commence Emergency Log record of events
9. Instigate clean-up / retrieval of any materials on vessel, sea or shore
10. Provide initial notifications to relevant parties (e.g. DA (refer to incident reporting requirements in Table 22 of EP), Tasmanian EPA, Proponent managers)
11. Complete Incident Report and circulate to all relevant parties
12. Spillages of fuel, oil or other pollutants of an amount greater than 80 litres must be reported to the Designated Authority (DA) and to the State Environment Protection Authority (EPA) within 12 hours of any such spillage occurring (Incident Report)

Maritime Emergency Services Contact details

The Rescue Coordination Centre (RCC) which works under the Australian Maritime Safety Authority (AMSA). The RCC operates a 24 hour Emergency numbers:

1 800 641 792 or +61 2 6230 6811

The RCC may either coordinate the search and rescue or may pass the coordination of the appropriate regional police organisation to conduct the search and rescue operations within their jurisdiction. The RCC can also coordinate medical evacuations and broadcasts maritime safety information.

Designated Authority (DA) Contact details

Mineral Resources Tasmania
Street Address: 30 Gordons Hill Road, Rosny Park, Tasmania
Postal Address: PO Box 56, Rosny Park, Tasmania, Australia 7018
Main Switchboard: (03) 6233 8377
Fax Number: (03) 6233 8338
Email: info@mrt.tas.gov.au
Contact: Carol Bacon

Tasmanian EPA Contact details

To notify the Director EPA of a pollution incident call the Pollution Incidents and Complaints Hotline number (24 hours a day, 7 days a week):

1800 005 171

The notification must include: full name, address and telephone contact details; date, time and duration of the incident; the type of pollutant or a description of the incident, discharge or emission; location of the incident, being as specific as possible; the source and cause of pollution if known; the extent or size of the area where the pollution is visible; anything else that is relevant to the incident; any photographs of the incident if possible, these can be sent at a later time.

Alternatively, if the incident has been resolved contact EPA by lodging the above information by email to **incidentresponse@environment.tas.gov.au**.

Proponent Contact details

Mr Michael Beer
Managing Director & CEO
TNT Mines Limited

Level 2, 34 Colin Street
West Perth WA 6005
Australia

T: (08) 6468 4578
M: 0412 945 818
E: mbeer@tntmines.com.au

2. INTRODUCTION AND SCOPE OF DOCUMENT

2.1 Background

TNT Mines is proposing to undertake a program of mineral exploration within Ringarooma Bay in the north-west of Tasmania. The exploration target area is situated within State and Commonwealth waters. Applications for exploration licences have been lodged with Mineral Resources Tasmania (MRT), which, in respect of Commonwealth waters under the *Offshore Minerals Act 1994*, is the Designated Authority for the proposed Ringarooma Bay minerals exploration work. MRT is also the regulatory authority, under the *Mineral Resources Development Act 1995*, for exploration in Tasmanian State waters.

A standard condition of an exploration licence includes the requirement that a "plan of proposed activities and a program to safeguard the environment" be submitted to the Designated Authority for assessment and approval prior to proceeding with any activities on the exploration licence.

2.2 Purpose and Scope

This Environment Plan (EP) provides a "plan of proposed activities and a program to safeguard the environment", as required by a condition of exploration licences issued by MRT as the Designated Authority.

This EP is designed to serve two purposes:

1. as a document to support the works approval process for the activity; and

2. as a practical Environment Plan to be used by operators in the field.

TNT Mines is aware that only the works outlined in Section 5.3.1 of this EP will be granted approval by the Designated Authority. Any significant alteration or expansion to the exploration program approved through this EP and detailed in Section 5.3 shall require an amended or addendum EP, which will need to be submitted to and approved by the Designated Authority prior to these new works beginning.

Therefore this document seeks approval for the operations described in Section 5, and listed specifically in Section 5.3.1 of this EP.

2.3 Reference Documentation

The intent and structure of this EP is based on the Guidelines for the Preparation and Submission of an Environmental Plan, issued under the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999, and amended 20 December 2005.

Other documentation referenced in the compilation of sections of this EP is listed either:

- in Section 4 – Environmental Legislation and Other Requirements,
- within the text, or
- in Section 11 – References.

3. CORPORATE ENVIRONMENTAL POLICY

TNT Mines' corporate Environmental Policy is provided on the following page. The responsible person who has the authority to oversee the implementation of TNT's Environmental Policy during the offshore exploration work is Mr Mike Woodbourne, TNT Mines' Marine Manager.

TNT MINES LIMITED

ABN 67 107 244 039

ENVIRONMENTAL POLICY

TNT Mines Limited is committed to managing its activities in an environmentally responsible manner. Through effective management practices, TNT Mines aims to ensure activities have a minimum impact on the marine and terrestrial environments.

TNT Mines will:

- Develop, implement and maintain environmental management systems to identify, assess and manage environmental risk at all stages of its operations as a fundamental part of its long-term strategy.
- Communicate with business partners, suppliers, customers, communities and other stakeholders regularly to ensure all interested parties are fully aware of our policy.
- Keep the community informed on a regular basis of the Company's activities and consult with the community in relation to the Company's operations.
- Minimise the environmental impacts of our operations through the efficient use of natural resources and the reduction of input materials and waste.
- Prepare and maintain a plan for the eventual closure of each exploration project or operation which shall include consultation with local communities and the rehabilitation of sites or areas disturbed as set out in the applicable Environmental Management Plan.
- Seek to enhance the environment through the alternative uses of land and the marine environment that are surplus to operational requirements including for example: habitat protection, biodiversity conservation, forestry and agriculture.
- Ensure that its employees and contractors are informed about this policy and made aware of their environmental responsibilities in relation to all stages of the Company's activities and operations.
- Require all contractors to comply with this policy and to have their own environmental management systems appropriate to their specific operational environments.
- Comply with this policy as well as any applicable laws and regulations.
- Monitor, continuously improve and publicly report our environmental performance and provide appropriate resources and training to meet the performance targets identified.

Michael Hannington
Managing Director

1 December 2011

STREET ADDRESS: Level 2, 34 Colin Street, West Perth WA 6005
T: +61 8 6468 4578 **F**: +61 8 9264 7099 **E**: frontdesk@tntmines.com.au

4. ENVIRONMENTAL LEGISLATION AND OTHER REQUIREMENTS

4.1 Environmental Legislation Summary

A summary of international, national and state legislation, agreements, and guidance is provided in Appendix C. The table includes a summary of the instruments and an assessment of their applicability to the proposed exploration works in Ringarooma Bay. Appendix C includes cross-references to sections of the EP, where legislation is noted as being either relevant or specifically applicable to TNT Mines proposed mineral exploration work.

4.2 Principal Applicable Regulatory Instruments

Appendix C has summarised a broad range of relevant international agreements, as well as specific guidelines, policies and regulations. However, the intents of these are principally included, provided for and regulated by the main overarching Commonwealth and State instruments listed below:

- *Environment Protection and Biodiversity Conservation Act* 1999 (Cwth);
- *Offshore Minerals Act* 1994 (Cwth);
- Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cwth);
- *Environment Protection (Sea Dumping) Act* 1981 (Cwth);
- *Historic Shipwrecks Act* 1976 (Cwth));
- *Mineral Resources Development Act* 1995 (Tas);
- *Aboriginal Relics Act* 1975 (Tas);
- *Environmental Management and Pollution Control Act* 1994 (Tas);
- *Historic Cultural Heritage Act* 1995 (Tas);
- *Living Marine Resources Management Act* 1995 (Tas);
- State Coastal Policy 1996 (Tas);
- *Nature Conservation Act* 2002 (Tas); and
- *Threatened Species Protection Act* 1995 (Tas).

5. DESCRIPTION OF THE ACTIVITY

5.1 Location

5.1.1 Regional Context

The proposed exploration area is located across both State and Commonwealth waters at Ringarooma Bay in north-eastern Tasmania. Latitude and Longitude coordinates are provided in Table 5. Ringarooma Bay faces north north-west across Bass Strait. The proposed exploration area is shown in Figure 1.

Clarke Island is located approximately 40km to the north-east and the remainder of the Flinders Island Group is located between 50 – 125km to the north and north-east. The City of Launceston is located approximately 90km south-west of Ringarooma Bay. The nearest town is Gladstone, located approximately 15km south-east of Ringarooma Bay.

Table 5: Estimated Latitude and Longitude coordinates for the proposed exploration area in Ringarooma Bay

	Latitude			Longitude		
location point	**degrees**	**minutes**	**seconds**	**degrees**	**minutes**	**seconds**
1	-40	33'	36.9" S	147°	40'	10.8" E
2	-40	44'	8.7" S	147°	49'	23.4" E
3	-40	44'	17.6" S	147°	54'	55.3" E
4	-40	47'	40.7" S	147°	55'	29.6" E
5	-40	51'	51.2" S	147°	50'	49" E
6	-40	47'	23.2" S	147°	43'	51.4" E
7	-40	33'	30.5" S	147°	37'	32.4" E

5.1.2 Local Context

Ringarooma Bay is an irregular semi-circular bay sited between Waterhouse Point and Cape Portland, the distance between these points is approximately 24 kilometres, and Ringarooma Bay is approximately 12 kilometres wide at its apex, west of Campbell Point. Refer to Figure 2 which illustrates the local context.

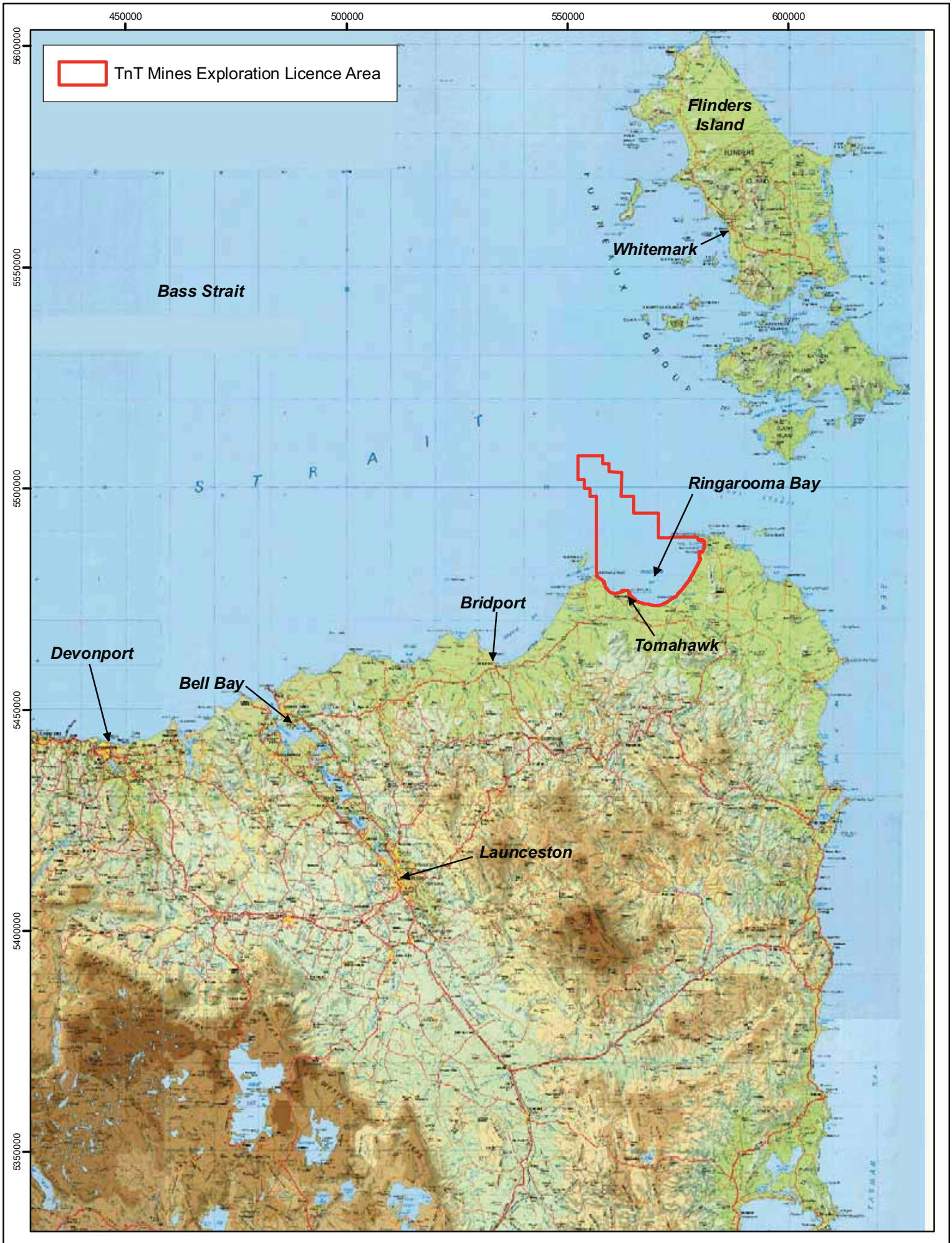
Ringarooma Bay is one of several similar bays in the northwest of Tasmania; its two neighbours are Little Musselroe Bay and Great Musselroe Bay to the east, and Anderson Bay to the west. Waterhouse Island is situated off the western end of Waterhouse Point (Figure 2).

The coast along Ringarooma Bay is fringed by sandy beaches, such as Boobyalla Beach, sand dunes, rocky outcrops and headlands, such as Tomahawk Point and Petal Point, the Ringarooma River inlet (Boobyalla Inlet) at Campbells Point, the Tomahawk River mouth at Tomahawk, wetlands (e.g. near Boobyalla Inlet), and lagoons (e.g. Bowlers Lagoon and Tregaron Lagoons). Several small islands also occur within Ringarooma Bay, Maclean Island, Baynes Island and Tomahawk Island.

The estuary and wetland areas associated with the on-land portion of the Ringarooma River are designated as a Ramsar-listed wetland. The Waterhouse Conservation Area is located at the western end of the bay near Waterhouse Island (refer to Section 6.3.2).

Ringarooma Bay is accessed by land via an unsealed road that connects to Waterhouse Road then to the locality of Boobyalla. The only locality on the shore of Ringarooma Bay is Tomahawk. The settlement of Tomahawk is located near the western end of Ringarooma Bay. Tomahawk has a population of approximately 100 people and is serviced by a shop, service station, a caravan park and a boat ramp.

The nearest port facilities capable of servicing the vessels which will be used for the proposed exploration work are at Bell Bay (approximately 90km west from Waterhouse Point) or Devonport (approximately 150km west from Waterhouse Point). Bridport (approximately 30km west from Waterhouse Point) may provide a base for small supplies and services. Whitemark, on Flinders Island (approximately 80km northwest of Ringarooma Bay) may also be a suitable port facility for some supplies and services.



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Ringarooma Bay EP

Figure 1: Location Map

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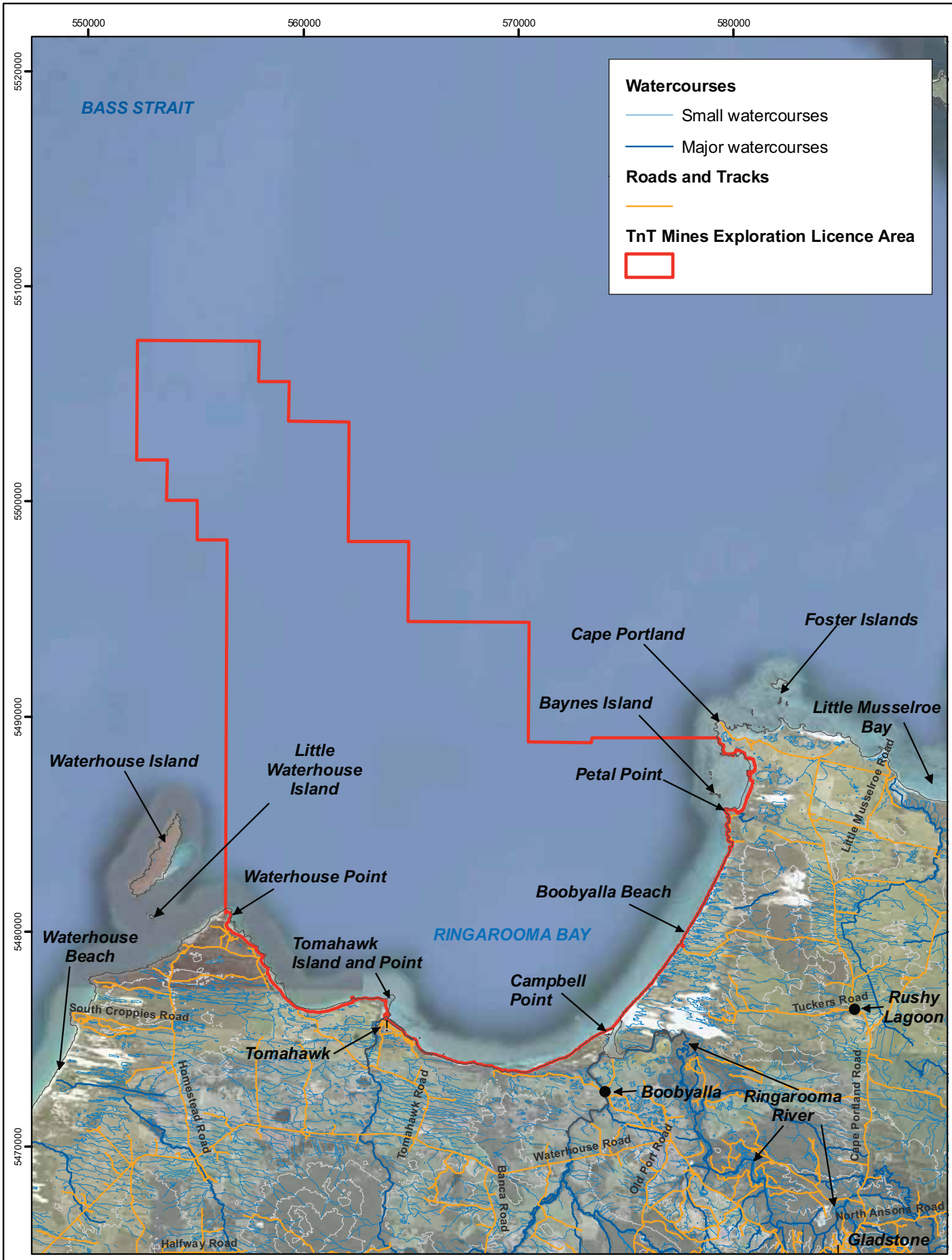
ENVIROPAC

Datum: GDA94 Grid: MGA Zone 55
Date: 2nd February 2012
Prepared by: SEMF Pty Ltd

Project: 3998.001
Client: TnT Mines

0 12,500 25,000 Meters



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Ringarooma Bay EP

Figure 2: Geographical Map of Ringarooma Bay

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ENVIROPAC

Base data by TASMAP. © State of Tasmania
Base image © Google Earth

Datum: GDA94 Grid: MGA Zone 55
Date: 25th July 2012
Prepared by: SEMF Pty Ltd

Project: 3998.001
Client: TnT Mines

0 2,500 5,000 Meters

5.1.3 Current and Historical Usage

Areas of Ringarooma Bay are used periodically for scallop dredging and other commercial and recreational boating and fishing activities. Land around Ringarooma Bay is used largely for forestry and farming purposes.

The north-eastern region of Tasmania has a long history of mining activity with tin being discovered in the area in 1874-75. Within a few years there were thousands of miners, both European and Chinese, working in the general area of the Ringarooma Valley. Mining peaked in the first decade of the 1900s, after the consolidation of several mining operations. Small mining and exploration concerns still operate on land-based leases in the region.

Given the upstream mineral resources along the Ringarooma River, attention has also been given to downstream palaeochannels of the Ringarooma River, which are now submerged beneath Ringarooma Bay. There is also evidence that old strandlines (i.e. ancient beaches), also now submerged beneath the bay, contain lenses of heavy mineral concentrations. Several mineral exploration programs have occurred in the bay. Further information on past exploration is provided in Section 5.2.1.

5.1.4 Tenure

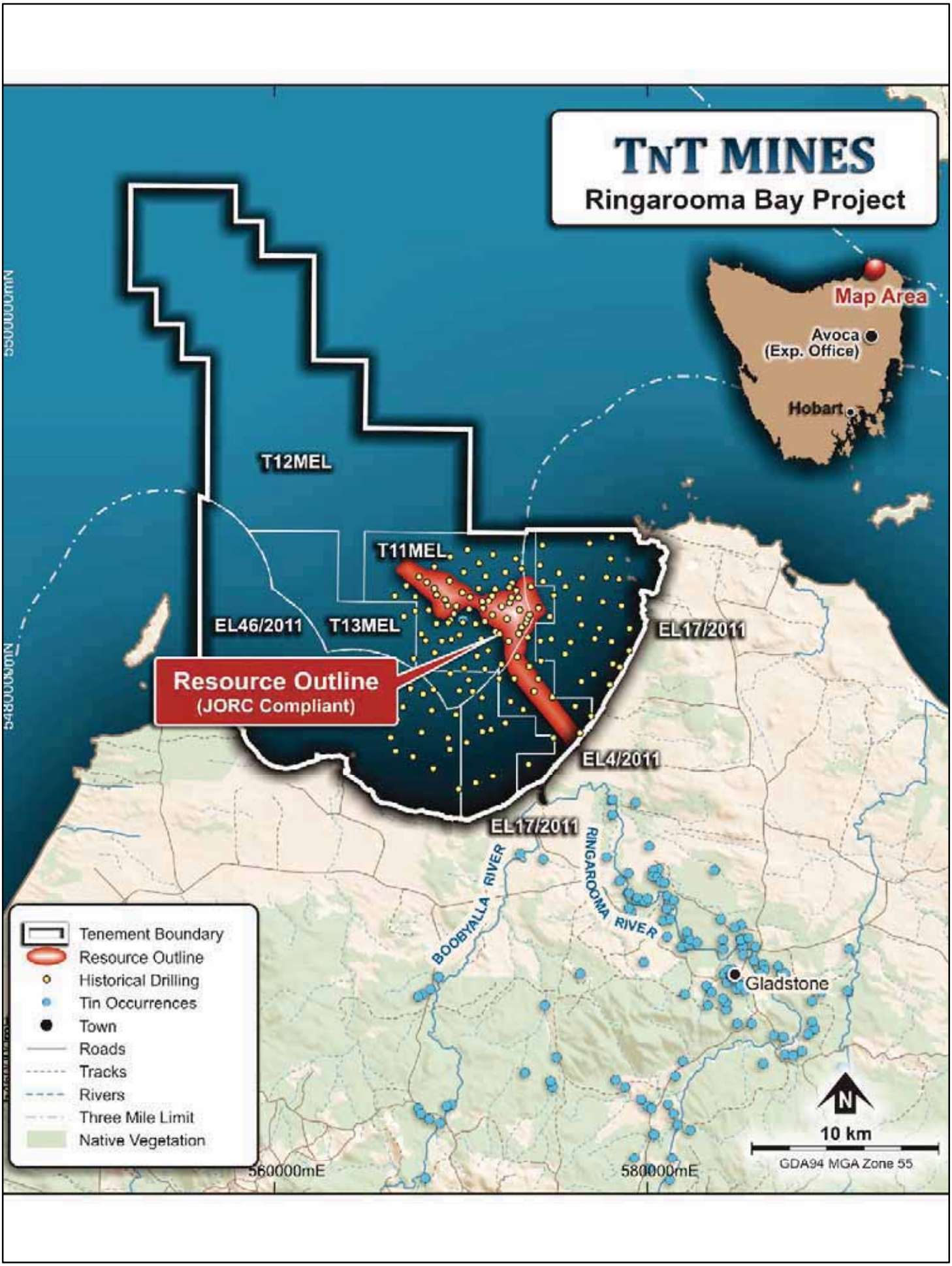
Details of the Exploration Licences applied for TNT Mines' proposed exploration works are described in Table 6 and their locations are shown in Figure 3. The number of blocks or total area included in each licence is provided in Table 6; the total exploration licence area comprising six licences is 47,472 hectares. At the date of this EP, both the three State licences and three Commonwealth licences have been granted. The State licences extend from the low water mark to the boundary of the outer limit of Tasmanian Coastal Waters. Areas excluded from the State licences include:

- Baynes Island, off Petal Point, and
- The marine portion of the Lower Ringarooma Floodplain Ramsar site, which is contained within less than 400m beyond the low water mark.

The exclusion areas from State Licences are shown in Appendix A. There are no known exclusions from the Commonwealth licences.

Table 6: Exploration Licences

Licence Id	Jurisdiction	Size	Held By	Product category
EL17/2011 (granted)	State	69 sq km	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances 5 – Industrial Minerals, Semi/Precious Stone
EL4/2011 (granted)	State	24 sq km	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances 5 – Industrial Minerals, Semi/Precious Stone
EL46/2011 (granted)	State	99 sq km	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances 5 – Industrial Minerals, Semi/Precious Stone
T11MEL (granted)	Commonwealth	23 blocks	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances
T12MEL (granted)	Commonwealth	71 blocks	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances 5 – Industrial Minerals, Semi/Precious Stone
T13MEL (granted)	Commonwealth	21 blocks	TNT Mines Limited	1 – Metallic Minerals, Atomic Substances 5 – Industrial Minerals, Semi/Precious Stone



TnT Mines
Ringarooma Bay EP
Figure 3: Ringarooma Bay Exploration Licences

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ENVIROPAC

Datum: GDA94 Grid: MGA Zone 55
Date: 2nd February 2012

Project: 3998.001
Client: TnT Mines

5.2 Resource Overview and Project Rationale

5.2.1 Past Exploration Work

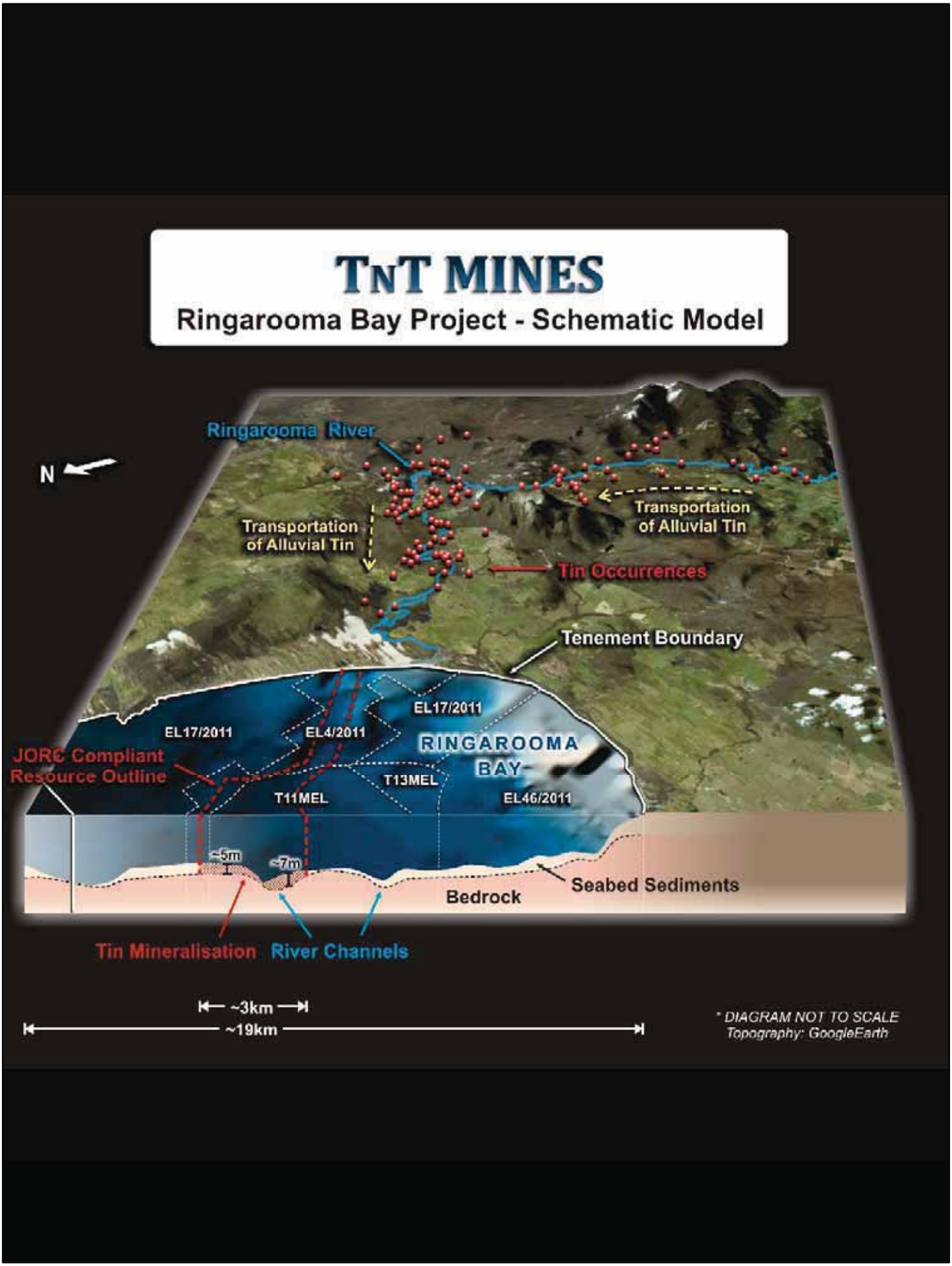
The inland area south of Ringarooma Bay is a well-known alluvial tin province which has produced in excess of 40,000 t of tin since discovery in the 1870's, from mines such as the Briseis, Arba, Pioneer, Endurance and others.

Tin-rich minerals have also been transported by river over millions of years from the tin-bearing rocks surrounding Ringarooma Bay and upstream of the Ringarooma River. Tin-rich alluvial sediments transported by the Ringarooma River settled within the Pleistocene course of the river which is now partly submerged beneath Ringarooma Bay (refer to Figure 3 and Figure 4). Tin-bearing minerals also occur along buried or submerged strandlines within the bay, parallel to the current coastline.

A number of exploration companies have carried out mineral exploration activities in Ringarooma Bay since 1966. A summary of this work is provided in Table 7, below.

Table 7: Summary of Mineral Exploration Work in Ringarooma Bay

Years	Offshore exploration activity
1966	Regional offshore bathymetric, seismic and sampling program (Tasmanian Offshore Exploration Company (TOEC))
1967 - 1968	A consortium led by Ocean Mining A G of Germany, drilled 138 holes in Ringarooma Bay in 1967 and 1968. This utilised a drill ship capable of drilling 30m holes in 60m of water. This work outlined an offshore palaeochannel
1968	Utah together with BHP completed 15 holes to 18 m water depth up to 4.3 km offshore in 1968. Average hole depth was 8.7 m. The best two holes were within 600m of shore
1981 - 1982	During 1981 and 1982, Hellyer Mining and Exploration Pty Ltd, using Hydrosets Ltd, completed a program of bathymetric, seismic and magnetic work and a comprehensive reinterpretation of TOEC data. This confirmed the existence of a main river palaeochannel and revealed other prospective structures.
1983	CRAE (Conzinc Riotinto of Australia Exploration Pty Ltd) took tenure over available areas in 1983. They interpreted the identified resource to range from 21 M cu.m at 175 g/cu.m to 14 M cu.m at 200 g/cu.m depending on the area of influence assigned to the TOEC samples.
1998 - 2000	MHA Pty Ltd reassess the resources from exploration results within Ringarooma Bay.



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Ringarooma Bay EP
Figure 4: Schematic Model of Mineralisation in Ringarooma Bay

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ENVIROPAC

Datum: GDA94 Grid: MGA Zone 55
Date: 2nd February 2012

Project: 3998.001
Client: TnT Mines

5.2.2 Other Minerals

Between 1998 and 2000 Mineral Holdings Australia (MHA, 2001) assessed the resource base of several of the tenements and in particular the major resources contained within the Great Northern Plains (Ringarooma River). As a result of those works Mineral Holdings confirmed, that in addition to the cassiterite, the alluvial deposits also contain a significant assemblage of valuable accessory minerals, specifically:

- zircon,
- rutile,
- chromiferous ilmenite,
- gold,
- pale to mid blue gem sapphire,
- Ta / Nb tantalite locked in cassiterite and possibly as free discrete particles in magnetic fractions of the tin concentrates.

Most of these are likely to be present within the Ringarooma Bay deposits; their presence enhances the potential value of the tin resource. Recent exploration work inland from Ringarooma Bay has confirmed the presence of high quality Ceylon Blue and Star Sapphires associated with the tin bearing alluvial gravel deposits.

In addition, 2 million cubic metres of heavy mineral sands with Ti and Zr credits is inferred close to the shore in Ringarooma Bay (MHA, 2002).

5.2.3 Project Rationale / Justification

As outlined in the two previous sections, there has been a significant body of work done over several decades on potential mineral deposits within Ringarooma Bay. Tin resources are known for the bay. Furthermore, the bay also hosts other minerals of commercial value. One of the main reasons the resources have not already been mined, or have not been defined in more detail, is because of high upfront costs of carrying out the work in a marine environment.

Exploration drilling activities were carried out predominantly between 1966 and 1968 and this sampling formed the basis for the estimation of a JORC Inferred Resource in 2000. The resource is estimated to comprise approximately 194Mm^3 with a concentration of 150-250g/m^3 of tin (with approximately 29,100 – 48,500t of contained tin) (TNT Mines Limited, Pre-IPO Investor Presentation, May 2011). The Indicated Resource is in the order of 16Mm^3 at 227g/m^3 of tin. The Joint Ore Reserves Committee (JORC) – compliant Inferred Resource is estimated as 29,000 to 48,000t of tin (TNT Mines Limited, Pre-IPO Investor Presentation, May 2011). The resource also contains zircon, ilmenite, rutile, and other potential commodity minerals.

The extent and locations of past exploration drilling is shown in Figure 3. JORC-compliant inferred resource outline is shown in red in Figure 3.

Although past exploration results are encouraging, additional information is required on the resource in order to develop the project. In particular, it is necessary to better evaluate the resource from an economic, metallurgical, and mining feasibility perspective.

To this end, TNT Mines proposes to carry out geophysical and sediment sampling surveys for the purpose of better defining the extent and characteristics of alluvial tin and heavy minerals resources within Ringarooma Bay. The information gained during TNT Mines' exploration will be used to undertake a financial evaluation of potential future mineral extraction.

The proposed exploration work for **Years 1 and 2** will include:

- Geophysical remote sensing work, which will assist in delineating the palaeochannels, strandlines, the shallow geology and potential ore-bearing sediments; and
- Additional drilling and sea-floor sampling within the already defined resource area, which will provide infill drilling information to better define the resource and provide bulk samples for gravity separation and concentration test work.

TNT Mines expect that if the interpretation of results from geophysical surveys and sediment sampling confirm the extent and nature of the mineral resources, they will then follow up with further bulk sampling and trial suction dredging works to test the proposed extraction method. Trial suction dredging would not occur until **Years 3 or 4** and TNT Mines propose to address this activity, and request approval for it, via a separate expanded EP, or EP addendum.

5.3 Operational Details

5.3.1 General

Exploration work proposed by TNT Mines for Years 1 and 2 of the Exploration Licences will comprise:

- an initial round of gravity coring and grab sampling;
- an initial remote sensing / geophysical survey stage; followed by
- another sampling stage, including drilling and grab sampling.

The remote sensing work will be undertaken from a vessel on Ringarooma Bay. The vessel will follow pre-determined survey lines, indicated in Figure 5, which will overlap the known resource areas. The survey work will be undertaken within the licences listed in Table 6, and will include the use of:

- Multibeam echosounder;
- Side-scan sonar;
- Boomer;
- Pinger;
- Magnetic gradiometer;
- GPS, tide gauge and barometer.

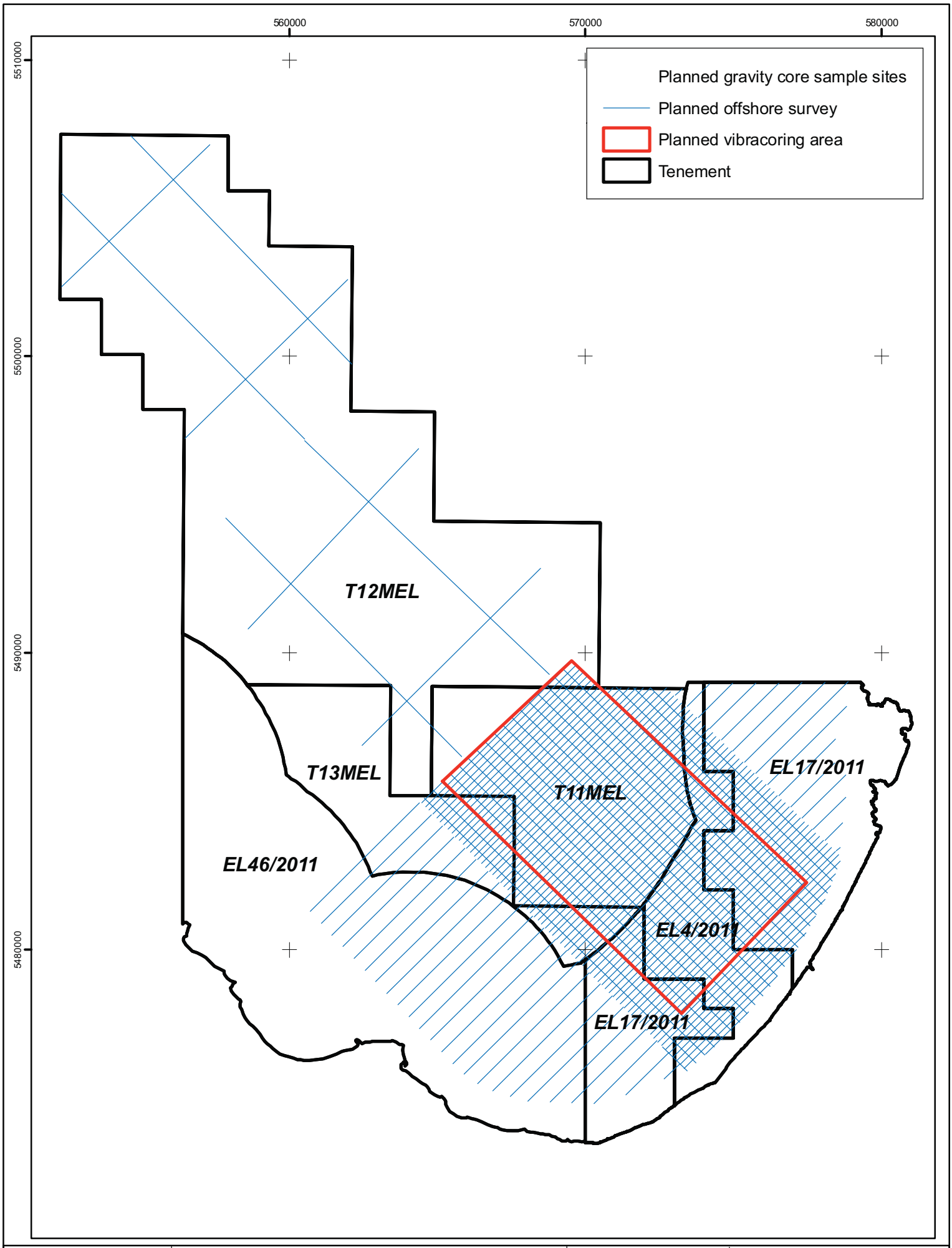
Gravity coring will occur in the interpreted extension of the defined resource area. Sediment sampling locations will be chosen after the interpretation of the geophysical survey work has been completed. Placement of sampling locations will enable infill of previous historic sampling locations, and will also target those areas identified by the geophysical surveys to

most likely contain tin and other economic minerals deposits. The sediment sampling methods proposed are as follows:

- vibracore sampling (100 locations x 6m long x 75-100mm diameter cores);
- grab sampling (100 x 2-5L samples);
- gravity coring (120 x 1 to 1.5m long x 75mm diameter cores) and
- diver sampling (100 x 5L samples).

All subsequent testing, gravity separation, analysis and other determinations will be conducted on shore at suitably licensed laboratory facilities.

Indicative locations of gravity coring sampling and survey lines (based on the current inferred extent of the resources) are indicated in Figure 5. As noted above, vibracoring, grab and diver sampling locations will need to be informed by geophysical survey interpretations and may therefore be modified prior to being carried out.



TnT Mines
Ringarooma Bay EP

Figure 5: Planned Work Program

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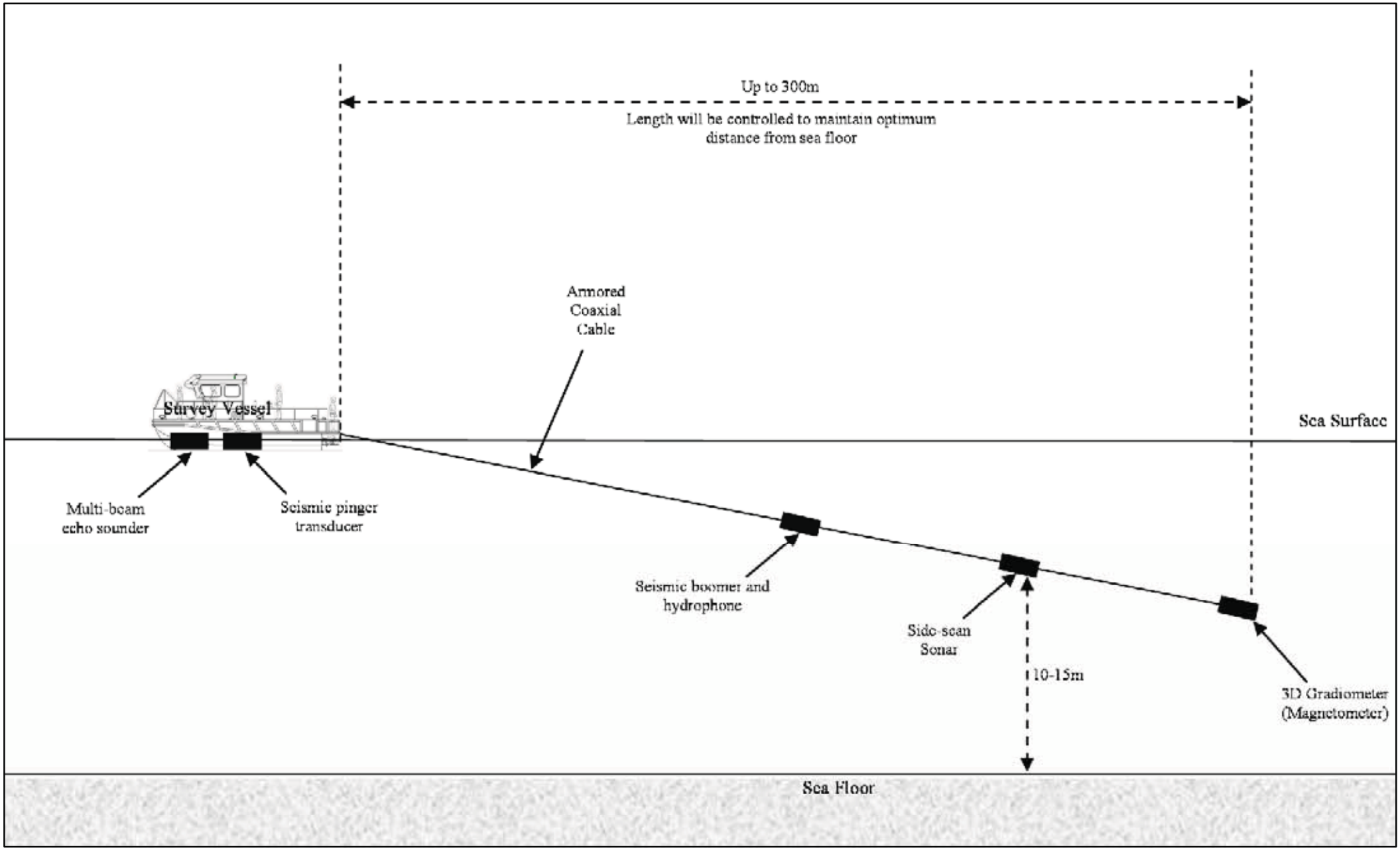
ENVIROPAC

Base data by TASMAP. © State of Tasmania

Datum: GDA94 Grid: MGA Zone 55
Date: 25th July 2012
Prepared by: SEMF Pty Ltd

Project: 3998.001
Client: TnT Mines

0 2,500 5,000 Meters



TnT Mines
Ringarooma Bay EP

Figure 6: Indicative diagram of geophysical survey vessel arrangement

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Datum: GDA94 Grid: MGA Zone 55
Date: 2nd February 2012

Project: 3998.001
Client: TnT Mines

5.3.2 Geophysical Survey

The geophysical survey will be undertaken by experienced marine geophysicists, and hydrographic surveyors using a specially equipped vessel.

The following equipment will be used during the survey:

- A tide gauge will be deployed underwater at Ringarooma Bay to monitor tidal levels to a defined datum for the duration of the survey operations; a calibrated barometer will be deployed to correct the tidal data for barometric pressure variations;
- Real Time geographic positioning system (GPS);
- Multibeam transducer: generates bathymetry data to measure the tidally corrected water depth. This will enable production of a highly accurate digital terrain model of the seafloor and a contour bathymetry map;
- Side-scan sonar: produces an aerial 'photograph' of the seafloor showing rock outcrops, different sediment types and shipwrecks or debris;
- Pinger transducer: generates sub bottom profiling data to approximately 10m depth into the unconsolidated sediments. This will enable a high resolution map of the upper sediments in the bay to be generated;
- Boomer: generates sub bottom profiling data to approximately 40m depth into the unconsolidated sediments. This will enable a map of the deeper geological layers and channels to be generated; and
- Magnetic Gradiometer: This will detect magnetic minerals such as magnetite which can be associated with the cassiterite and can be used as proxy data for ilmenite and cassiterite concentration.

The side-scan sonar towfish will be towed on a 300m armoured cable approximately 10-15m above the seafloor. Both 100kHz and 500kHz data will be recorded.

The sub-bottom profiling survey will involve the collection of boomer and pinger profiling data at a combination of two different frequencies to enable collection of an accurate dataset. The pinger transducer will be hull-mounted whilst the boomer transducer and hydrophone array will be "tethered and towed" at a fixed distance behind the vessel.

The magnetic gradiometer will be towed behind the side-scan sonar using a tandem tow array and the magnetometer elevation off the seafloor will be controlled by adjusting the tow cable length using a sonar winch. Gradiometer positioning will be accomplished using an ultra short baseline (USBL) positioning system.

As well as providing an excellent dataset on bathymetry, seafloor vegetation coverage, sediment distribution, underlying geology and potential mineral resource distribution, the geophysical survey will also enable underwater hazards (e.g. rocky reefs or shipwrecks) to be identified prior to sediment sampling in the areas of interest.

An indicative vessel and equipment array is given in Figure 6.

Approximately 1000 line kilometres of geophysical surveying will be undertaken in consecutive lines parallel to the coast. Lines will begin approximately parallel to and at a distance of at least 500 metres from the coast and will then be spaced between 200 and 500

metres from each other (Figure 5). Between half to over ¾ of each of the licence areas will be covered by the geophysical survey lines.

The survey work will be undertaken during daylight hours at an estimated rate of approximately 40km per day. This will enable the survey to be completed over approximately 19 days. In inclement weather the survey may be delayed and the vessel may seek safe anchorage in Bell Bay or Ringarooma Bay. Weather permitting; the vessel will anchor at night in a safe area in the vicinity of Waterhouse Point or in the lee of Waterhouse Island.

The vessel will resupply with fuel, water, food and other survey requirements, in Bridport, Bell Bay or Whitemark (Flinders Island). Small supplies may also be brought in to the jetty at Tomahawk.

5.3.3 Sampling Methods

Figure 5 shows the proposed gravity core locations, proposed vibracoring area and the proposed geophysical survey lines. The following percent areas are covered with proposed exploration survey and sampling work within each licence:

- EL4/2011: geophysical and vibracoring cover approximately 84% of the licence area;
- EL17/2011: geophysical and vibracoring cover approximately 79% of the licence area;
- EL46/2011: geophysical survey lines cover approximately 40% of the licence area;
- T11MEL: geophysical and vibracoring cover approximately 100% of the licence area, some of it with broad spaced geophysics;
- T12MEL: broad spaced geophysical and gravity coring cover approximately 90% of the licence area;
- T13/MEL: broad spaced and closed space geophysical and gravity- and vibra-coring cover approximately 55% of the licence area.

The details of these methods are provided in the following sub-sections.

5.3.3.1 Vibracore Sampling

Vibracore sampling will be undertaken using a vessel with an open back deck. The vessel will typically be equipped with an A-frame, winches, a crane and a four-point anchoring system. An example of a sampling vessel is given in Figure 7.

The vessel will position itself within 20m of the pre-determined drilling site. If the vessel has dynamic positioning capability, vibracoring will begin as described below. If the vessel has a four-point mooring system, this will be laid out over the site to ensure that the vessel doesn't drift offsite during the coring operation. It can take about two hours to set out the mooring system. Using this method it is estimated that 3 to 4 vibracores could be collected each day depending on the ground conditions and distance between sites.

Once the vessel is dynamically positioned or suitably anchored, the vibracoring unit is lowered into the ocean. The coring system comprises a 6.5m aluminium tripod fitted with a steel core barrel attached to a vibrating head. The hammer and core barrel rotate freely within the frame allowing the core barrel to penetrate difficult substrates. The vibrating hammer (vibrohammer) operates at a variable frequency from 0 to 6000Hz enabling frequency to be matched with sediment types. A 75 to 100mm sediment core is extracted. Vibracore samples will be lifted intact with the barrel of the sampler to the deck of the vessel.

The cores will then be stored upright to facilitate the drainage of water from the sediments prior to being extracted from the barrels and placed in core trays. An example of a deployed vibracoring unit is given in Figure 8.

No drilling fluids are used in the process of vibracoring. No drill cuttings or sediment discharge occurs during vibracoring; Figure 9 provides an excerpt of a video taken from the operation of a vibracorer, showing that no sediment is discharged during the vibracoring process (a full video of the operation of a vibracorer is provided in digital format on the CD accompanying this EP).

The resulting drillhole is expected to slowly collapse onto itself as vibracoring will only penetrate through unconsolidated sediments. The unconsolidated sediment profile is expected to rapidly settle into the drillhole upon retraction of the vibracorer head and barrel. A minimal amount of turbidity will be generated immediately at the collar of the drillhole by the displacement of water from within the drillhole during infilling by surrounding sediments.

Figure 7: Example of a vessel equipped for vibracoring

Figure 8: Vibracorer being deployed

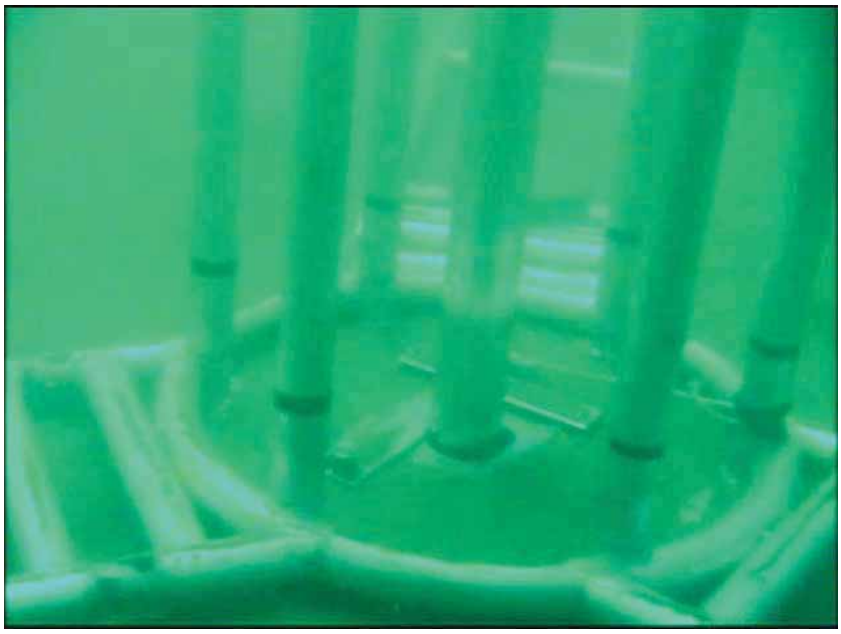


Figure 9: Underwater picture of vibracorer in operation
***Source**: vibracoring video by Marine GeoSolutions*

The core trays will be stored on the vessel until demobilisation in port. The vibracorer will penetrate up to 6m and has a maximum diameter of 10 cm (=0.0078 m^2). Approximately 165 x 6 metre long samples will be taken. Sampling will be undertaken no closer than 500m from the shore. Where drilling penetration encounters refusal shallower than 4 metres depth, then an alternative nearby location will be drilled as a replacement drill hole.

At a rate of 3 to 4 vibracore samples per day. Sampling could take between 25 and 34 days. In inclement weather the survey may be delayed and the vessel may seek safe anchorage in Bell Bay or Ringarooma Bay. Weather permitting; the vessel will anchor at night in a safe area in the vicinity of Waterhouse Point or in the lee of Waterhouse Island.

The vessel will be resupplied with fuel, water, food and other survey requirements, in Bridport, Bell Bay or Whitemark (Flinders Island). Small supplies may also be brought in to the jetty at Tomahawk (refer to
Figure 2).

Total surface disturbance area from vibracoring will be approximately:

- Drillhole areas: 165 x 0.0078 m^2 = 1.29 m^2
- Tripod areas: 3m x 0.5m x 3 = 4.5 m^2 x 165 locations = 742.5 m^2
- Anchor areas (if no dynamic positioning vessel is used): 0.5 m^2 x 2 x 165 = 165 m^2

Total worst case disturbance area for 165 vibracore holes, with a vessel requiring anchoring at each location would be of the order of 910 m^2.

Vibracoring will occur predominantly within EL4/2011, EL17/2011 and T11MEL, with a few samples being in T13MEL, T12MEL and EL46/2011. The vibracore sampling grid will cover approximately 50% of EL4/2011, approximately 1/8th of EL17/2011, approximately ¾ of T11MEL, approximately 10% of T13MEL and a very small proportion of T12MEL and EL46/2011.

5.3.3.2 Grab Sampling

Grab samples will be collected using either a Van Veen or Shipek grab. The Shipek grab collects a 3.0L sample and the Van Veen collects a 20L sample in two bucket halves deployed from the boat by line and hauled back on board. The samples will be bagged on the vessel and will be taken ashore at vessel demobilisation. Approximately 220 samples will be taken.

Grab sampling will be undertaken at similar locations used for vibracoring and as a tool for assessing the geology and sediment composition across the project area. Sampling would be undertaken a minimum of 500m from the shore.

The aim of these samples will be to better quantify and characterise the near surface resource concentrations within delineated target economic resource areas and to map the sea floor.

A Van Veen grab image is shown in Figure 10 and a Shipek grab being deployed from a vessel is shown in Figure 11.

Figure 10: Image of a Shipek Grab sampling bucket

Figure 11: Image of a Shipek Grab being deployed from a vessel

5.3.3.3 Gravity Coring

Cores will be collected with the aid of a gravity corer. The corer samples are designed to test for the presence of tin further out into Bass Strait along the palaeo-channel of the Ringarooma River. A total of around 120 core samples will be taken along six lines, two kilometres apart, with samples taken approximately 400m apart (refer to Figure 5). Another 100 gravity core samples will be taken across other parts of the project area, yet to be located exactly. The gravity corer equipment will be run off the same vessel as the geophysical survey work. Examples of gravity coring work are provided in Figure 12, Figure 13 and Figure 14.

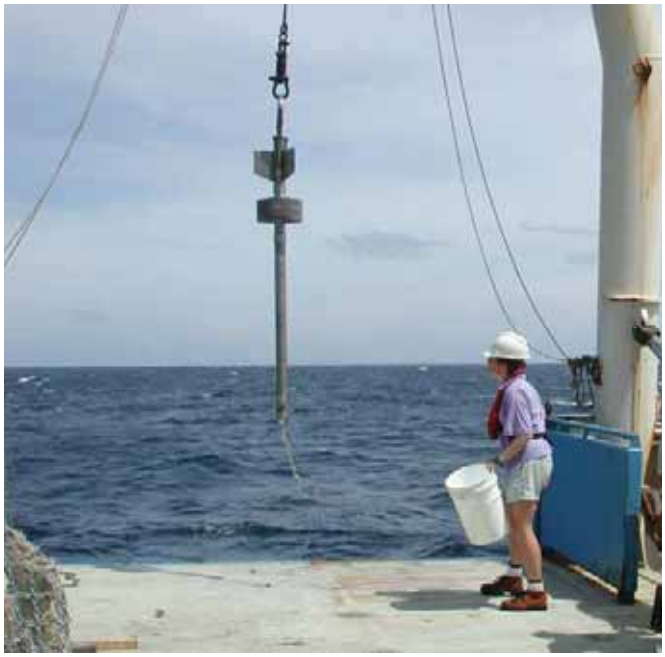


Figure 12: Gravity corer retrieval

Figure 13: Gravity corer disassembly for core removal

Figure 14: Gravity corer sample

5.3.3.4 Diver Sampling

Diver samples will be collected with a lower amount of disturbance in comparison to the grab sample and with more geological control over the sample medium. A 5L bucket would be filled with a scoop, capped and hauled to the surface. Approximately 100 samples will be taken.

Diver sampling may be undertaken using the same vessel used for gravity coring.

Sampling would be undertaken a minimum of 500m from the shore.

The aim of these samples will be to characterise the near surface geology and mineralogy of target economic resource units and to collect mineralised material for metallurgical studies.

5.3.3.5 Sample Handling

Vibracorer Core Samples

After completion of the survey, the cores will be discharged and transported to a suitable existing storage facility at TNT Mines' Avoca shed. Cores will be split (using a plasma cutter), sampled and photographed in high resolution. The unsampled half of the core will be stored in plastic core boxes, with a lid and labelled. The core boxes will remain in the Avoca shed, for reference during the project. The sampled half of the cores will be sent off to a laboratory for testing. The cores will be analysed to determine their sedimentology, grain size statistics, organic carbon content, carbonate content, mud content and mineralogy. Detailed core logs indicating sediment types, grainsize statistics, calcium carbonate contents, organic carbon contents, gravel contents, mud contents and geochemical analyses will be produced. Core samples will also undergo testing via physical separation with test gigs which will allow for heavy media separation and estimation of tin, zircon, titanium and other accessory mineral and metals concentrations.

Grab Samples
Samples will be allowed to drain off seawater prior to being bagged. All bagged samples will be stored on the vessel until its final return to port. Bagged samples will be sent to a laboratory for testing. The grab samples will undergo testing via physical separation with test gigs which will allow for heavy media separation and estimation of tin, zircon, ilmenite, rutile and other accessory mineral and metals concentrations.

Gravity Corer Cores
Cores retrieved from the gravity coring equipment will be handled and processed similarly to the vibracore samples described above.

Diver Bulk Samples
Diver bulk samples will be handled and tested similarly to the grab samples.

Drainage Water
Seawater draining out of core barrels, grab or diver samples on the deck of the vessel will be channelled to a sediment collection pit which will allow fines to settle prior to discharging the decanted seawater back to the sea. Sediment generation from the grab and diver bulk samples is expected to be minimal as the sampling locations will target the coarse fractions of the seabed and are therefore unlikely to shed much material during seawater drainage.

It is estimated that a sediment collection pit which could process up to 50L of fine sediment laden seawater may be required. This is based on the maximum daily coincident sampling case of:

- 4 core barrels / day x 3 L drainage per barrel +
- 10 grab samples / day x 5 L drainage per grab +
- 4 diver samples / day x 2 L drainage per diver sample =
- which total a maximum of **70 L** of potentially sediment-laden seawater per day.

5.3.4 Project Schedule

An initial round of gravity coring and diver sampling is expected to be carried out around November-December 2012. The geophysical survey is proposed to commence in February 2013 subject to the necessary approvals. The geophysical survey phase will take approximately one month. Following completion of the geophysical survey, further sediment sampling will commence. An indicative project schedule for Years 1 and 2 is provided in Table 8.

It is anticipated that if the assessment of results from sediment sampling in Year 2 confirms the presence of an economic resource, TNT Mines would carry out trial dredging activities and bulk sampling in Years 3 and 4. Trial dredging or bulk sampling is not discussed further in this EP; TNT Mines intends to lodge an amended EP towards the end of Year 2, to address all aspects of trial dredging activities.

All operational work on the vessels will be undertaken during daylight hours only. Vessels will anchor during night hours in a sheltered area of Ringarooma Bay or in the lee of Waterhouse Island. Only low-impact lighting required for indoor vessel and minimal on-deck functions will be used.

Table 8: Indicative Project Schedule, Years 1 and 2

Activity	Month	EL Year
Geophysical survey logistics	Oct – Dec 2011	1
Develop EP and obtain approval (Years 1 & 2 activities)	Aug 2011 – July 2012	
Sampling strategy and logistics	Feb – Dec 2012	
Gravity coring and diver sampling program (Part 1)	Nov – Dec 2012	
Assess Part 1 sampling results	Dec – Jan 2012	
Geophysical survey	Feb - Mar 2013	2
Geophysical data analyses	Mar – Apr 2013	
Vibracore, grab and diver sampling (Part 2)	Apr – Jun 2013	
Assess all sampling results – correlate with survey findings	May – Jul 2013	
Scope trial dredging and bulk sampling activities, develop EP (Years 3 & 4 activities) and obtain approval	May – Sep 2013	

5.3.5 Workforce

The estimated workforce numbers required for each of the stages of the exploration work are summarised in Table 9. Estimated totals of contracted workforce used to set up the exploration work, pilot the vessels and carry out the surveys or sampling are totalled under the 'Contractors' column.

During the actual geophysical surveys and sediment sampling work, the workforce will be accommodated on the vessels for the duration of the surveys which are estimated at around 2 weeks for the gravity coring, in Year 1; 3 weeks for the geophysical survey stage in Year 2, and around 4 weeks for the sediment sampling stage in Year 2.

Transit accommodation for the workforce prior to and after the surveys and sampling is expected to be taken up at tourist accommodation in George Town, near the port of Bell Bay or at Devonport if this latter port is used.

Table 9: Estimated workforce required for each activity (Years 1 & 2)

Activity	TNT Mines	Contractors	Total workforce on vessels
Geophysical survey logistics	2	2	-
Develop EP and obtain approval (Years 1 & 2 activities)	1	2	-
Geophysical survey	1	6	6
Geophysical data analyses	2	2	-
Sampling logistics	2	2	-
Vibracore, grab and diver sampling	1	3 - 6	3 - 6
Assess, correlate and interpret sampling results	2	0	-
Scope trial dredging and bulk sampling activities, develop EP (Years 3 & 4 activities) and obtain approval	2	4	-

5.3.6 Vessel and Equipment Requirements

A contractor has not yet been appointed to carry out the geophysical or sampling work. TNT Mines have obtained several quotations for the work. TNT Mines will appoint contractors based on prior experience and technical ability, as well as good health, safety and environmental compliance track records. Typical vessel requirements are outlined below. At least two different types of vessels will be required, a towing vessel for the geophysical survey work, and a lifting vessel for the sediment sampling / vibracoring work.

Geophysical Survey Vessel
The type of vessel required for the geophysical survey is expected to have the following characteristics:

- approximately 17 – 20 metres long;
- approximately 1.5 – 1.7 metres draft;
- room and facilities to accommodate (feed and sleep) between 6 – 10 people;
- room to affix and store all geophysical equipment (as listed below).

The survey is expected to require up to 6 people on the vessel; rooms would also be used to house data acquisition hardware and act as offices.

An example of the type of vessel is shown in Figure 15, below.

Figure 15: Example Geophysical Survey Vessel (*MV Dell Richey II*)
Source: Marine GeoSolutions, December 2011

The following equipment technical specifications are likely to be used during the remote sensing survey:

- C-Nav RTG GPS;
- Reson Seabat 7101ER multibeam echosounder;
- Applanix POSMV 320 inertial navigation system;
- Sound velocity profiler;

- Klein 3000 digital side-scan sonar;
- CSW-7 side-scan sonar winch;
- 300 J Design Projects/Applied Acoustics 300 J boomer system (spare hydrophone);
- 4 kHz GeoAcoustics pinger system;
- SeaQuest 3D gradiometer;
- Easy Track USBL positioning system; and
- Full digital acquisition system (HyPack, Klein and CodaOctopus).

Examples of these pieces of equipment are provided in Appendix D.

Sediment Sampling Vessel – Vibracoring capability
The type of vessel required for vibracoring is expected to have the following characteristics. Other sediment sampling is expected to be carried out concurrently via the same vessel.

- Approximately 30m in length;
- With an open back deck;
- Equipped with a 7m tall A-frame;
- Winches;
- Three tonne crane;
- The vessel needs to have dynamic positioning ability or alternatively a four-point anchoring system;
- Room and facilities to accommodate (feed and sleep) between 6 – 10 people; and
- Room to install and store all vibracoring and sediment sampling equipment and samples (as listed below).

An example of a sampling vessel is given in Figure 7.

The following equipment technical specifications are likely to be used during the vibracoring work:

- Real-time Gypsy GPS C-Nav 2050 for positioning;
- Navigation software;
- 6.5m tall aluminium tripod with retractable legs;
- 6m long stainless steel core barrels of 75 – 100mm internal diameter;
- Variable frequency (0 to 6000 Hz) vibrating head contained within the rigid 6.5 m aluminium tripod with a spare head and cables;
- An underwater video camera will be used to assess the rate and depth of penetration;
- A control panel is used to control rotation direction and frequency.

An example of a vibracoring unit is given in Figure 8.

5.4 Infrastructure Requirements

5.4.1 Energy

The vessels used for the geophysical surveys and sediment sampling will be initially supplied at the outfitting port of Devonport. Resupply of fuel will be undertaken at licensed marine fuel distribution outlets, such as at Devonport, Bridport, Bell Bay or possibly Whitemark on Flinders Island.

The vessels will also be equipped with generators suitable for operation of geophysical survey and sampling equipment. No additional energy requirements are anticipated.

Each vessel will carry its own normal fuel capacity (diesel) within its inbuilt fuel storage compartments. Maximum carrying capacity or fuel volumes will not be known until actual vessels are formally commissioned. The preferred contractor's vessel will have a capacity of 30,000 litres.

5.4.2 Water Supply

Potable water will be required for use by contractors aboard the survey and sampling vessels. Potable water will be sourced from suitable supplies at Devonport, Bridport, Bell Bay or Whitemark, and replenished as required during refuelling and resupply.

5.4.3 Grey Water

Grey water will be generated on the vessels by toilet sinks, kitchen cooking and washing, workers showers. Grey water will be contained and treated on the vessel prior to discharge to sea.

5.4.4 Sewage

All sewage will be discharged during resupply / refuelling of the vessels. Sewage will be stored in specifically designed holding tanks, which will be pumped out / discharged at suitable points (e.g. Devonport, Bridport, Bell Bay or Whitemark) for treatment at the nearest licensed waste water treatment plant.

If the vessel used is equipped with sewage treatment facilities, treated effluent may be discharged at sea according to the following criteria, with any resulting undisposed sludge being disposed at dedicated port discharge points (as above).

- Procedures for treatment and disposal of sewage will be in place. The sewage treatment system will include comminution, maceration and disinfection.
- If sewage needs to be discharged from the vessel, it will not be discharged within 3 nautical miles of the coastline unless the vessel has a certified approved sewage treatment plant in place under Regulation 8 (1) (b) of MARPOL 73/78 Annex IV.
- If the vessel needs to discharge sewage between 3 and 12 nautical miles of coast, the sewage will, as a minimum, be comminuted, macerated and disinfected.

5.4.5 Survey and sampling consumables

Sufficient consumables will be loaded onto the vessels at Bell Bay during the initial outfitting for the work. Consumables would include items such as:

- spares for the remote sensing equipment;
- core trays for vibracore samples; and
- bags for gravity corer, sediment grab and bulk samples.

5.4.6 Workers consumables

Sufficient non-perishable consumables will be loaded onto the vessels at Bell Bay during the initial outfitting to last the duration of the work. Perishable consumables will be stocked initially from Bell Bay, and then restocked at refuelling stops, at Bridport, Bell Bay or Whitemark. Workers consumables may include:

- food;
- toiletries; and
- other day-to-day necessities.

5.5 Waste Management

Waste materials likely to be generated on board the vessels include:

- grey water,
- putrescibles,
- packaging and domestic wastes,
- sewage,
- minor amounts of sediment laden seawater from samples retrieved and stored on the vessels, and
- minor amounts of chemical and oils from day-to-day servicing of equipment.

No other wastes are anticipated. Most wastes will be stored in suitable containers on the vessels and will be brought to shore and discharged to suitable facilities or picked up by waste management contractors.

The main wastes that are expected to be discharged to sea after suitable treatment are:

- treated grey water;
- minor amounts of seawater from sample drainage;
- treated sewage (if the vessel is equipped with a treatment facility, otherwise sewage will be disposed at port sewage pumping facilities).

6. DESCRIPTION OF THE ENVIRONMENT

6.1 Physical Environment

6.1.1 Geography

Ringarooma Bay is located in the north eastern tip of Tasmania. It forms a broad semi-circular bay which faces broadly north towards Bass Strait. It is flanked to the east by Cape Portland, and to the west by Waterhouse Point and Waterhouse Island. The bay is fringed predominantly by white sandy beaches, with several small intervening headlands, such as at Tomahawk on the western side of the bay (refer to
Figure 2).

Much of the land area beyond the bay is managed by agricultural practices, with most coastal plains having been heavily modified by agriculture (grazing and dairy). It consists of sandy floodplains, sand dunes, lagoons and wetlands. The latter occur along a line parallel to the shore. The Ringarooma River meanders to its estuary, which has been influenced by wave action and sand migration.

Several reserves and Ramsar Wetlands occur near Ringarooma Bay; these are discussed in Section 6.3.2.

Public access routes on land to the bay are minimal due to the large private landholding over the area and the lack of infrastructure requiring servicing. The best road to the bay is to the locality of Tomahawk. Other unsealed minor roads access the historic town of Boobyalla, and the camp grounds near Waterhouse Point and Cape Portland on the northern end of Boobyalla Beach.

6.1.2 Geology, Seabed Composition, Minerals

Regional Geology
The primary tin is hosted in Silurian – Devonian shales and quartzites known as the Mathinna Beds (MHA, 2000). These are intruded by Late Devonian granites with accompanying quartz – cassiterite veins and greisens. A Jurassic dolerite, the Ringarooma Tier, outcrops in the east of the district and in weathered clay form, occurs widely as bottom in mining areas. Early Tertiary down faulting formed a coastal sedimentary basin bounded by the granites and the dolerite inland and open to the coast and the west. In the Tertiary, valleys and river channels were cut into the basement with the formation of stanniferous deep leads. This was followed in the later Tertiary by land subsidence and marine transgression and the burial of the deep leads by lake, estuary and finally marine sediments. Basalts flowed during the peak of the subsistence period. In Latest Tertiary – early Quaternary time the land re-emerged with stripping and reworking of the previously buried sediments, derivation of new tin concentrations and development of the present course of the Ringarooma River.

Devonian granites dominate elevated areas of the region forming rugged hills and ranges. These are overlain by diverse soils. Extensive lowland plains, coastal deposits and dunes typically consist of Quaternary and Tertiary materials overlain by sandy soils (Australian Natural Resource Atlas – Biodiversity Assessment – Flinders:
http://www.anra.gov.au/topics/vegetation/assessment/tas/ibra-flinders.html).

Local Geology

The geology around Ringarooma Bay consists broadly of the following units (1:250,000 geological mapping); these are listed in chronological order:

- Ordovician Mathinna Group micaceous greywacke turbidite sequences;
- Devonian adamellite granite;
- Permian glaciomarine sequences of mudstone, pebbly mudstone and sandstone, minor limestone and Tasmanite oil shale;
- Jurassic dolerite with locally developed granophyre;
- Tertiary basalt and associated pyroclastic rocks; and
- Quaternary coastal sand, mud and gravel of lacustrine and littoral origin.

1:25,000 MRT geological units for the area are shown in Figure 16.

There are only minor occurrences of the Ordovician greywacke and the Permian glaciomarine sequences in the area. The Tertiary basalt and associated pyroclastic rocks have only been mapped on the eastern portion of Cape Portland. The Devonian adamellite-granite forms a significant part of Waterhouse Point and the bedrock in other inland areas around the south of Ringarooma Bay. The Jurassic Dolerite forms significant parts of the bedrock in eastern areas of Ringarooma Bay and outcrops on the western side of Cape Portland and other headlands and islands west of Cape Portland, including Petal Point. The Tomahawk area and headland also consists of Jurassic Dolerite.

A veneer of Quaternary sand, mud and gravel sediments has covered much of the older rocks, with deposition occurring through lacustrine, fluvial, littoral wave and wind action. Flood plain deposits occur along the drainage lines and in particular the Ringarooma River flood plain. Extensive dune fields have developed (refer to Section 6.4 – Geoconservation). Dune crests are typically oriented along a roughly east-west axis, with the exception of the coastal dune line perpendicular to the shore along the bay.

Seabed Composition

The near-shore bathymetry of Ringarooma Bay has been mapped as part of the Seamap Tasmania – Mapping the Gaps Project (Lucieer *et al.* 2009). The project included mapping the seabed composition, within 1.5km of the shore, including distribution of cobble, reef, sand and seagrass.

The report (Lucieer *et al.* 2009) notes that their acoustic mapping method made it difficult to distinguish between cobble and seagrass, particularly due to the intermixed nature of these habitats at the 1:25,000 mapping scale used, as such, it was ‘impossible’ to cartographically represent these habitats using linear boundaries.

Based on the 1:25,000 maps provided in the report (copies are provided in Appendix E), the following can be noted:

- reef and cobble dominate the 1.5km zone at either end of Ringarooma Bay, i.e. from Foster Islands and Cape Portland to Baynes Island, at the eastern end, and the area west, northwest, and northeast of Waterhouse Island, at the western end, with sand occurring only in restricted patches;
- a small reef area occurs around Petal Point;

- the eastern half of the Bay between Petal Point and Boobyalla Inlet is dominated almost exclusively by sand in the 1.5km zone from the coast; this also included the Ringarooma River lower floodplain with the RAMSAR site;
- from Boobyalla Inlet, west to Waterhouse Point, the seafloor is dominated by sand and seagrass, with some cobble areas and a range of small isolated reefs, including west of Murdoch's Beach (west of the Boobyalla Inlet), and at Tomahawk Point.

The sand has been characterised as 'fine sand' (Lucieer *et al.* 2009). The reefs in the area were reported as predominantly 'low profile'.

Mineral Deposits
The following offshore minerals deposits summary is based on MHA's 2000 review.

TIN

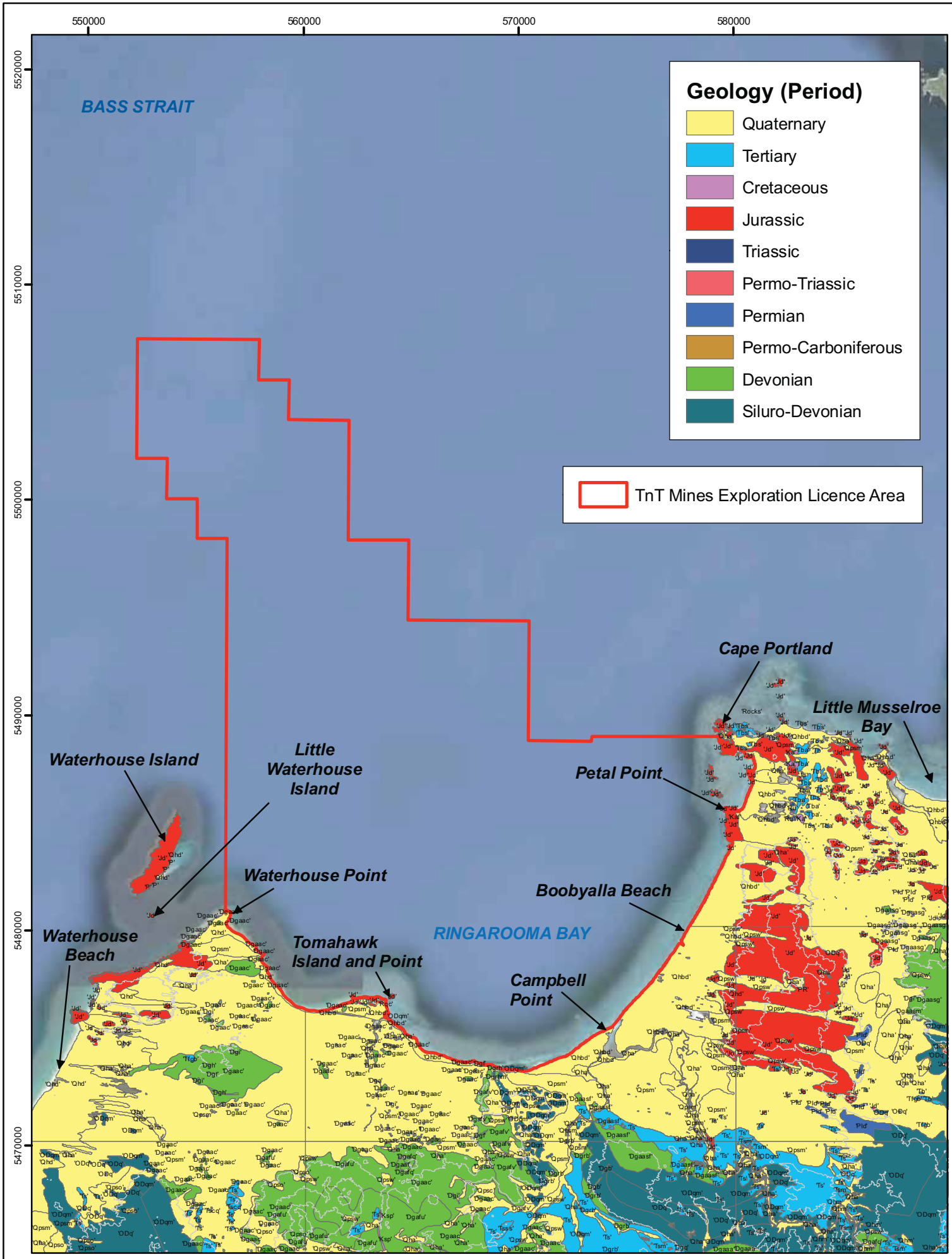
- the tin wash commonly lies directly on the seabed or with less than 2 m of cover;
- MHA has defined an area of 4 sq km containing shallow alluvials with high concentrations of tin up to a maximum of 694 g/t of tin, using 100 g/t cut off – this area is interpreted to correspond to reworked placers which have formed a thin and wide blanket perpendicular to the palaeochannel and parallel to the shore, likely along an old strand line;
- Less frequently, tin wash occurs under up to 10m of cover; this is more common deeper in the bay;
- The best grades are in medium to coarse sands to fine gravels, often with well rounded granules or pebbles to 75mm diameter. Many of the richest intersections are underlain by a sticky silt/clay bottom. This may correspond to the onshore "Marine Bottom" or may be a false bottom.
- In comparison with most alluvials where the grade decreases away from sources the tenor of the offshore tin wash, of 150 to 250 g/cu.m, is not significantly different from the onshore sheet wash.

SAPPHIRE
Sapphire concentrations in the offshore environment are uncertain, but it is considered that the main channel could contain high quality stones as they are potentially extensions of the known concentrations in the onshore areas.

HEAVY MINERALS

- Ilmenite and rutile: recent offshore exploration by MHA has defined a zone of higher concentrations of heavy mineral sands associated with the "Near Shore Sediment" buildup. This represents a palaeo shore line, 500m to 2km from the present shore.
- Zircon concentrations are more wide spread than ilmenite, and are associated with both the tin and the other heavy mineral sand concentrations.

MHA (2002) associated the tin placers in Ringarooma Bay with the palaeochannel of the Ringarooma River and considered the plateau structure in Ringarooma Bay, which hosts most of the indicated resource, to be an ancient strand line formed at a time of stable sea level by reworking of the palaeochannel deposits, which have formed an east-west trending resource.



TnT Mines
Ringarooma Bay EP

Figure 16: Local Geology (based on MRT 1:25000 Mapping)

SEMF SCIENTISTS ENGINEERS MANAGERS & FACILITATORS
ENVIROPAC

Base data by MRT. © State of Tasmania
Base image © Google Earth

Datum: GDA94 Grid: MGA Zone 55
Date: 2nd February 2012
Prepared by: SEMF Pty Ltd

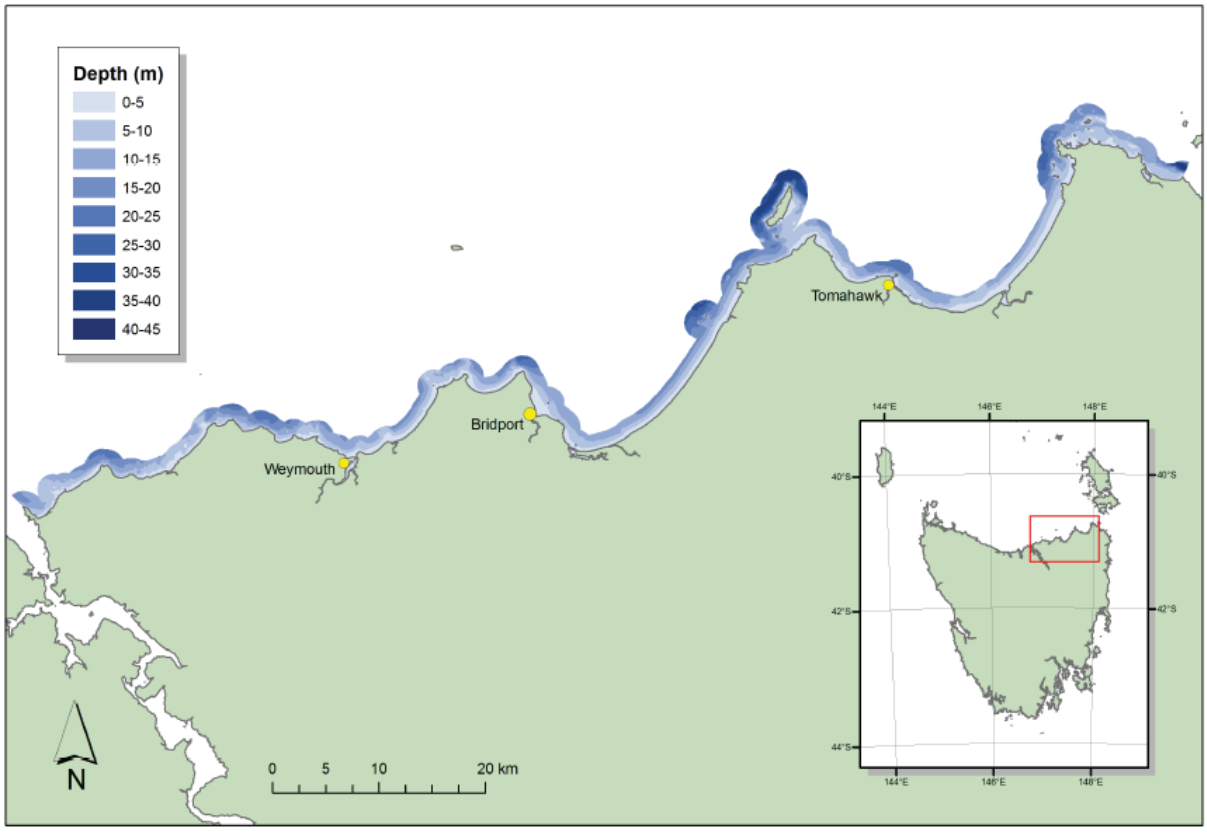
Project: 3998.001
Client: TnT Mines

0 2,500 5,000 Meters

6.1.3 Bathymetry

The near-shore bathymetry of Ringarooma Bay has been mapped as part of the Seamap Tasmania – Mapping the Gaps Project (Lucieer *et al.* 2009). The project included bathymetric maps of up to 1.5km from the shore. Figure 42 (Lucieer *et al.* 2009), reproduced below in Figure 17 suggests that depths to seafloor within 1.5km of shore, in most of Ringarooma Bay, reach to between 10 and 15 m. The exceptions include north of Tomahawk and west of Petal Point and Cape Portland, where depths to seafloor increase more rapidly within the 1.5km distance, to depths of between 15 to 20m. In the north and west of Waterhouse Island, depths increase even more rapidly from shore, reaching to around 30m only a short distance from the shore. The rapid deepening of the seafloor near headlands is likely to be due to the stronger and more erosive water currents in those areas, in contrast to the broad wave-energy-dispersive embayments of Boobyalla Beach, for instance.

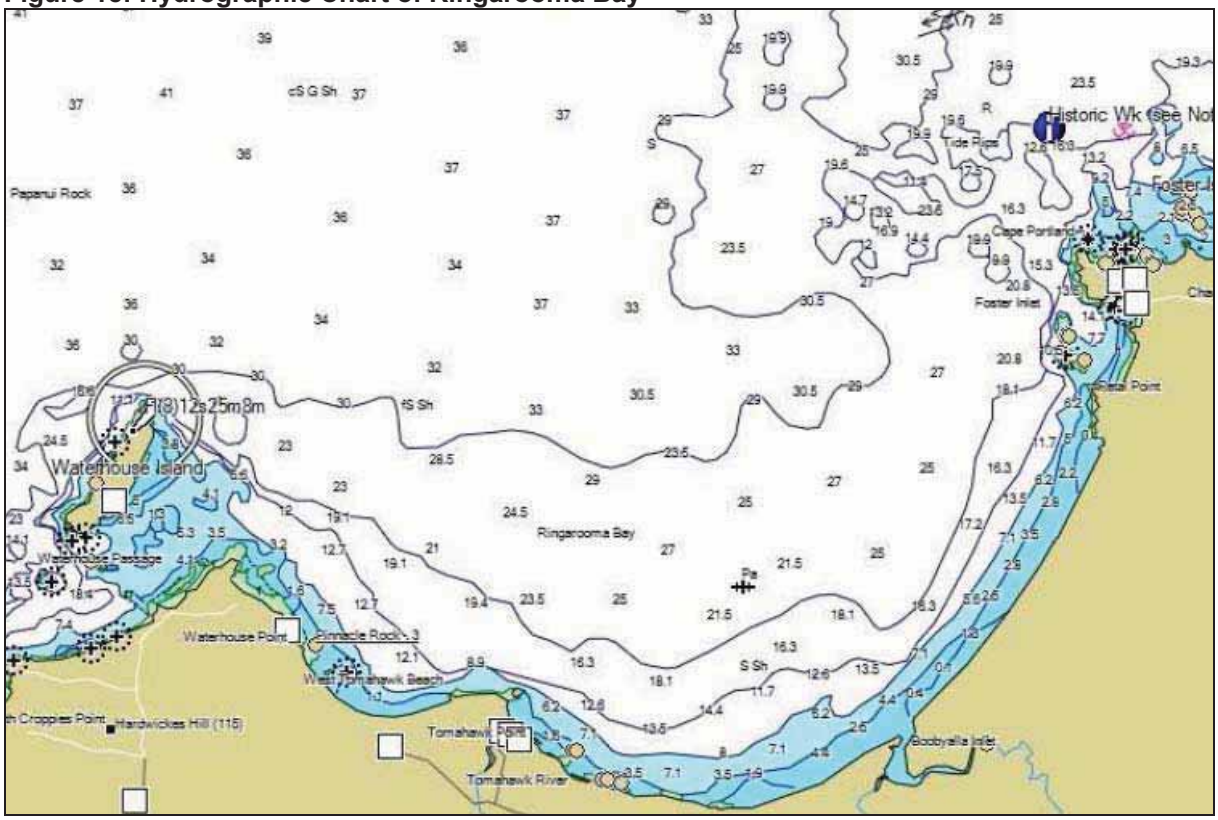
Figure 17: Bathymetry within 1.5km of Coast



Source: figure 42 in Lucieer *et al.* 2009

Published bathymetric contours (Hydrographic Chart) of Ringarooma Bay (Figure 18) show that the bay consists of roughly even contours to depths of around 30 metres below mean sea level. Linear depressions occur which represent the palaeochannels from the Ringarooma River.

Figure 18: Hydrographic Chart of Ringarooma Bay



Schematic slices of Ringarooma Bay are provided below (Figure 19 to Figure 22). The Bonzle Terrain summary (maps Bonzle.com 2011, Digital Atlas) sections provide a topographic profile in north-south, west-east, and northwest to southeast, plus northeast to southwest diagonal slices, centred around Ringarooma Bay, with 10km slice distances from the centre of Ringarooma Bay.

The north-south slice shows the gradual / gentle deepening of the bay. The east-west slice shows the depressions formed by the palaeochannels. The northwest to southeast and northeast to southwest diagonal slices show that the wave regimes on the eastern and western ends of the bay differ markedly, with the southwestern area having developed a steep drop off, whereas the southeastern area has developed a much gentler profile. Ocean movements and wave actions may be stronger and more erosive on the western portion of the bay, whereas these are likely to be gentler and more depositional in nature in the eastern portion of the bay.

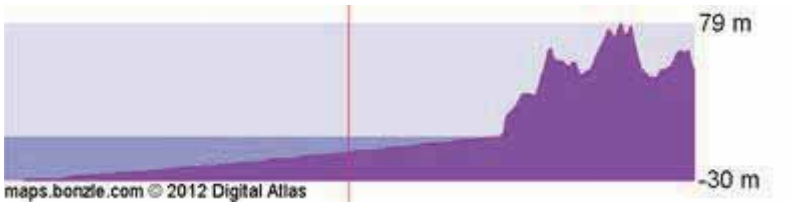


Figure 19: North to South Terrain Slice of Ringarooma Bay

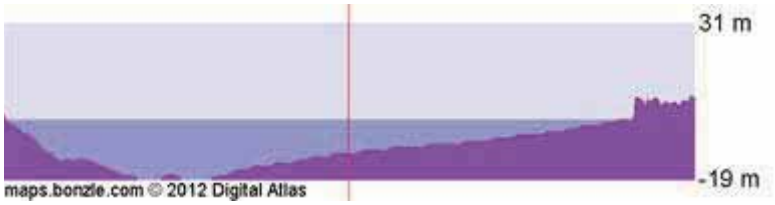


Figure 20: West to East Terrain Slice of Ringarooma Bay

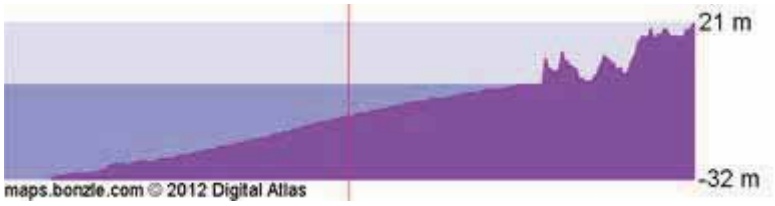


Figure 21: Northwest to Southeast Terrain Slice of Ringarooma Bay

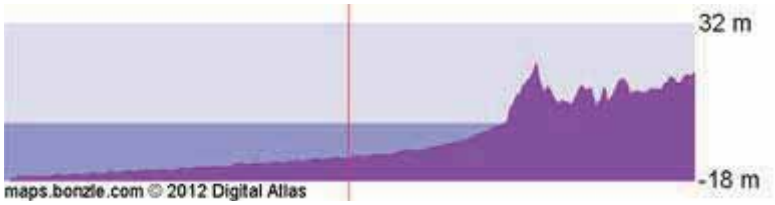


Figure 22: Northeast to Southwest Terrain Slice of Ringarooma Bay

6.1.4 Oceanography

The bathymetry and oceanography of the bay has been mapped within 1.5km of the coast by Seamap Tasmania – Mapping the Gaps Project (Lucieer *et al.* 2009). No other detailed information is known to exist. However this exploration project will provide a large amount of bathymetric and seabed mapping via the multibeam echosounder and the side-scan sonar data imaging, which will provide detailed bathymetric and seafloor topographic information as well as detailed outlines of reefs, channels, shipwrecks, etc. This mineral exploration project has the potential to provide the public domain with extremely useful and detailed oceanographic information of Ringarooma Bay.

6.1.5 Climate

The closest Bureau of Meteorology (BOM, http://www.bom.gov.au/climate) weather stations to Ringarooma Bay are Bridport (60km to the west), Eddystone Point (65km to the East) and Flinders Island Airport (100 km north). Given its position, Bridport would be expected to have similar climate characteristics to, say, Tomahawk, except that under an easterly regime, Ringarooma Bay could experience a higher degree of climate "shading" from Flinders Island, than that experienced at Bridport. Eddystone Point is located on the east coast of Tasmania and is likely to experience different climate regimes to the north east cost of Tasmania where Ringarooma Bay is located. Flinders Island, in particular the western side of the island, where the airport weather station is located, is likely to have similar characteristics to the eastern end of Ringarooma Bay, near Cape Portland.

Temperatures
Summer maximum daily temperatures average between 18.5 and 20.4°C with overnight minimums averaging between 13 and 14.8°C.

Winter maximum daily temperatures average between 13 and 13.8°C with overnight minimums averaging between 8.1 and 9.2°C.

Sea surface temperatures
Average annual sea surface temperature at Ringarooma Bay is 15°C (recorded from 1970 to 2010 by BOM). Average sea surface water temperatures by season are:

- Summer = 15°C;
- Autumn 17°C; and
- Winter and Spring = 13°C.

Rainfall
Rainfall statistics for the Waterhouse (Barooga) weather station to the west of Ringarooma Bay are provided in Table 10, below.

Table 10: Average Rainfall (1959 – 2011) for Waterhouse (Barooga) Weather Station (BOM website)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	41.1	31.8	41.5	58.5	68.0	61.1	74.7	72.4	58.1	54.2	51.1	50.7
Median	32.6	21.7	33.7	46.0	60.4	56.8	68.2	67.7	54.8	55.5	47.2	47.8
Highest Daily	68.0 *2011*	47.8 *1964*	98.0 *1980*	89.0 *1980*	70.2 *2007*	39.0 *1988*	72.0 *1982*	52.3 *1967*	46.5 *1966*	52.0 *1992*	80.0 *1975*	80.0 *1982*

Wind speed
Wind speed at Bridport (BOM) averages 9.4 km/hr at 9am and 15.5 km/hr at 3pm with highest average monthly wind speed being 18.9 km/hr in January. Wind speed at Flinders Island Airport at 9am averages 21 km/hr and 24.9km/hr at 3pm, with highest monthly average wind speed being 28.1 km/hr in December.

Highest wind speeds appear to occur in summer, in the afternoons and are likely to be stronger on the eastern part of the bay. This suggests that a prevailing westerly to north- or south-westerly regime dominates the wind directions at Ringarooma Bay.

6.1.6 Air

Air quality at Ringarooma Bay is expected to be excellent as there is no industry in or around the bay. The only impact to air quality would come from farming and grazing activities and use of cars and farming machinery around the bay, as well as use of recreational and commercial fishing vessels on the bay. All of these activities are short lived and are not expected to have a noticeable long term effect on the air quality in the bay.

6.2 EPBC Search Matters - Overview

A search of EPBC matters was carried out on the Department of Sustainability, Environment, Water, Population and Communities EPBC Act Protected Matters Report website page, for an area overlapping the proposed exploration licenses.

In summary, the report noted that within the area of the proposed survey, the matters listed in Table 11 and shaded light green, were likely to be relevant to the survey area. The Comment column of the table notes whether the matters are discussed in the EP and in what Section of the EP.

Table 11: EPBC Search Matters - Summary

Matter	Status	Comment
World Heritage Properties	None	Not discussed further in the EP
National Heritage Places	None	Not discussed further in the EP
2 x Wetlands of International Importance	2 Ramsar Wetlands	Discussed in Section 6.3.2
Great Barrier Reef Marine Park	None	Not discussed further in the EP
Commonwealth Marine Area	Yes	A permit may be required for activities in a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Refer to Section 6.3.1
Threatened Ecological Community	1 threatened ecological community	Discussed in Section 6.3.1
Threatened Species	44	Discussed in Section 6.3.1
Migratory Species (some included in the Threatened Species listing)	49	Discussed in Section 6.3.1
Listed Marine Species (some included in the above species listings)	83	Discussed in Section 6.3.1
Whales and other cetaceans (some included in the above species listings)	11	Discussed in Section 6.3.1
Critical habitats	None	Not discussed further in the EP
Commonwealth Reserves	None	Not discussed further in the EP
Places on the Register of National Estate (RNE)	12	Discussed in Section 6.3.2
State Reserves	10	Discussed in Section 6.3.2
Regional Forest Agreement	1	Not relevant to the proposed exploration work which is to be undertaken in the marine environment only.
Invasive Species	7	Discussed in Section 6.3.1
Nationally Important Wetlands	8	Discussed in Section 6.3.2

6.3 Biological Environment

6.3.1 EPBC Matters Search & Threatened Species Protection Act – Flora and Fauna Species

A search of EPBC matters was carried out on the Department of Sustainability, Environment, Water, Population and Communities EPBC Act Protected Matters Report website page, over the proposed survey area.

In terms of flora and fauna, the EPBC Matters report for the Ringarooma Bay proposed survey area noted the possible occurrence in the area of:

- 1 x threatened ecological community, namely the Lowland Native Grasslands of Tasmania;
- 44 x threatened species;
- 49 x migratory species;
- 83 listed marine species;
- 11 whales and other cetaceans; and
- 7 invasive species.

Appendix F provides a synopsis of all of the above fauna and flora species, and presents:

- their status;
- type of presence (according to the EPBC search tool);
- typical species habitat descriptions and the likelihood of occurrence within the proposed exploration areas;
- assessment of the likelihood of impact to each species from the proposed exploration work; and
- whether management actions may be required.

A query of the Natural Values Atlas (maintained by the Tasmanian Government Department of Primary Industries, Parks, Water and Environment) identified a few additional species that occur within the area covered by the ELs and MELs. Comments on the occurrence of these species in the ELs and MELs and potential impacts to them from the activities of surveying are incorporated into Appendix F.

6.3.2 Reserves / Bio-Conservation Areas

A search of EPBC matters was carried out on the Department of Sustainability, Environment, Water, Population and Communities EPBC Act Protected Matters Report website page over the proposed survey area.

In terms of reserves and conservation areas, the EPBC Matters report noted the possible occurrence in the area of the following matters, which are discussed in this section:

- No Commonwealth reserves;
- Relevant to the Commonwealth Marine Area;
- 2 Ramsar Wetlands;

- 8 Nationally Important Wetlands;
- 12 places on the Register of National Estate (RNE) (for Bio-conservation); and
- 10 State reserves.

Commonwealth:
Although there are no Commonwealth reserves near or within the proposed exploration area, the exploration licences area is situated within Commonwealth waters, i.e. it lies within a Commonwealth Marine Area.

Wetlands:
Ringarooma Bay area is located within the Flinders bioregion. The Flinders bioregion contains 5 Ramsar sites (Logan Lagoon, East Coast Cape Barren Island Lagoons, the flood plain of the lower Ringarooma River, Jocks Lagoon and Little Waterhouse Lake).

Two Ramsar Wetlands occur near Ringarooma Bay (refer to Figure 23):

- Lower Ringarooma Floodplain, situated immediately south of Ringarooma Bay and comprises 3520 hectares; and
- Little Waterhouse Lake, situated 7 kilometres south-west of Waterhouse Point and Ringarooma Bay and comprises 56 hectares.

Other Nationally Important Wetlands listed in the EPBC search tool include the following:

- Blackmans Lagoon, situated over 11 kilometres southwest of Waterhouse Point, and comprises approximately 13 hectares;
- Tregaron Lagoons 1 & 2, situated over 1 kilometre east of Ringarooma Bay, and comprise a total of around 70 hectares;
- Little Waterhouse Lake (discussed above, as it is a Ramsar Wetland);
- The Chimneys (this area is included in the Lower Ringarooma Floodplain Ramsar Wetland, listed above); and
- 5 Unnamed Wetlands.

Conservation priorities for the Flinders bioregion are wetlands (for their importance as amphibian, bird and fish habitat), migratory birds and migratory bird habitat, coastal birds and heath ecosystems.

Priority management issues in the region are water and wetland habitat quality, which are affected by agriculture, mining, changes in land use and the modification of wetlands through drainage or impoundment. Loss of natural vegetation to agriculture, forestry and forestry plantation development needs to be addressed, as does the implementation of inappropriate fire regimes. Management of *Phytophthora cinnamomi* is a priority in coastal ecosystems where floral endemism may be high and many species are very susceptible (Australian Natural Resource Atlas – Biodiversity Assessment – Flinders: http://www.anra.gov.au/topics/vegetation/assessment/tas/ibra-flinders.html)

Reserves and Conservation Areas:

Places on the Register of National Estate (RNE)
The following places are listed on the Register of National Estate for Bio-conservation purposes:

- Lower Ringarooma River Flood Plain – now a declared Ramsar Wetland, as discussed above (Indicative place);
- Mount Cameron – Great Northern Plain Area (Indicative place), now replaced by the Cameron Regional Reserve;
- Ringarooma Coastal Reserve (Indicative place), included in the Lower Ringarooma River Flood Plain Ramsar Wetland, and an informal reserve along the foreshore;
- White Rock Tier (Indicative place) now included in the Cameron Regional Reserve;
- Cape Portland Conservation Area (Registered site), included in the Cape Portland Conservation area;
- Cape Portland Geological Monuments (Registered site), included in the Cape Portland Conservation area;
- Foster Islands Nature Reserve (Registered site), included in the Foster Islands State Reserve;
- Sheoak Hill Geological Monument (Registered site); and
- Waterhouse Conservation Area (Registered site), included in a State Reserve of the same name.

There are also three listed Indigenous sites:

- Cape Portland Aboriginal Area (Indicative Place)
- Campbells Point Site (Registered site)
- Waterhouse Point Area (Registered site);

These are discussed in the Aboriginal Heritage Section 6.5.1 of the EP.

Background to the Register of National Estate

Register of the National Estate is a list of natural, Indigenous and historic heritage places throughout Australia.

It was originally established under the *Australian Heritage Commission Act* 1975. Under that Act, the Australian Heritage Commission entered more than 13,000 places in the register. In 2004, responsibility for maintaining the Register shifted to the Australian Heritage Council, under the *Australian Heritage Council Act* 2003 (AHC Act).

On 1 January 2004, a new national heritage system was established under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). This led to the introduction of the National Heritage List, which was designed to recognise and protect places of outstanding heritage to the nation, and the Commonwealth Heritage List, which includes Commonwealth owned or leased places of significant heritage value.

The establishment of this national system was in line with a 1997 agreement by the Council of Australian Governments that each level of government should be responsible for protecting heritage at the appropriate level. The Australian Governments role in relation to heritage is to focus on protecting places of world and national heritage significance and on ensuring Commonwealth compliance with state heritage and planning laws. Each state and territory government, and local government, has a similar responsibility for its own heritage.

As a result, there was a significant level of overlap between the Register of the National Estate, and heritage lists at the national, state and territory, and local government levels.

Many places in the Register are already included in other statutory lists, such as the state heritage lists, or local government heritage registers. As a result, those places receive protection under the relevant federal, state or territory legislation, or under council bylaws.

In the case of places of national or Commonwealth significance that are in the Register, some of these places are already included in the National Heritage List or the Commonwealth Heritage List, and therefore receive protection under the EPBC Act.

Following amendments to the Australian Heritage Council Act 2003, the Register of the National Estate (RNE) was frozen on 19 February 2007, which means that no new places can be added, or removed.

The Register will continue as a statutory register until February 2012. During this period the Minister for the Environment, Heritage and the Arts (the Minister) is required to continue considering the Register when making some decisions under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). This transition period has allowed states, territories, local and the Australian Government to complete the task of transferring places to appropriate heritage registers where necessary and to amend legislation that refers to the RNE as a statutory list.

From February 2012 all references to the Register will be removed from the EPBC Act and the AHC Act. The RNE will be maintained after this time on a non-statutory basis as a publicly available archive.

Where RNE sites listed above have been identified to overlap with, or to be replaced by State reserves, this has been stated in the listing above. Based on that listing it is apparent that all areas listed or registered under the RNE for bio-conservation have already been included into State Reserves.

State Reserves:

- Waterhouse Conservation Area;
- Musselroe Bay Conservation Area;
- Little Waterhouse Island Nature Reserve;
- Cape Portland Conservation Area;
- (Mt) Cameron Regional Reserve;
- Baynes Island Nature Reserve;
- Foster Islands Nature Reserve;
- Boobyalla Downs; and
- Carisbrook.

Most of the above reserves are situated on land, away from the proposed marine exploration works. Little Waterhouse and Foster islands are situated outside of the Ringarooma Bay proposed exploration works area. Baynes Island is situated close to the proposed works within the bay:

- Foster Island is Tasmania's only pelican breeding colony; and
- Little Waterhouse Island is an important bird area, in particular for Black-faced Cormorants.

6.3.3 Mount William National Park

Mount William National Park is situated approximately 20 kilometres southeast of Ringarooma Bay. The park was established in the 1970s, in part to provide refuge for the Forester kangaroo, a Tasmanian subspecies of the eastern grey kangaroo, which was in grave danger of extinction at the time. The park is now considered an important area for the conservation of Tasmania's coastal heathlands and dry sclerophyll plants.

The park extends from Musselroe Bay to Ansons Bay and includes Cape Naturaliste and Eddystone Point along the coast and Mt William (216m). The National Park faces the east coast and is dominated by hilly and eroded granitic terrain, granitic rocky shores and coarse white sand beaches. It has two main camping areas.

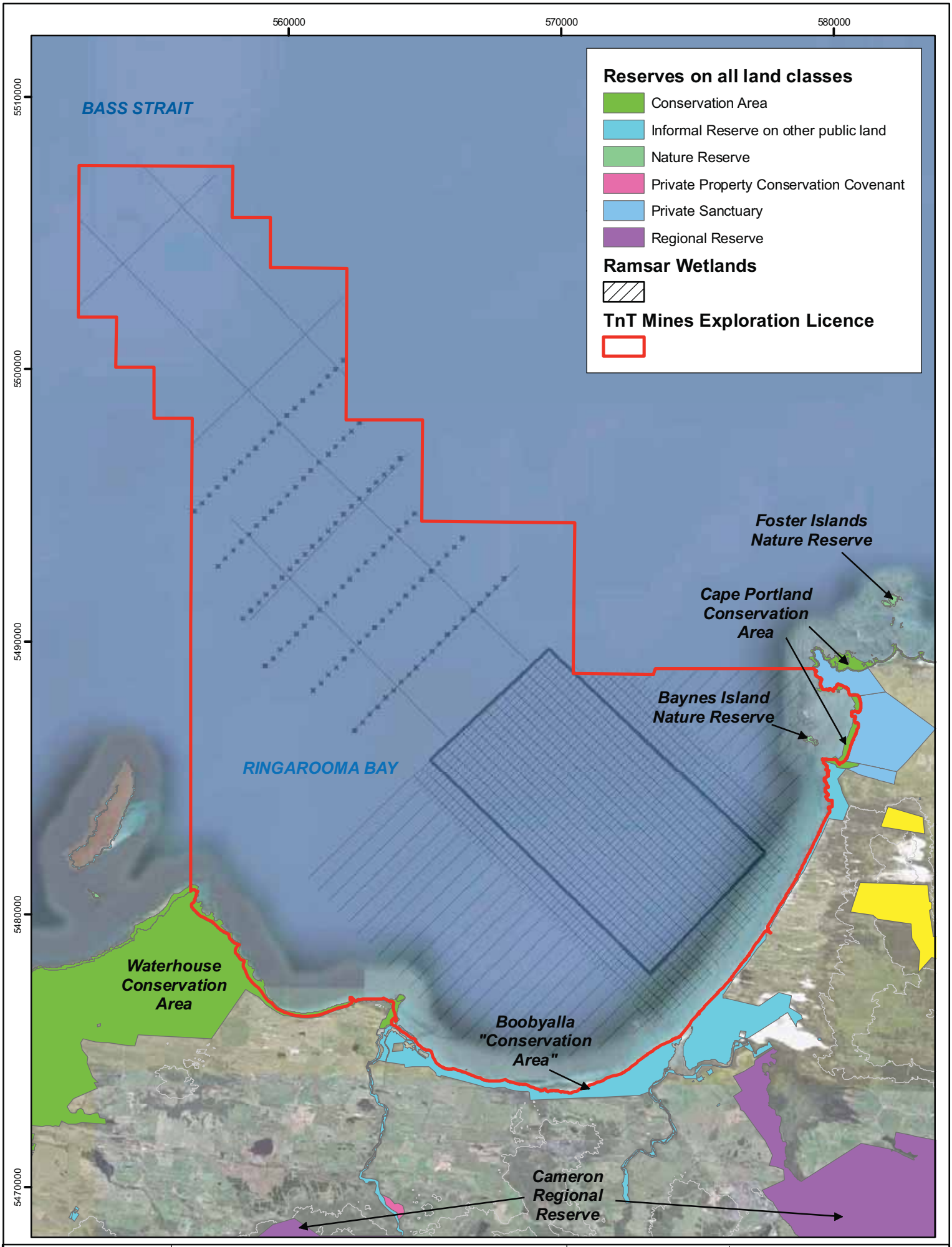


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Figure 23: Locations of all Reserves, Conservation Areas, Ramsar Sites, etc.

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Base data by TASMAP. © State of Tasmania
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Datum: GDA94 Grid: MGA Zone 55
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Prepared by: SEMF Pty Ltd

Project: 3998.001
Client: TnT Mines

0 2,500 5,000 Meters

6.4 Geoconservation

The land around Ringarooma Bay is surrounded by the:

- Northeast Tasmania Pleistocene Aeolian System.

This system consists of terrestrial remnants of the largest Pleistocene desert dune complex in Tasmania that formally covered Bass Strait, and includes a range of aeolian landforms such as extensive sand sheets and longitudinal dunes. It is a listed geoconservation area and is shown on Figure 24.

Other listed geoconservation sites around Ringarooma Bay include:

- Waterhouse Dunefield, south and west of Waterhouse Point;
- Waterhouse Island Cuspate Foreland, on the southeastern coast of Waterhouse Island;
- Cape Portland Cretaceous Andesites, Appinites and Lamprophyres, near Petal Point and Fosters Inlet, which are listed as including the best documented Tasmanian example of surficial rocks of Cretaceous age.

All sites are shown in Figure 24.

As discussed above, the EPBC Search Matters tool for the proposed Exploration Licences area provided the following listing of geoconservation sites from the Register of National Estate:

- Cape Portland Conservation Area (Registered site);
- Cape Portland Geological Monuments (Registered site); and
- Sheoak Hill Geological Monument (Registered site).

It is considered that the first two have been included within the Cape Portland Cretaceous Andesites, Appinites and Lamprophyres mentioned above. The Sheoak Hill area has been included within the large geoconservation area allocated to the Northeast Tasmania Pleistocene Aeolian System.

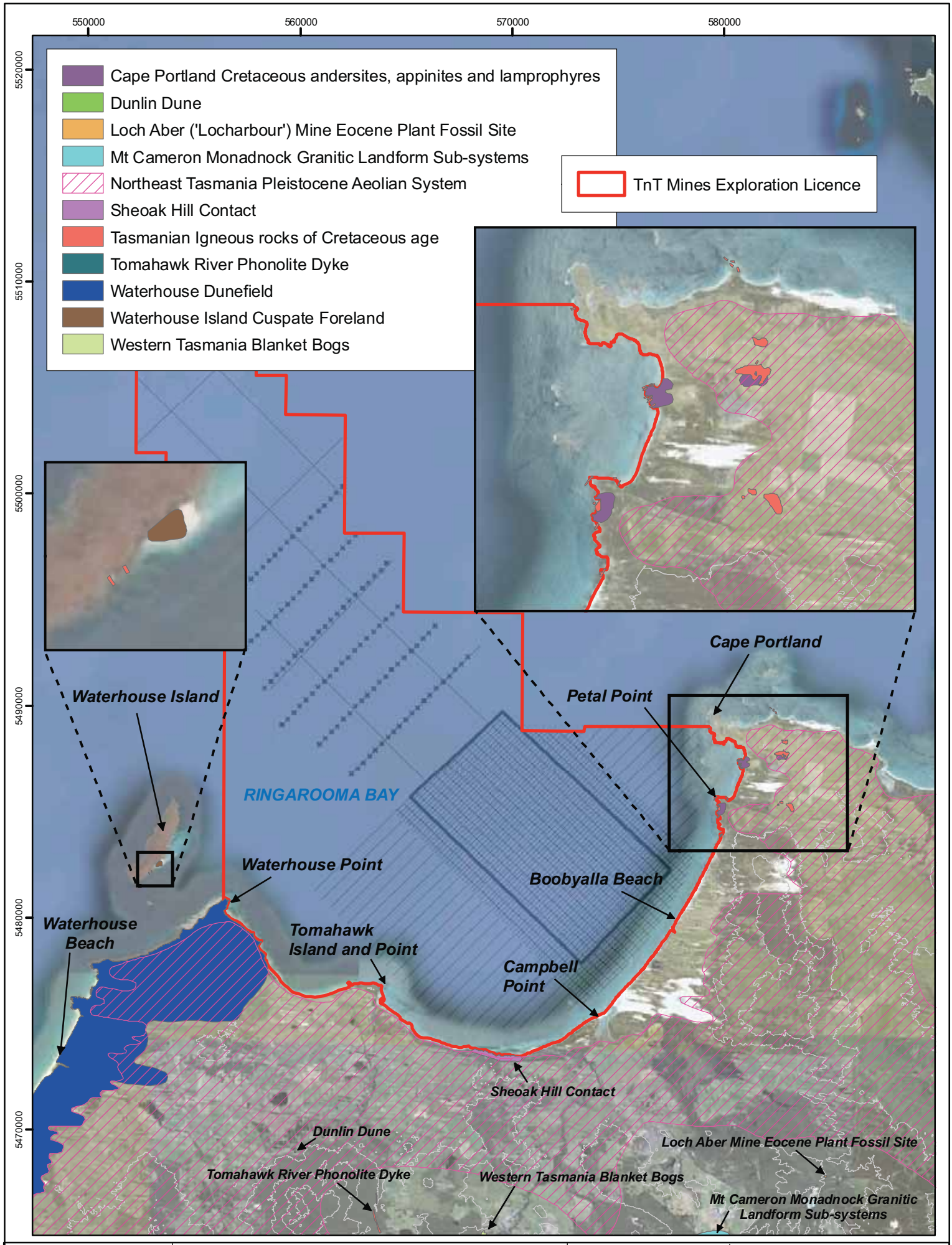

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Figure 24: Locations of Geoconservation Areas

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6.5 Cultural Environment

The following sections outline Aboriginal and European cultural values near Ringarooma Bay. Implication of the activity on each of these is discussed in the respective sections.

6.5.1 Aboriginal Heritage

No search of the Tasmanian Aboriginal Site Index (TASI) database has been requested since none of the activities proposed will impact on land, other than within existing infrastructure such as port loading facilities and jetties.

Coastal areas around Ringarooma Bay are known to contain shell middens as well as artefact scatters such as stone tools. All Aboriginal relics are protected from destruction, damage, defacing, concealing or otherwise interfering with under Section 14(1) of the *Tasmania Aboriginal Relics Act 1975*.

From RNE, discussed earlier, the following three sites are listed or registered as Aboriginal places or sites (refer to Figure 25):

- Cape Portland Aboriginal Area (Indicative Aboriginal place);
- Campbells Point Site (Registered Aboriginal site); and
- Waterhouse Point Area (Registered Aboriginal site).

None of the exploration work is likely to impact directly on these sites or places, as the work will be undertaken at sea, and anchoring will occur offshore.

6.5.2 European Heritage

The township of Boobyalla and its cemetery are local historic sites which are relics from the nineteenth century mining activity in the region. The township consists of ruins resulting from the abandonment of a short term town which was established at the height of the tin mining boom, upstream of the Ringarooma River. The township of Boobyalla is located over 2 kilometres from the shore of Ringarooma Bay and the cemetery even further.

The Register of National Estate includes the Mount Cameron Water Race as a Registered Historic site. The following is extracted from the Australian Heritage Database (within the www.environment.gov.au) held by the Department of Sustainability, Environment, Water, Population and Communities. The Mount Cameron Water Race was constructed circa 1882 and extended in 1890. The well constructed race, with its flume, siphons, channels and series of dams, is of significance to the north eastern region of Tasmania as a largely intact and working example of nineteenth century water race technology. It has supplied water to the region almost continuously from 1882 to 1996. The water has been supplied to tin mines for sluicing operations, from 1882 to 1984 and from 1986 to 1996 it has irrigated the "Rushy Lagoon," an extensive pastoral property. The Mount Cameron Water Race is 53 kilometres long. It comprises 50 kilometres of earth channel, 3 kilometres of three concrete syphons (the Musselroe Syphon, 1889, the Edina Syphon, 1889 and the Moores Syphon, 1889) and four storage dams (the Government Reservoir, Empress Dam, Conserving Dam and Old Chum Reservoir). The Old Chum Creek Flume was built in 1964 replacing the original wooden fluming of 1881. It was called the "Iron Fluming" 1905-1939. It is located near Aberfoyle Hill, at Junction Creek, on Old Chum Creek, and at the intake on the Great Musselroe River. Its total area is 290 hectares. The property of Rushy Lagoon is located typically over 5 kilometres from the shore of Ringarooma Bay, and the Mount Cameron Water Race is situated further inland of the property.

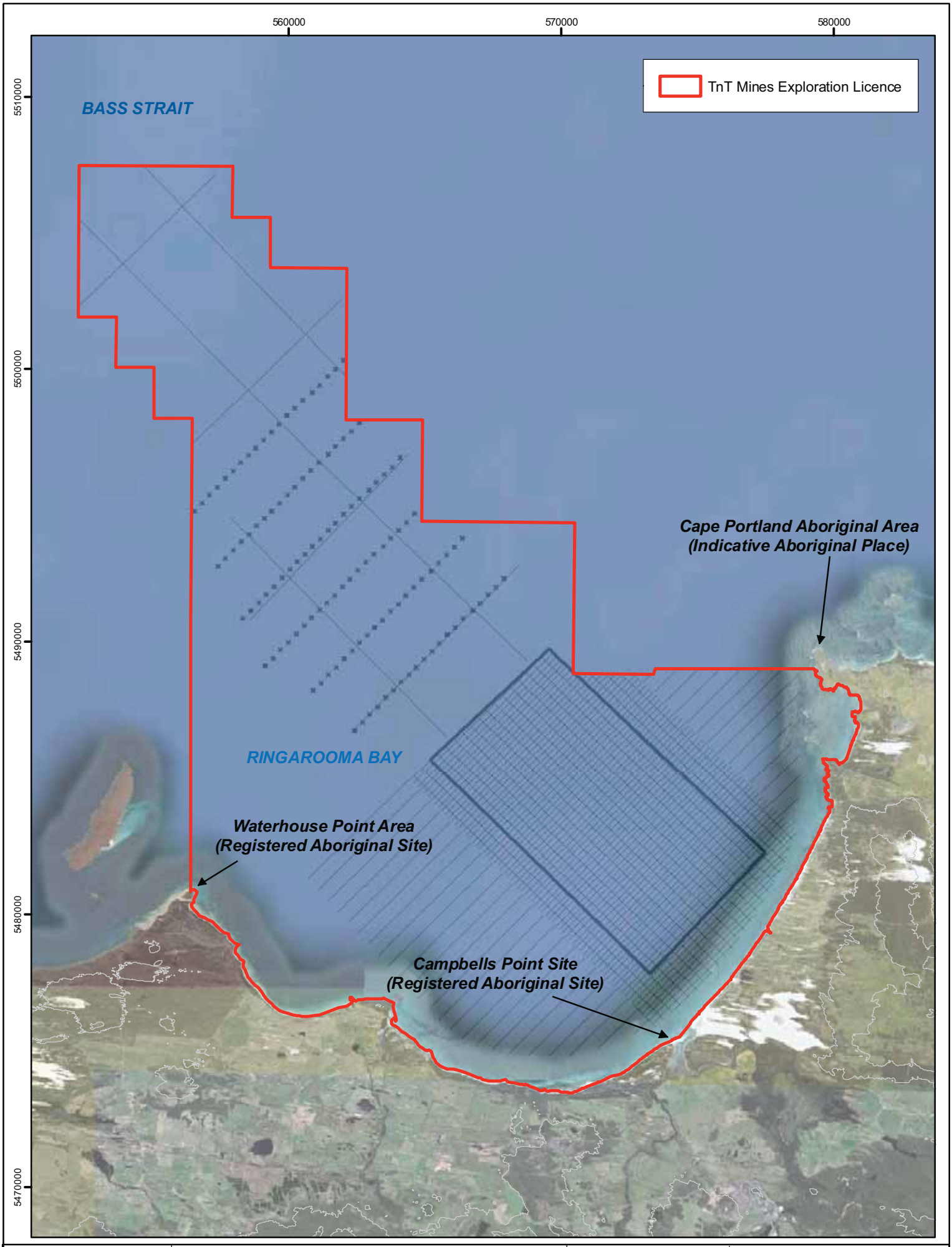

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Figure 25: Listed or Registered Aboriginal Places

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0 2,500 5,000 Meters

6.5.3 Shipwrecks

A search of the Commonwealth Shipwrecks Database for Ringarooma Bay returned five vessels, listed in Table 12. However, the first ship listed, the Howard, was refloated and therefore only four known shipwrecks occur within Ringarooma Bay.

The Commonwealth Shipwrecks Database provides latitude and longitude coordinates for the four remaining shipwreck vessels within Ringarooma Bay, however these are considered to be approximate only. These have been plotted on to Figure 26, as an indication of these shipwrecks' presence.

Since all four shipwrecks and their associated artefacts were lost over 75 years ago all of their remains are automatically protected under the Commonwealth *Historic Shipwrecks Act 1976* and the State *Historic Cultural Heritage Act 1995*.

None of these four shipwrecks have been included in a declared "no-entry zone". These zones may cover an area up to a radius of 800 metres around a wreck site, and may be declared where circumstances place it at particular risk of interference.

Details on each of the shipwrecks are provided in Table 13 below, as extracted from the Commonwealth Shipwrecks Database.

Table 12: Known Shipwreck Locations - Ringarooma Bay

Id (Commonwealth Database id number)	**Vessel**	**Type**	**Year wrecked**	**Wreck location**
7262	*Howard*	*Sailing vessel*	*1886*	*Ringarooma Bay*
7679	Sally	Sailing vessel	1826	Ringarooma Bay
7776	Swordfish	Sailing vessel	1882	Tomahawk, Ringarooma Bay
7882	Victory	Sailing vessel	1897	Tomahawk, Ringarooma Bay
7905	Water Witch	Sailing vessel	1876	Tomahawk, Ringarooma Bay

Source: https://apps5a.ris.environment.gov.au/shipwreck/public/wreck/advancedSearchSubmit.do

Table 13: Details of Ringarooma Bay Shipwreck Vessels

Vessel name and details	**General history**
Howard, Sailing barque Gross tonnage (imperial tons): 613.0 Year wrecked: 1886 Jurisdiction: Tasmania Region: TAS - North East Coast	The barque Howard was bound from Quebec to Melbourne with a cargo of timber when navigation errors put it off the north-east coast of Tasmania. Unable to enter Port Dalrymple the barque was forced back eastwards by bad weather until it was beached at Ringarooma Bay. There were no casualties, and after much effort the vessel was eventually **refloated**. At a subsequent inquiry the master's certificate was suspended for 12 months and the first mate's for 6 months.

Vessel name and details	General history
Sally, Schooner Gross tonnage (imperial tons): 40.0 Year wrecked: 1826 Jurisdiction: Tasmania Region: TAS - North East Coast Latitude: -40.88 Longitude: 147.8 Datum: WGS84 Chart number: AUS 798	The schooner Sally sailed from Hobart on 24 June 1826, bound for Ringarooma Bay with 18 settlers and stores. On the night of the 30th the vessel encountered a heavy gale while approaching its destination and stranded about a quarter of a mile offshore. Some escaped by boat and others drifted ashore but a total of 13 lives were lost including three women and five children. The survivors reached Georgetown by boat on 13 July.
Swordfish, Brigantine Gross tonnage (imperial tons): 155.0 Year wrecked: 1882 Jurisdiction: Tasmania Region: TAS - North East Coast Latitude: -40.86 Longitude: 147.76 Datum: WGS84 Chart number: AUS 798	The brigantine Swordfish was en route from New Zealand to Melbourne with a cargo of timber when a series of gales in Bass Strait drove it southwards. The vessel was anchored up under Waterhouse Island on 2 May 1882, but on the 7th the anchor cables parted during a gale and the Swordfish was driven ashore. All hands landed safely and the wreck stayed together for at least eight weeks while most of its cargo, gear and fittings were salvaged. 
Victory, Ketch Gross tonnage (imperial tons): 37.8 Year wrecked: 1897 Jurisdiction: Tasmania Region: Unknown Latitude: -40.86 Longitude: 147.76 Datum: WGS84	No history has been recorded for the Victory. Date wrecked: 02/10/1897. Where vessel was wrecked: Tomahawk, Ringarooma Bay Type of wreck: Stranded
Water Witch, Cutter Gross tonnage (imperial tons): 13.0 Year wrecked: 1876 Jurisdiction: Tasmania Region: TAS - North East Coast Latitude: -40.88 Longitude: 147.78 Datum: WGS84 Chart number: AUS 798	The cutter Water Witch sailed from Launceston for Ringarooma on 8 January 1876 with a cargo of sundries and some passengers. During heavy gales on the 14th the vessel was driven ashore at Tomahawk Bay, on the north-east coast. There was no loss of life but the Water Witch became a total wreck. Date wrecked: 14/01/1876 How vessel was wrecked: Vessel driven ashore during a gale Where vessel was wrecked: Tomahawk, Ringarooma Bay Type of wreck: Stranded Weather condition: Gale

Source: https://apps5a.ris.environment.gov.au/shipwreck/public/wreck/advancedSearchSubmit.do

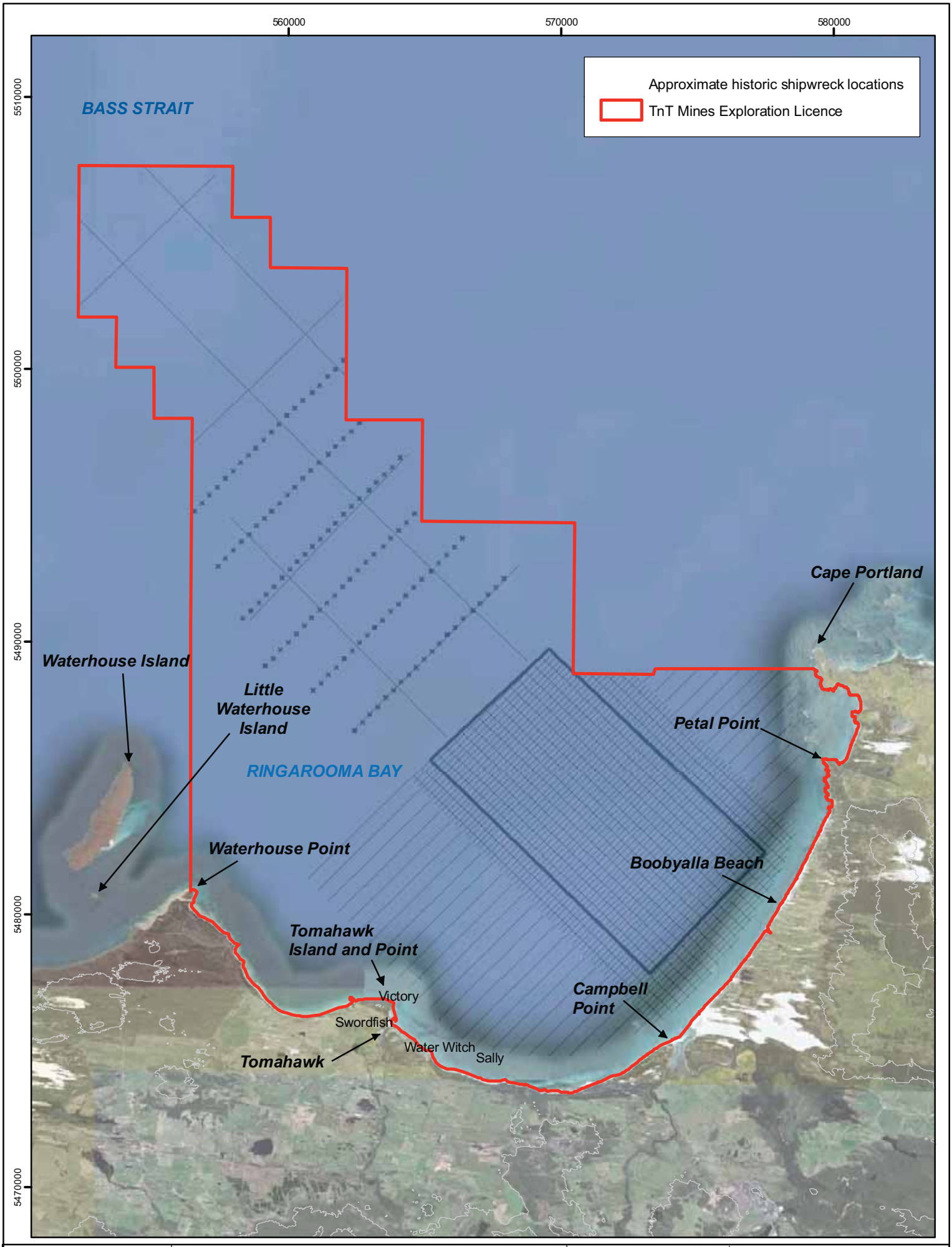

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Figure 26: Historic Shipwrecks - Approximate Locations

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0 2,500 5,000 Meters

6.6 Socioeconomic Environment

6.6.1 Population Characteristics

The 2006 Census summary statistics were sourced as general population characteristics for the townships around Ringarooma Bay. Full statistics were available for Tomahawk, however only limited information was available for Waterhouse, due to the small population base, and no specific information was available from the 2006 Census for Cape Portland or Rushy Lagoon.

It is considered that the Tomahawk characteristics are broadly representative of the other localities mentioned, although the permanent population base and the holiday residents are likely to be higher than at the other localities.

Table 14 shows that:

- the total usual resident populations of Tomahawk and Waterhouse were just shy of 200 in 2006, of which
- around a quarter were considered family households (with or without children);
- the median age of the residents was 44 years;
- local workforce employment was high, at around 92%; with
- farming being the largest employer, taken up to 63% of the workforce;
- other sectors of employment included specialised food retailing, wholesale trade and tertiary education.

In 2006, the Census data show that in Tomahawk around one third of the dwellings are occupied by the usual residents, with the other two thirds interpreted to be holiday dwellings and accommodation. This proportion is more of the order of half and half in the Waterhouse township.

It is expected that population characteristics for Cape Portland and Rushy Lagoon, compared to Waterhouse, would likely include:

- slightly lower population numbers than at Waterhouse, due to being more remote;
- lower proportions of families, i.e. less than a quarter of the population would be part of a family, again due to being more remote;
- it is expected that the percentage of the workforce employed would also be very high, with most residents occupied with the productivity of their landholdings;
- the main industry of employment is likely to be farming, at an even higher percentage than for Tomahawk;
- the proportion of occupied to unoccupied private dwellings is expected to be equivalent to (50/50) or higher than at Waterhouse, again, due to the remoteness of the area.

Table 14: Summary Population Statistics of Local Townships

Characteristic	Tomahawk	Waterhouse	Total
Usual Resident Population	111	87	198
Number of family households (with or without children)	25	24	49
Median Age	44	nd	44
% of workforce employed	92%	nd	92%
Industries of employment (% of persons employed >15 y.o.)			
Farming	63%	nd	63%
Other	9%	nd	9%
Occupied private dwellings	46	39	85
Total private dwellings	136	57	193

Source: Summary Statistics from 2006 Census
nd = no data

6.6.2 Local Area Uses

As suggested in Section 6.6.1, the area around Ringarooma Bay is home to a small population occupied predominantly with farming related activities (sheep, cattle, dairy, grain).

Tourism is also a significant seasonal input to the region, with between half to two thirds of the private dwellings not being permanently occupied, and having the potential to accommodate holidaying people. The area within 10km of the shore of Ringarooma Bay includes the localities of Tomahawk, Waterhouse, Rushy Lagoon and Cape Portland. This overall area is estimated to comprise of the order of 250 permanent residents, with the potential for the population to swell to between 500 and 1000 residents during peak holiday periods, such as during summer school holidays.

There are also two camping grounds, one southeast of Waterhouse Point, near the shore of Ringarooma Bay, and the other south of Cape Portland, also near the shore of Ringarooma Bay. Both camping grounds have only minimal facilities. They are likely to be well used by numerous campers during the summer months; however during the cooler months and outside of school holidays, these basic camp grounds do not typically attract many campers.

Other activities in the area of Ringarooma Bay include:

- beach activities, such as walking, swimming and recreational activities;
- quad biking along beach dunes (e.g. at Petal Point);
- recreational boating and fishing (mostly during the summer months);
- commercial fishing (shark, scallops, etc); and
- shipping routes from Bell Bay to Whitemark on Flinders Island could potentially transit close to the northern extents of the exploration licences.

No other exploration (mineral or petroleum) are known to be occurring or known to be planned in the near future within Ringarooma Bay.

6.6.3 Fisheries

The Bridport to Cape Portland area is home to the following popular species:

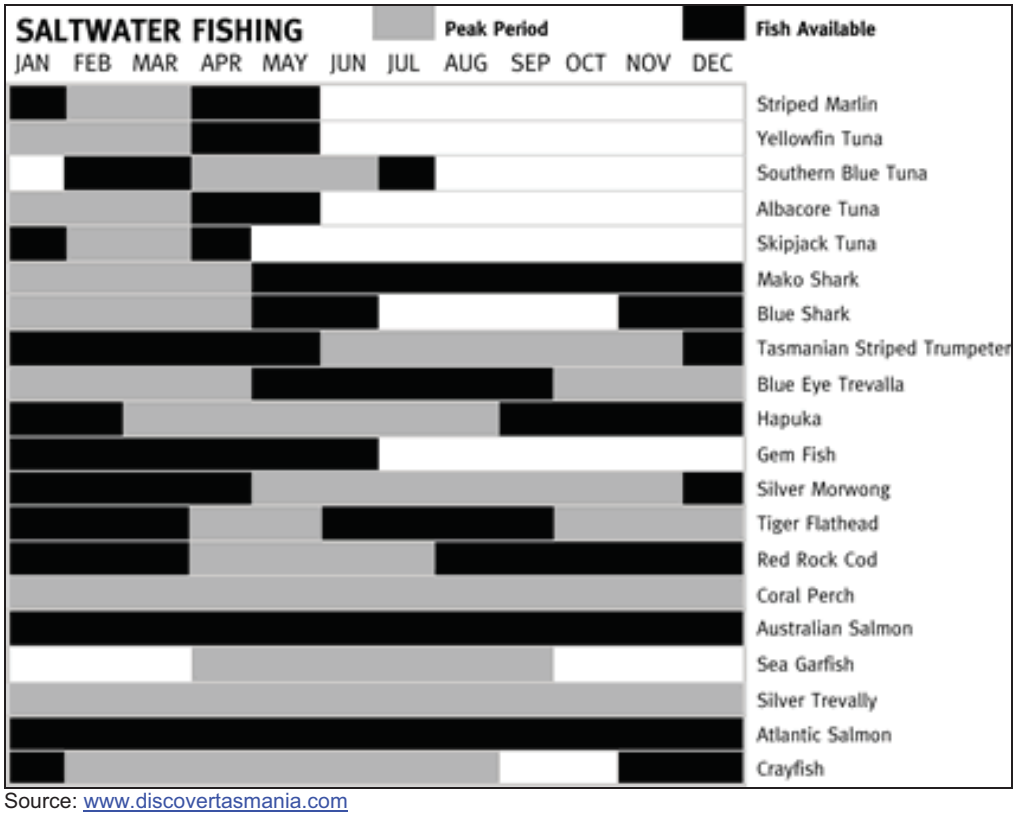
- rock lobster,
- flathead,
- couta,
- snook,
- striped trumpeter,
- bream,
- Australian salmon,
- Kingfish, and
- snapper.

Salmon, flathead and sharks are the most popular species here (www.tasfish.com), however, there is a great potential for a kingfish and snapper fishery with these prized fish often caught over spring and summer.

From the shore, areas such as Cape Portland, Waterhouse Point, Tomahawk and Croppies and South Croppies Point provide some good fishing for salmon, couta, pike and snook. Schools often travel through in tight groups.

The beaches are most productive for big flathead which can be taken all year. By-catches from the sand include sharks and rays, whiting, mullet and salmon. Most sharks are taken at night. Scallop beds also exist within the bay and are trawled periodically in years when they have reached commercial sizes.

Waterhouse Island is the most popular spot for boaties. Trolling for big salmon, couta and snook is popular. Yellowtail kingfish and snapper are also caught. Figure 27 illustrates the sea-fishing calendar for most popular species in Tasmania.



Source: www.discovertasmania.com

Figure 27: Sea Fishing Calendar of Tasmania

Many of these species are targeted by recreational fishers. Commercial fishing operators also fish in and around Ringarooma Bay. Exchanges with some of the operators which use the area have highlighted that:

- scallops beds grow and are fished periodically from the seabed within Ringarooma Bay;
- gummy shark and other shark species are fished within approximately 500m of the shore of Ringarooma Bay;
- Australian salmon is also fished within the bay.

6.7 Values and Sensitivities

A number of local and regional values and sensitivities exist around Ringarooma Bay. These have been split into:

- Within the bay – i.e. may be impacted directly by the proposed activity;
- On and near the coast around bay, within a nominal 1km from the coast – i.e. may have no or only minor direct or indirect impacts from the proposed activity; and
- Inland, near the bay, more than a nominal 1km from the coast – due to the distance any values and sensitivities are unlikely to incur any noticeable impacts from the proposed activity.

Within Ringarooma Bay:

- Baynes Island Nature Reserve;

- Marine portion of the Lower Ringarooma Floodplain (Ramsar Wetlands) (refer to Figure 23);
- remoteness and generally low usage of the area of the bay;
- large bay available for recreational usage;
- commercial fishery operations, which target shark in shallow waters and scallops in the seabed;
- 4 historic shipwrecks occur within the bay (refer to Figure 26);
- seagrass beds occur within the bay, down to around 15 – 20 metres depth (Lucieer, 2009) (refer to Appendix E) – these are significant habitats for seahorse and pipefish species;
- rocky reefs occur mostly near the two ends of the bay and around intervening headlands – these are suitable habitats for seahorse and pipefish species; and
- areas of temporal significance such breeding or spawning grounds, migration routes and resting and aggregation areas.

On and near the coast around the Bay (within 1km of the coast of Ringarooma Bay):

- dune / coastal landscape;
- unpopulated coastal expanse and quiet amenity;
- registered or listed Aboriginal sites (refer to Figure 25);
- the Lower Ringarooma Floodplain (Ramsar Wetlands) (refer to Figure 23);
- the Northeast Tasmania Pleistocene Aeolian System (geoconservation area) (refer to Figure 24);
- Cape Portland Cretaceous Andesites, Appinites and Lamprophyres, near Petal Point and Fosters Inlet, which are listed as including the best documented Tasmanian example of surficial rocks of Cretaceous age (geoconservation area) (refer to Figure 24);
- Tasmanian Igneous Rocks of Cretaceous age (refer to Figure 24);
- Waterhouse Dunefield south and west of Waterhouse Point (geoconservation area) (refer to Figure 24);
- Waterhouse Island Cuspate Foreland, on the southeastern coast of Waterhouse Island (geoconservation area) (refer to Figure 24);
- other Conservation areas and reserves (refer to Figure 23); and
- residences (Tomahawk and rural properties).

Inland near the Bay (at least 1km from the coast of Ringarooma Bay):

- rural landscape;
- Boobyalla Historic (ghost) town and cemetery (refer to Figure 2);
- Little Waterhouse Lake (Ramsar Wetlands) (refer to Figure 23);
- Waterhouse Conservation Area (refer to Figure 23);
- Several lagoons and inland farm dams may represent temporal significance as they could act as breeding grounds, migration routes and resting and aggregation areas for wetland and migratory bird species; and

- The northern end of Mount William National Park is located around 20 kilometres to the southeast of Ringarooma Bay.

Figure 23 to Figure 26 show the locations of TNT Mines' proposed exploration work relative to:

- reserves and conservation areas;
- geoconservation areas;
- listed and registered Aboriginal sites; and
- known historic shipwreck sites.

Based on these, TNT Mines' proposed exploration work is unlikely to have a direct impact on any of these values or sensitivities. Appendix E presents only near-shore seabed mapping which identifies areas of seagrass in the western area of Ringarooma Bay. It is likely that the seagrass beds extend further within the bay, however their extent will be controlled by depth, water clarity and the amount of sunlight penetrating through the water column. It also appears that there is little or no seagrass in the eastern portion of the bay except nearer Cape Portland, where the substrate and water currents become more favourable. Much of the intrusive seafloor sampling from gravity coring, vibracoring, etc. will occur in the central to eastern half of the bay, where there is a lesser likelihood of seagrass occurrences.

6.8 Consultation

TNT Mines has been undertaking consultation regarding their proposed exploration work in Ringarooma Bay since early 2011. A summary of the consultation is provided in Table 15. Most of the consultation has been with:

- the Delegated Authority – MRT, and the Commonwealth
- complainants who responded to the public notices advertising the exploration licences; and
- geophysical surveys specialist contractors.

All State licences were granted on 4 January 2012. The granting of Commonwealth licences T11MEL and T12MEL occurred on 26 April 2012 and T13MEL on 21 May 2012. All environmental concerns and management for the first two years' proposed exploration work within the licences are expected to be addressed through this EP and its implementation.

Three complainants raised issues regarding the potential impact of exploration and mining work within Ringarooma Bay. It was made clear at mediation, held on 19 September 2011, that the licences were only being granted for exploration work, not mining. The three complainants' main issues were regarding:

- potential impact to scallops and the fishery in the bay from the acoustic / geophysical survey;
- potential impacts to scallops and disturbance to the fishery in the bay from the sampling work to be undertaken on the seabed; and
- impacts to the fishery and the environment within Ringarooma Bay.

Most of these concerns were alleviated during discussions at mediation and follow up information regarding the proposed work. It is understood that all objections were withdrawn given that the State licences have been granted.

It is also noted that one of the vessels likely to be used for some of the exploration work is owned by one of the original complainants. This will allow for a close rapport to be built and the partnership should also ensure transparency and accountability regarding the survey work and environmental management during the exploration surveys.

TNT Mines will liaise with the local community (Tomahawk and landowners surrounding Ringarooma Bay) to brief them on the project and address any additional concerns that may be raised prior to undertaking the exploration work. Since public notices have been issued in the local newspaper, The Examiner, for all the licence applications, it is anticipated that most local residents would already be aware of TNT Mines' exploration intentions.

Table 15: Summary of Consultation to end January 2012

Date	Type	From	To	Parties	Summary
12/02/2011	Newspaper			TNT Mines, The Examiner and the Public	Public notice advising of application for T11MEL placed in The Examiner.
02/04/2011	Newspaper			TNT Mines, The Examiner and the Public	Public notice advising of application for T12MEL placed in The Examiner.
16/04/2011	Newspaper			TNT Mines, The Examiner and the Public	Public notice advising of recommendation to the Minister to grant EL4/2011 placed in The Examiner.
26/05/2011	Letter	Therese Taylor	Russell Fulton	MRT and TNT Mines	Letter advising that three objections had been lodged
17/06/2011	Newspaper			TNT Mines and The Examiner	Public notice advising of recommendation to the Minister to grant EL17/2011 placed in The Examiner.
18/08/2011	Letter	Therese Taylor	Russell Fulton	MRT and TNT Mines	Letter advising date and time for mediation meeting with objectors to EL4/2011
19/09/2011	Meeting			Russell Fulton-TNT, Mike Hannington-TNT, Bob Lister-Objector, Neil Stump-Objector, Stuart Richey-Objector, Carol Bacon-MRT, Clive Calver-MRT, Kim Creak-MRT	Mediation meeting. TNT outlined it's exploration plans and the objectors outlined their concerns. Neil Stump and Stuart Richey had no problemn with the exploration side of things but expressed concern in regard to possible mining activity. Bob Lister appeared to be strongly opposed to anybody being in the bay other than scallop fishermen.
21/09/2011	Newspaper			TNT Mines and The Examiner	Public notice advising of application for T13MEL placed in The Examiner.
27/09/2011	Email	Mike Hannington	Stuart Richey, Bob Lister, Neil Stump	TNT Mines and objectors	Follow-up to mediation meeeting with more details on what we proposed to do for exploration. Also contained link to vibracoring video and attachments showing TNT Mines' Tasmanian projects.
28/09/2011		Neil Stump	Mike Hannington	Neil Stump and TNT Mines	Reply to email of 27/09/2011 thanking Mike H for his detailed email.
29/09/2011		Stuart Richey	Mike Hannington	Stuart Richey and TNT Mines	Reply to email of 27/09/2011 thanking Mike H for his detailed email. Also offering commercial charter of his vessel for the marine survey work.
20/10/2011	Email	Russell Fulton	Carol Bacon	TNT Mines and MRT	Follow up to see if objections to EL4/2011 had been withdrawn
27/10/2011	Email	Russell Fulton	Stuart Richey	Stuart Richey and TNT Mines	Request for charter rate to hire his vessel for marine survey work
27/10/2011	Email	Stuart Richey	Russell Fulton	Stuart Richey and TNT Mines	Stuart Richey outlined capabilities and charter costs for his vessel
27/10/2011 - 01/11/2011	Emails	Stuart Richey, Russell Fulton	Stuart Richey, Russell Fulton	Stuart Richey and TNT Mines	Exchange of emails in regards to proposed charter of Dell Richey II including requests for photos and GA plans, all supplied.
01/11/2011	Email	Russell Fulton	Stuart Richey	Stuart Richey and TNT Mines	Advised Stuart Richey that we would also want to acquire sub-bottom profiling data using his vessel
27/10/2011 - 01/11/2011	Emails	Stuart Richey, Russell Fulton	Stuart Richey, Russell Fulton	Stuart Richey and TNT Mines	Exchange of emails in regards to proposed charter of Dell Richey II including requests by TNT for further information, all supplied.
05/11/2011	Newspaper			TNT Mines and The Examiner	Public notice advising of recommendation to the Minister to grant EL46/2011 placed in The Examiner.
07/11/2011	Email	Therese Taylor	Russell Fulton, Carol Bacon	TNT Mines and MRT	Fowarded letter dated 3/10/11 from Carol Bacon outlining results of mediation meeting on the 19/09/2011. The letter indicated that objections were resolved and outlined the exploration techniques that TNT would be using. There was no mention of sub-bottom profiling so there will need to be follow up to make sure everyone at MRT is aware that TNT wants to use this technique. Also include letter from Stuart Richey advising that he had no objection to exploration using side scan sonar, magnetometer, grab sampling or hand sampling. He expressed some concerns re vibracoring.
11/11/2011	Email	Russell Fulton	Carol Bacon, Therese Taylor	TNT Mines and MRT	Email advising that letter re mediation meeting outcome neglected to mention sub-bottom profiling via high frequency soundings as an exploration technique that TNT would want to use.
11/11/2011	Email	Carol Bacon	Russell Fulton	TNT Mines and MRT	Carol Bacon advised that she would add Pinger and Boomer surveys to the MRT file and agreed that it was covered in the mediation meeting. Carol advised that the Commonwealth had accepted the joint technical report and were likely to approve the licences
01/10/2011 - 15/11/2011	Emails, phone calls			TNT Mines, Marine GeoSolutions, Gardline Marine Sciences, Fugro, EGS Survey Pty Ltd	Email correspondence and telephone calls in regard to : invitation for tenders to conduct marine geophysical survey; analysis of tenders; selection of contractor.
15/11/2011 - 23/12/2011	Email, phone calls & meetings			TNT Mines, Marine GeoSolutions, TNT Mines	Selection of Marine GeoSolutions as contractor and Richey Fishing Co as vessel provider. Preparation and finalisation of survey proposals.
6-7/12/2011	Report	Dr Peter Ramsay - Marine GeoSolutions		Marine GeoSolutions, Richey Fishing Company and TNT Mines	Dr Ramsay carried out acoustic noise testing on the Dell Richey II to confirm it's suitability as a survey vessel
04/01/2012	Email and letters	Ashley McQueen	Russell Fulton	TNT Mines and MRT	Advised that the three State licences had been granted on the 4th January 2012.
16/01/2012	Email	Therese Taylor	Russell Fulton	TNT Mines and MRT	Request to provide more information to the Commonwealth on the amount of work to be conducted on each tenement
20/01/2012	Email	Russell Fulton	Therese Taylor	TNT Mines and MRT	Information requested by Therese Taylor 16/1/12, was supplied to MRT for the Commonwealth

7. ENVIRONMENTAL RISK ASSESSMENT

7.1 Baseline Studies

Apart from consultation work, documented earlier, no intrusive baseline studies have been carried out by TNT Mines for this project.

It is considered that the likely environmental impacts from the works proposed by TNT Mines within this EP are very small and that the overall environmental risk is low. This is discussed further in the following sections.

It was therefore decided that no onsite baseline studies would be carried out.

7.2 Risk Assessment

The components of the exploration survey that could result in environmental effects to local residents and users as well as flora and fauna within Ringarooma Bay have been determined through an evaluation of the proposed activity, the surrounding environment and legislative requirements.

Activities with potential to cause significant environmental effects to the amenity and flora and fauna within Ringarooma Bay include:

- Operation of the vessel(s);
- Use of local accommodation and supply outlets;
- Storage, disposal and spills of fuel, oil and waste hydrocarbons;
- Introduction of exotic species;
- Storage, treatment and disposal of liquid wastes;
- Chemicals, detergents or hazardous materials storage and disposal;
- Solid and putrescibles waste storage and disposal;
- Drilling and grab sampling on seafloor;
- Disposal of wastewater and rainwater from vessel;
- Towing of geophysical arrays on long lines through the survey area;
- Anchoring of vessel(s);
- Discharge or ‘firing’ of the acoustic energy source arrays;
- Accidental loss of materials and equipment overboard;
- Vessel breakdown, capsizing, running aground; and
- Collision of vessel(s) with large marine mammals.

Although the risk presented by each of these is generally considered to be low, each of these activities has the potential to result in detrimental impacts on the physical, biological and socio-economic environment of the area.

In order to estimate the risk profile in detail for each of the 'environmentally significant' activities, an environmental risk assessment has been carried out for each of these 'environmentally significant' activities. The assessment is presented in Table 19.

The risk assessment outlines the range of proposed avoidance, mitigation and management measures which will lower the overall risk profile from each activity. The resulting risk rankings assessed for each activity range from **low** to **very low**. None of the activities are seen as having Medium, High or Critical risk ratings.

The risk assessment ratings scheme used includes individual Likelihood and Consequence ratings on potential residual impacts (i.e. after avoidance, mitigation and management measures have been applied). The Likelihood and Consequence ratings were then used to come up with the risk rating associated with each activity. The Likelihood, Consequence and Risk Rating tables are provided in Table 16 to Table 18.

Table 16: Likelihood Rating

Likelihood		
Rating	**Score**	**Description**
Almost Certain	5	High likelihood of risk event happening several times within the next year
Probable	4	A risk event is likely to occur more than once in the next 12 months
Possible	3	Might occur some time in the future
Unlikely	2	Could occur but unlikely
Rare	1	May occur but only in exceptional circumstances

Table 17: Consequence Rating

Consequence						
Rating	**Score**	**Criteria**				
		People / fauna	**Reputation**	**Business Process**	**Financial**	**Environmental**
Catastrophic	5	Death or multiple life threatening injuries	Adverse national media or inquiries	Critical system failure. Business severely affected	Financial loss >25% of budget	Large scale regional pollution
Major	4	Life threatening injury or multiple serious injuries with hospitalisation	Intense public, political, media scrutiny	Strategies not consistent with Govt agenda. Service is degraded	Financial loss >10% of budget	Off-site pollution (extended) resources needed for clean up
Moderate	3	Serious injury causing hospitalisation or multiple medical cases	Scrutiny by government committees or inquest	One or more key accountability requirements not met	Financial loss >5% of budget	On-site clean-up by internal team
Minor	2	Minor injury or first aid case	Scrutiny required by internal audit to prevent escalation	Procedures occasionally not met or services do not fully meet needs	Financial loss >2.5% of budget	Localised spill, clean-up by one person
Insignificant	1	Injuries or ailments not requiring treatment	Internal Review	Minor errors in systems or processes requiring corrective action	Financial loss >1% of budget	No impact, clean-up not necessary

Table 18: Risk Rating Matrix

Consequence						
	5	MEDIUM	HIGH	CRITICAL	CRITICAL	CRITICAL
	4	LOW	MEDIUM	HIGH	CRITICAL	CRITICAL
	3	LOW	LOW	MEDIUM	HIGH	CRITICAL
	2	VERY LOW	LOW	LOW	MEDIUM	HIGH
	1	VERY LOW	VERY LOW	LOW	LOW	MEDIUM
		1	2	3	4	5
		Likelihood				

Table 19: Environmental Risk Assessment

'Environmentally Significant' Activities	Potential Impacts	Proposed Avoidance, Mitigation, Management	Potential Residual Impacts	Likelihood of residual impacts	Consequence of residual impacts	Risk Rating
Physical operation of vessel	Noise, air emissions, lighting, anchoring	- Only well maintained vessels with experienced crews will be used; - Surveys will be carried out during day-time hours; - Surveys will be carried out outside of peak holiday periods; - External facing night lighting will be avoided or minimised; - Low impact bulbs will be used; - Low impact anchor(s) will be used; - Anchoring will occur only in areas of little or no seagrass and scallop beds (an underwater camera or ground-truthed maps will be used); - Operations will occur at distances greater than 500m from shore, including 500m from Baynes Island (off Petal Point).	Short term impacts from vessel operational noise, minor emissions to air, night lighting and temporary impacts from seabed anchors will occur but will be short lived and of very minor consequence.	3	1	Low
Use of local accommodation and supply outlets	Excessive demand on local accommodation and supply outlets, creating pressure on holiday trade	- Surveys will be undertaken outside of peak holiday periods; - Vessel and survey crews will typically be accommodated on the vessel(s) during the surveys; - Accommodation would typically only be used in the larger centres such as Devonport, at the start and end of the surveys; - Restocking of the vessel(s) will typically occur from larger port facilities with ample stock of consumables; - Vessel operator(s) will check ahead of time to ensure supplies are available from the chosen restocking port.	Minor or no impacts are expected to be experienced by local trader or holiday makers	2	1	Very low

'Environmentally Significant' Activities	Potential Impacts	Proposed Avoidance, Mitigation, Management	Potential Residual Impacts	Likelihood of residual impacts	Consequence of residual impacts	Risk Rating
Fuel, oil and waste oil on board	Accidental spill of fuel, oil or waste oil, contaminating water, sediments, coast	- Only well maintained vessels with experienced crews will be used; - Oils will be stored in supplied dedicated storage containers; - Waste oil will be stored in dedicated waste oil containers for disposal;	Contamination of seawater, marine habitat, sediments and coast	1	3	Low
Refuelling	Accidental spill of fuel, contaminating water, sediments, coast	Refuelling will only occur in dedicated vessel refuelling facilities, which have all equipment and materials to deal with spill contingencies.	Contamination of seawater, marine habitat, sediments and coast in area potentially already impacted by refuelling	2	3	Low
Ballast water and unwanted marine pests	Introduction of marine pests	- Ballast water will be pumped in at clean ports with intake placed in the water column several metres from shore or seafloor; - Only well maintained vessels with experienced crews will be used.	Introduction of marine pests	2	3	Low

'Environmentally Significant' Activities	Potential Impacts	Proposed Avoidance, Mitigation, Management	Potential Residual Impacts	Likelihood of residual impacts	Consequence of residual impacts	Risk Rating
Liquid wastes, such as grey water and sewage	Damage to sensitive resources from discharge of sewage	- Preference will be given to lease vessels which store and process sewage; then pump out treated sewage at suitable port waste disposal facilities; - If sewage needs to be discharged from the vessels, it will not be discharged within 3 nautical miles of the coastline unless vessel has a certified approved sewage treatment plant in place under Regulation 8 (1) (b) of MARPOL 73/78 Annex IV. - Procedures for treatment and disposal of sewage will be in place. The sewage treatment system will include maceration and disinfection. - If the vessel needs to discharge sewage between 3 and 12 nautical miles of coast, the sewage will, as a minimum, be comminuted, macerated and disinfected. - A **Waste Log Form** will be maintained to record waste management practices.	Damage to sensitive resources from accidental release of untreated sewage	2	3	Low

'Environmentally Significant' Activities	Potential Impacts	Proposed Avoidance, Mitigation, Management	Potential Residual Impacts	Likelihood of residual impacts	Consequence of residual impacts	Risk Rating
Chemicals, cleaning detergents and hazardous wastes	Impact to marine environment from disposal of chemicals and hazardous wastes	- No disposal of chemicals or hazardous wastes will occur to seawater. - Correct segregation of chemical and hazardous wastes will be practised in all areas of the vessel. - A vessel **Waste Log Form** will be kept detailing quantities of wastes transported ashore, where the waste was disposed, and by which licensed waste transport company. - Drilling muds or additives will not typically be used for vibracore drilling; if these happen to be required, minimal amounts will be used, biodegradable formulations will be used as a preference, and no additives / muds will be discharged to the marine environment. - Spillages of fuel, oil or other pollutants of an amount greater than 80 litres will be reported to the Designated Authority and to the State Environment Protection Authority (EPA) within 12 hours of any such spillage occurring (**Incident Report**).	Accidental release / spill of chemicals and hazardous wastes causing impacts to marine environment	2	3	Low
Solid wastes, such as packaging, domestic wastes, putrescibles, equipment consumables	Impact to marine environment through littering	- No solid or putrescibles wastes will be disposed to seawater. - Correct segregation of solid and putrescible wastes will be practised in all areas of the vessel. - A vessel **Waste Log Form** will be kept detailing quantities of wastes transported ashore, and where the waste was disposed and by which licensed waste transport company.	Accidental release of solid or putrescibles wastes causing impacts to marine environment	2	3	Low

'Environmentally Significant' Activities	Potential Impacts	Proposed Avoidance, Mitigation, Management	Potential Residual Impacts	Likelihood of residual impacts	Consequence of residual impacts	Risk Rating
Vibracore, gravity core and grab samples	Disturbance of historical shipwrecks, disturbance of seagrass beds and scallop beds, disturbance of reefs, disturbance of seahorse and pipefish habitat, disturbance of seabed and benthic fauna.	- Underwater cameras will be used prior to carrying out vibracoring and gravity coring in order to avoid shipwrecks, avoid large seagrass beds, high density scallop beds and significant reef systems; - Divers will be used where necessary to help site vibracore and gravity core sampling locations to minimise disturbance to large seagrass beds and high density scallop beds. - Diver bulk sampling will be undertaken after the diver has visually inspected the sampling area and will sample away from reef, seagrass, scallops or shipwrecks.	Minor and short-lived disturbance of seagrass beds and scallop bed, seahorse and pipefish habitat and benthic fauna	3	1	Very low
Disposal of waste water from the deck of the vessel (water from drilling, or rain, etc.)	Increased turbidity of seawater	- Vibra-core samples will contain very little water, which will be drained to a sump to allow sediment to drop from suspension (water will be returned to the sea near the point of its source); - Grab samples will be from coarse grained sediments which will not generate much fine sediment; - Vessel decks will be kept swept and clean.	Very small plumes of sediment may be generated on capture and retrieval of grab samples, or from draining of vibracore samples.	3	1	Very low
Geophysical survey work – long armoured coaxial cable	Presence of long lines (armoured coaxial cable) which could entangle larger fish, mammals or birds, or get tangled in shipwrecks or reefs	- Devices attached to the long line (armoured coaxial cable) will not provide attractants to large marine birds; - Only a single line (armoured coaxial cable) will be used which will be kept under tension to avoid potential large fish/mammal entanglement; - Underwater camera will be used in shallow water; - Depth sensing equipment will be used on the vessel to control the depth of the survey line (armoured coaxial cable) and ensure it is maintained at 10-15m above the seabed.	Possible collision of fish / mammal with long line or attached equipment	2	2	Low

'Environmentally Significant' Activities	Potential Impacts	Proposed Avoidance, Mitigation, Management	Potential Residual Impacts	Likelihood of residual impacts	Consequence of residual impacts	Risk Rating
Vessel anchoring	Physical damage to seagrass beds and reefs and degradation to fish breeding and foraging habitat including sea horses and pipefish	- Avoid anchoring of the vessel during the survey. - When dropping anchor for the night, choose an area known to not have seagrass beds or reefs.	Minor impacts to seafloor sediments and seagrass.	3	1	Low
Geophysical survey work - release of sound from acoustic source	Disturbance from discharge of the acoustic energy underwater to baleen whales or odontid whales, dolphins and seals, resulting in disruption to their behaviour (foraging and breeding) patterns. Emission of acoustic energy and frequencies could cause physical impacts on fixed or free swimming species.	- TNT Mines will aim to carry out the geophysical surveys outside of the peak cetacean migrations (May to December) periods. - 'Soft start' procedures will be employed to permit free swimming mammals and fish to leave the area. - **If the geophysical survey operators demonstrate that the received sound exposure level for each shot will not likely exceed 160dB re 1µPa^2·s, for 95% of acoustic shots at 1km range**, the following precaution zones will be applied (DEWHA, 2008): - ***Observation zone***: 3+ km horizontal radius from the acoustic source. - ***Low power zone***: 1 km horizontal radius from the acoustic source. - ***Shut-down zone***: 500m horizontal radius from the acoustic source. If the above cannot be demonstrate for the proposed acoustic surveys, then the low power zone will be: - ***Low power zone***: 2 km horizontal radius from the acoustic source. - 10-minute continuous whale and seal watch will be held every hour during geophysical / acoustic surveys; if a whale is sighted, keep watch until it is	Minor disturbance to free swimming and fixed species	2	2	Low

'Environmentally Significant' Activities	Potential Impacts	Proposed Avoidance, Mitigation, Management	Potential Residual Impacts	Likelihood of residual impacts	Consequence of residual impacts	Risk Rating
		out of the low power zone for more than 30 minutes. - Operators will prepare to implement and will implement Low Power or Shut-Down procedures as above (DEWHA, 2008), if whales are seen within 3km of the geophysical survey vessel. - Stop work procedures will be implemented if seals are sighted within 100m of the geophysical vessel. - Responsibilities for monitoring and recording whale and seal sightings will be clearly identified and conveyed to vessel personnel. - **Sighting Reports** will be completed according to 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au and copied to TNT Mines management.				
Dropping of objects overboard	Littering of seafloor, impact to local seafloor habitat, potential for local contamination if object is not inert in seawater	- Good housekeeping will be practised on board the vessel, e.g. efficient waste collection, segregation and enclosure; - Whenever possible, materials / equipment handling tasks will be carried out within enclosed / walled areas of the vessel to prevent materials / equipment falling or rolling overboard; - Survey work will be undertaken during calm seas which will minimise the chance of accidentally dropping objects overboard; - Underwater camera(s), diver(s) and cables will be used to retrieve any materials / equipment dropped overboard.	Minor disturbance to free swimming species, and minor disturbance to fixed species	2	3	Low

'Environmentally Significant' Activities	Potential Impacts	Proposed Avoidance, Mitigation, Management	Potential Residual Impacts	Likelihood of residual impacts	Consequence of residual impacts	Risk Rating
Vessel breakdown, capsize, running aground	Physical damage to coast, potential for spill and contamination (as above), and dropping of objects overboard	- The vessel(s) hired will be well maintained and have a sufficient and experienced crew; - Existing marine charts will be obtained prior to survey work; - Bathymetric and seafloor data gathered during the surveys will be used, where possible, to inform vessel placement; - Weather forecasts will be scrutinised ahead of and during all survey work; - Survey work will be undertaken where possible during calm seas; - All solid waste containers will be capped with clippable lids; - All liquid waste containers will be sealed; - Vessel **Emergency procedures** will be practised by all vessel and survey crew to ensure familiarity; - **Local emergency service numbers** will be obtained prior to the surveys.	Physical damage to coast, potential for spill and contamination (as above), and dropping of objects overboard	1	4	Low

'Environmentally Significant' Activities	Potential Impacts	Proposed Avoidance, Mitigation, Management	Potential Residual Impacts	Likelihood of residual impacts	Consequence of residual impacts	Risk Rating
Vessel bulk	Collision with large cetaceans	- TNT Mines will aim to carry out its surveys and sampling outside of the peak cetacean migrations (May to December) periods. - 'Soft start' procedures will be employed to permit free swimming mammals and fish to leave the area. - 10-minute continuous whale and seal watch will be held every hour during geophysical / acoustic surveys. - Stop work procedures will be implemented if whales are seen within 3km of the geophysical survey vessel. - Responsibilities for monitoring and recording whale and seal sightings (**Sighting Reports**) will be clearly identified and conveyed to vessel personnel. - If a whale(s) is/are sighted less than 300m from the vessel then the vessel speed will be reduced to 'no wake' and the vessel will move away from the whale(s) to increase the distance to over 300m.	Disturbance to or close encounter with cetaceans	2	2	Low

7.3 Disturbance to Marine Fauna from Acoustic Surveys

McCauley (1994) provides a detailed review of the potential effects of acoustic survey data acquisition on marine animals. The review was undertaken by an Independent Scientific Review Committee (ISRC), chaired by Professor John Swan, and commissioned by the Australian Petroleum Exploration Association (APEA) and the Energy Research and Development Corporation (ERDC).

The ISRC report examined all aspects of the possible effects of seismic/acoustic surveys on marine life, from whales to plankton. Potential impacts on hearing, and behaviour at different stages of development were studied. The ISRC report concluded on this note:

> "Given the relatively small scale of seismic activity, the often large scales over which biological events occur, and the low probability of encounter between seismic surveys and 'at risk' populations at an appropriate time and place, then the wider implications of disruption by seismic surveys appear to be small for most species …. However the risks increase dramatically when seismic surveys are conducted in or adjacent to aggregation areas for 'at risk' populations".

According to the ISRC report, environmental issues relating to seismic/acoustic surveys have largely focused on the potential effects to fish stocks and marine mammals from the sound waves associated with the seismic/acoustic energy source.

Concerns have included:

- Pathological effects (lethal and sub-lethal injuries) – immediate and delayed mortality and physiological effects to nearby marine organisms;
- Behavioural change to populations of marine organisms;
- Disruptions to feeding, mating, breeding or nursery activities of marine organisms in such a way as to affect the vitality or abundance of populations;
- Disruptions to the abundance and behaviour of prey species for marine mammals, seabirds and fish; and
- Changed behaviour or breeding patterns of commercially targeted marine species, either directly, or indirectly, in such a way that commercial or recreational fishing activities are compromised.

The response of marine fauna to marine acoustic survey sounds will range from no effect to various behavioural changes. Immediate pathological effects are likely to be restricted to very short ranges and high sound intensities and are unlikely to occur for the majority of species, as most free-swimming animals will practice avoidance manoeuvres well before they get within the ranges at which pathological effects may occur.

7.3.1 Fish and Sharks

Acoustic surveys can have an impact on individual fish, fish populations and fisheries, either directly through harmful physiological effects or through behavioural changes.

There appears to be a wide range of susceptibility among fish; however, those with a swim bladder will be more susceptible than those without this organ. Many adult fishes, including the elasmobranchs (sharks and rays) do not possess a swim bladder and so are not susceptible to swim bladder-related trauma. Most pelagic fish are expected to swim away when acoustic noise reaches levels at which it might cause pathological effects; however, the anecdotal presence of many open sea fish near operating vessels suggest that some of these species are hardly affected by the sounds at all.

Studies with caged fish (e.g. Kosheleva, 1992) have shown that some fish species that are caged, and therefore unable to swim away from the noise source, can suffer physiological damage to eyes and hearing. Conditions that could result in fish being trapped and unable to move more than a few metres from the noise source as the survey vessel traverses the area do not exist in the proposed survey area (indeed it is difficult to conceive of any vessel-based acoustic survey causing fish to be trapped within a few metres of the noise source). Therefore it is considered that the risk of physiological effects to fish is negligible.

For some fish, strong 'startle' responses have been observed at underwater sound levels of 200 to 205 dB re 1mPa, indicating that sounds at or above this level may cause fish to flee. Sound levels of this magnitude are likely to occur approximately 100 to 300m from an acoustic energy source array. Based on this, an approximate range of 200m is given as the minimum distance at which fish may flee from an operating array, and below which pathological effects may occur (McCauley, 1994).

Based on existing information, significant impacts on fish populations resulting from acoustic survey noise are likely to be restricted to:

- Short ranges and high sound intensities (i.e. <200m range from source);
- Populations that cannot move away from operating arrays (e.g. shallow water site-attached benthic species);
- Surveys that take place over protracted periods close to areas important for the purposes of feeding, spawning or breeding; and
- Surveys that take place over protracted periods close to areas that constitute narrow restricted migratory paths.

Fish may possibly be exposed to noise levels sufficient to cause startle responses or pathological damage if air-gun arrays start suddenly. In circumstances where arrays are already operating (such as when a vessel moves along an acquisition line), individuals would be expected to implement avoidance measures before entering ranges at which pathological damage might take place. There are no narrow or restricted areas within the proposed survey areas that could 'trap' fish.

Twenty-seven fish species which may be impacted upon by the proposed exploration activity in Ringarooma Bay, include:

- great white shark;
- shortfin mako shark;
- Australian grayling;
- short-head seahorse;
- bullneck seahorse;
- leafy seadragon;
- common seadragon;
- Mother-of-pearl pipefish;
- Port Phillip pipefish;
- longsnout pipefish;
- spotted pipefish;
- widebody pipefish;
- ringback pipefish;

- hairy pipefish;
- red pipefish;
- pugnose pipefish;
- brushtail pipefish;
- Australian smooth pipefish;
- javelin pipefish;
- sawtooth pipefish;
- halfbanded pipefish;
- Tucker's pipefish;
- crested pipefish;
- rhino pipefish;
- knifesnout pipefish;
- trawl pipefish; and
- deepbody pipefish.

7.3.2 Cetaceans

Cetaceans employ an extremely acute acoustic sense to monitor their environment and are correspondingly sensitive to sounds below and, to a lesser extent, above the water surface (Richardson *et al.,* 1995). Sound waves created from acoustic operations, if they are of high enough intensity, may interfere with the acoustic perception and communication of any cetaceans in the vicinity, and may have the potential to induce stress.

Nine species which may be impacted upon by the proposed exploration activity in Ringarooma Bay include:

- common dolphin;
- pygmy right whale;
- minke whale;
- blue whale;
- humpback whale;
- orca;
- short-finned pilot whale;
- dusky dolphin; and
- bottlenose dolphin.

The protocols and EPBC Act Policy Statement 2.1 – interaction between offshore seismic exploration and whales, specify recommended and accepted practice for offshore seismic/acoustic exploration. A copy is provided in Appendix B.

Key measures are outlined in Table 19, and Section 8.8.3.

7.3.3 Seals

Two species which may be impacted upon by the proposed exploration activity in Ringarooma Bay include:

- Australian fur seal; and
- New Zealand fur seal.

The hearing capacity of seals is not well understood and only a small amount of data is available from captive seals from the northern hemisphere. Otariid seals (fur seals and sea lions) seem to have poorer hearing than phocids below 1 kHz and their high frequency cut off is at 36 to 40 kHz (Richardson *et al*., 1995).

The acoustic energy source array proposed will produce noise pulses at frequencies centred around 800Hz. This frequency is **one to two orders of magnitude below the predicted sensitivity of seals**. Anecdotal stories of seals approaching working seismic/geophysical vessels support the prediction that seals would be unaffected by the proposed acoustic survey. Richardson *et al* (1995) [p. 291] concludes 'Thus we might expect seals to be rather tolerant of, or habituated to underwater sounds from distant seismic sources'.

7.4 Disturbance to Marine Fauna from Mechanical Operations

The act of grab and drill sampling has the potential to impact on sessile species and their habitat through direct physical disturbance. This potentially includes the crushing of reefs with heavy sampling equipment and the scraping of the seafloor that removes seagrass beds. The magnitude of the disturbance from the exploratory activities are considered to be considerably less than that which would occur from commercial fishing operations (e.g. trawling) which are permitted in the Bay. Key measures to reduce the likelihood of impacting on fish habitat whilst conducting drill and grab samples are outlined in Section 8.6.

The geophysical surveys have the potential to impact on mobile aquatic marine species through direct physical disturbance caused by line entanglement and interference to animal movement patterns via the presence of an 'obstruction' presented by the coaxial cable and instruments towed behind the survey vessel. Key measures to reduce the likelihood of impacting on mobile marine animals (e.g. cetaceans, fish, seals and rays/sharks) whilst conducting the geophysical surveys are outlined in Section 8.7.3 and Section 8.8.3 of the EP.

Only two species, the Short tailed Shearwater and the Caspian Tern are listed as having breeding areas known to occur within the area.

Ten State reserves, other than natural and indigenous, were identified in the attached EPBC Protected Matters report. The majority of which were situated on land, outside of the exploration works area. However, three of the reserves are islands, as discussed below:

- Baynes Island is situated adjacent to Cape Portland on the eastern side of Ringarooma Bay.
- Foster Island is situated outside of the Ringarooma Bay exploration works area, immediately to the north east of Cape Portland. The island is Tasmania's only pelican breeding colony.
- Little Waterhouse Island is located to the west of the exploration works area, and Waterhouse Point on the western side of Ringarooma Bay. The island has been declared as part of the Ninth and Little Waterhouse Islands Important Bird Area, as it holds over 1% of the world population of Black-faced Cormorants.

None of these islands will be impacted directly by the proposed exploration works within Ringarooma Bay as the vessels will operate solely within the marine area and will anchor off the shore. The operation of the exploration vessels in Ringarooma Bay will provide similar distant visual and noise impacts to fishing vessels which already operate in the bay; hence indirect impacts on the bird habitats within the islands are expected to be extremely low to insignificant. All works will be undertaken more than 500m from the shore and any islands, including Baynes Island.

8. PERFORMANCE OBJECTIVES, STANDARDS AND MEASUREMENT CRITERIA

8.1 Potential Effects, Avoidance and Mitigation Strategies

The main potential environmental effects have been detailed in Table 19. In summary the main potential effects, from the proposed exploration work, fall into the following categories:

- degradation of the amenity of the Bay;
- degradation of the marine habitat, through contamination and disturbance;
- direct and indirect impacts to marine flora and fauna;
- introduction of marine pests.

Avoidance, mitigation and management measures have also been detailed in Table 19. These measures are outlined further in the relevant sections below, together with relevant performance criteria.

8.2 Objectives

The overarching objectives of the environmental management measures are to:

- **avoid** environmental impact or harm to the amenity, marine habitat or marine species (e.g. avoid peak migration times for cetaceans);
- **minimise and mitigate** unavoidable impacts to the amenity, marine habitat and marine species (e.g. presence of vessel, noise from vessel operating, etc.);
- gather and provide any **reportable information** as required (refer to Section 9).

8.3 General Vessel Operations

8.3.1 Background

General vessel operations in Ringarooma Bay will:

- Emit noise;
- Emit to air;
- Have lighting at night; and will
- Require anchoring at night or when not operating.

The main potential impacts are considered to be minor and to impact on the amenity in the bay, disturbance to fauna and disturbance to seafloor from anchoring.

8.3.2 Performance Criteria

The main criteria that would apply to general vessel operation include:

- United Nations Convention on the Law of the Sea 1982;
- *Navigation Act* 1912;
- Environmental Protection Policy (Air Quality) 2004;

- *Living Marine Resources Management Act* 1995;
- *Environmental Management and Pollution Control Act* 1994 (EMPCA) and
- Environmental Protection Policy (Noise) 2009.

8.3.3 Avoidance, Mitigation and Management

- Only well maintained vessels with experienced crews will be used;
- Only licensed vessel operators will be hired;
- All vessel operators and crew will familiarise themselves with the EP;
- Responsibilities for implementing actions under the EP will be clearly delegated to specific crew members;
- Surveys will be carried out during day-time hours;
- Surveys will be carried out outside of peak holiday periods;
- External facing night lighting will be avoided or minimised;
- Low impact bulbs will be used;
- Low impact anchor(s) will be used;
- Avoid anchoring of vessel during the surveys;
- Works to be undertaken over 500m away from the low water mark and any islands;
- Anchoring will occur only in areas of little or no seagrass and scallop beds or reefs (an underwater camera or ground-truthed maps will be used).

8.4 Storage and Waste Containment and Disposal

8.4.1 Background

Fuel and oils for normal vessel operations will be stored on the vessel(s); drilling muds will not typically be used for vibracoring or gravity coring, and only minimal quantities of cleaning detergents will be kept on the vessel for normal day to day function.

Likely wastes to be generated during the vessel operation may include:

- waste oil;
- solid wastes (consumables, packaging);
- putrescible wastes (food scraps, etc.);
- grey water; and
- sewage.

8.4.2 Performance Criteria

A number of commonwealth and state regulatory instruments govern different aspects of the protection of the sea, these include:

- *Environment Protection (Sea Dumping) Act* 1981;
- *Protection of the Sea (Civil Liability) Act* 1981;

- *Protection of the Sea (Prevention of Pollution from Ships) Amendment (oil transfers) Act* 2011;
- *Protection of the Sea (Prevention of Pollution from Ships) Act* 1983 & Protection of the Sea Legislation Amendment Bill 2010;
- National Plan to combat pollution of the sea by oil and other noxious and hazardous substances;
- Dangerous Substances (Safe Handling) Bill 2005;
- *Environmental Management and Pollution Control Act* 1994;
- Pollution of Waters by Oil and Noxious Substances Amendment Bill 2004;
- Tasmanian Waste and Resource Management Strategy 2009; and
- State Policy on Water Quality Management 1997.

8.4.3 Avoidance, Mitigation and Management

The following avoidance mitigation and management measures will be applied to avoid any discharges to or pollution of the sea.

Maintenance and housekeeping:

- Only well maintained vessels with experienced crews will be used;
- Oils will be stored in supplied dedicated storage containers;
- Correct segregation of chemical and hazardous wastes will be practised in all areas of the vessel;
- Correct segregation of solid and putrescible wastes will be practised in all areas of the vessel;
- Drilling muds or additives will not typically be used for vibracore or gravity drilling; if these happen to be required, minimal amounts will be used, biodegradable formulations will be used as a preference;
- Vessel decks will be kept swept and clean.

Refuelling:

Refuelling will only occur in dedicated vessel refuelling facilities, which have all equipment and materials to deal with spill contingencies.

Wastes:

- Waste oil will be stored in dedicated waste oil containers for disposal;
- No disposal of chemicals or hazardous wastes will occur to seawater;
- If used, no drilling additives / muds will be discharged to the marine environment;
- No solid or putrescibles wastes will be disposed to seawater; and
- Vibracore, gravity core and other samples will contain very little water, which will be drained to a sump.

Sewage:

- Preference will be given to lease vessels which store and process sewage; then pump out treated sewage at suitable port waste disposal facilities;
- If sewage needs to be discharged from the vessels, it will not be discharged within 3 nautical miles of the coastline unless vessel has a certified approved sewage treatment plant in place under Regulation 8 (1) (b) of MARPOL 73/78 Annex IV.
- Procedures for treatment and disposal of sewage will be in place. The sewage treatment system will include maceration and disinfection.
- If the vessel needs to discharge sewage between 3 and 12 nautical miles of coast, the sewage will, as a minimum, be comminuted, macerated and disinfected.

Records:

- A Waste Log will be maintained to record waste management practises;
- The Waste Log will record quantities of wastes transported ashore, where the waste was disposed, and by which licensed waste transport company.

Spills:
Spillages of fuel, oil or other pollutants of an **amount greater than 80 litres will be reported to the Designated Authority and to the State Environment Protection Authority (EPA) within 12 hours of any such spillage occurring** (refer to Section 9.1.5 and Section 9.2.2).

8.5 Ballast Water

8.5.1 Background

Vessels carry ballast water which may occasionally need discharging depending on its carrying load or sailing conditions.

8.5.2 Performance Criteria

The following commonwealth and state regulatory instruments provide overarching criteria dictating the need to prevent pollution of the seas by ballast water:

- International Convention for the Control and Management of Ship's Ballast Water and Sediments;
- *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC); and
- *Environmental Management and Pollution Control Act* 1994.

8.5.3 Avoidance, Mitigation and Management

- No international vessel will be used for the survey work; otherwise *Australian Ballast Water Management Requirements Version 5* will need to be applied;
- Ballast water will be pumped in at clean ports with pump intake placed in the water column several metres from the shore or the seafloor;
- Where possible, ballast water will be discharged where it was pumped in;
- Only well maintained vessels with experienced crews, familiar with Australian regulations will be used.

8.6 Drilling and Grab Sampling

8.6.1 Background

Vibracore drilling, gravity coring and grab sampling will be undertaken as part of the proposed exploration work. Each of these actions may disturb sediments, benthic communities, seagrasses and pipefish and seahorse habitat and rocky reefs.

8.6.2 Performance Criteria

The following commonwealth and state regulatory instruments provide overarching criteria to prevent or minimize disturbance to flora and fauna habitat and to prevent pollution of the sea by drilling or grab sampling:

- *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC);
- *Offshore Minerals Act* 1994;
- *Living Marine Resources Management Act* 1995;
- *Mineral Resources Development Act* 1995;
- State Policy on Water Quality Management 1997; and
- *Threatened Species Protection Act* 1995.

8.6.3 Avoidance, Mitigation and Management

- Underwater cameras will be used prior to carrying out vibracoring or gravity coring in order to avoid shipwrecks, avoid large seagrass and scallop bed and avoid reefs;
- Divers will be used where necessary to help site vibracore and gravity core sampling sites to minimise disturbance to scallop or seagrass beds and reefs;
- Diver bulk sampling will be undertaken after the diver has visually inspected the sampling area and will sample away from reef, seagrass, scallops or shipwrecks; and
- Works to be undertaken over 500m away from the low water mark and any islands.

8.7 Geophysical Survey

8.7.1 Background

The geophysical survey work proposed will include the use of a variety of emitting and detecting instruments fitted either to the vessel or to a line (armoured coaxial cable) which will be towed behind the vessel. There is potential for the line to become caught or entangled in fixed or moving objects or marine creatures. There is also potential for the acoustic components of the geophysical survey to affect some marine fauna species.

8.7.2 Performance Criteria

The following commonwealth and state regulatory instruments provide criteria to prevent or minimize disturbance to flora and fauna directly or indirectly, e.g. by disturbance to their habitat:

- *Environment Protection and Biodiversity Conservation Act*, 1999;

- EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales, September 2008 (a copy is provided in Appendix B);
- *Offshore Minerals Act* 1994;
- *Living Marine Resources Management Act* 1995;
- *Mineral Resources Development Act* 1995; and
- *Threatened Species Protection Act* 1995.

8.7.3 Avoidance, Mitigation and Management

Armoured Coaxial Cable:

- Devices attached to the long line (armoured coaxial cable) will not provide attractants to large marine birds – this will be achieved by keeping the devices below the surface of the water for as long as possible;
- Only a single line (armoured coaxial cable) will be used which will be kept under tension to avoid potential large fish/mammal entanglement;
- An underwater camera will be used in shallow water;
- Works to be undertaken over 500m away from the low water mark and any islands; and
- Depth sensing equipment will be used on the vessel to control the depth of the line (armoured coaxial cable) and ensure it is maintained at 10-15m above the seabed.

Acoustic Survey:

As surveys will be timed between February to March, outside of the peak cetacean migration times (May to December), it is considered that there will be a very low likelihood of encountering cetaceans. Based on DEWHA (2008) (Appendix B), only 'Standard Management Procedures' are proposed to be implemented, as outlined below. In the unlikely event that whales are encountered during the geophysical surveys, 'Additional Management Procedures' (as outlined in DEWHA 2008, EP Appendix B) will be implemented.

- Surveys will be carried out between January and April, i.e. outside of the peak cetaceans migration period (May to December);
- **If** the acoustic survey operators demonstrate that the received sound exposure level for each shot will not likely exceed 160dB re 1µPa2•s, for 95% of acoustic shots at 1km range, the following precaution zones will be applied (DEWHA, 2008 & Figure 28, below):
  - **Observation zone**: 3+ km horizontal radius from the acoustic source.
  - **Low power zone**: 1 km horizontal radius from the acoustic source.
  - **Shut-down zone**: 500m horizontal radius from the acoustic source.
- **If** the above cannot be demonstrate for the proposed acoustic surveys, then the applicable low power zone will be as follows, with the Observation and Shut-down zones being as stated above:
  - **Low power zone**: 2 km horizontal radius from the acoustic source.
- '**Pre-start**' observations will be made within a 3+ kilometre horizontal radius, for whales and seals; if a whale is sighted within the 3 kilometre zone during soft start a

crew member or dedicated observer will stay on the bridge to continuously monitor the whale(s) whilst in sight;

- If a whale is sighted within or about the enter the Low power zone, the acoustic source will be powered down to the lowest possible setting;
- If a whale is sighted within or is about to enter the Shut-down zone, the acoustic source will be shut down completely;
- '**Soft start**' procedures will be employed to permit free swimming mammals and fish to leave the area; soft start procedures will only resume after the whale has been observed to move outside the Low power zone, or when 30 minutes have lapsed since the last whale sighting;
- 10-minute continuous **whale and seal watch** will be held every hour during geophysical / acoustic surveys;
- Operators will prepare to implement and will implement **Low Power or Shut-Down** procedures as above (DEWHA, 2008, Appendix B), if whales are seen within 3km of the geophysical survey vessel;
- **Stop work** procedures will be implemented if seals are sighted within 100m of the geophysical vessel;
- Responsibilities for monitoring and recording whale and seal sightings will be clearly identified and conveyed to vessel personnel;
- Sighting reports will be completed according to (use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au).

September 2008: EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales

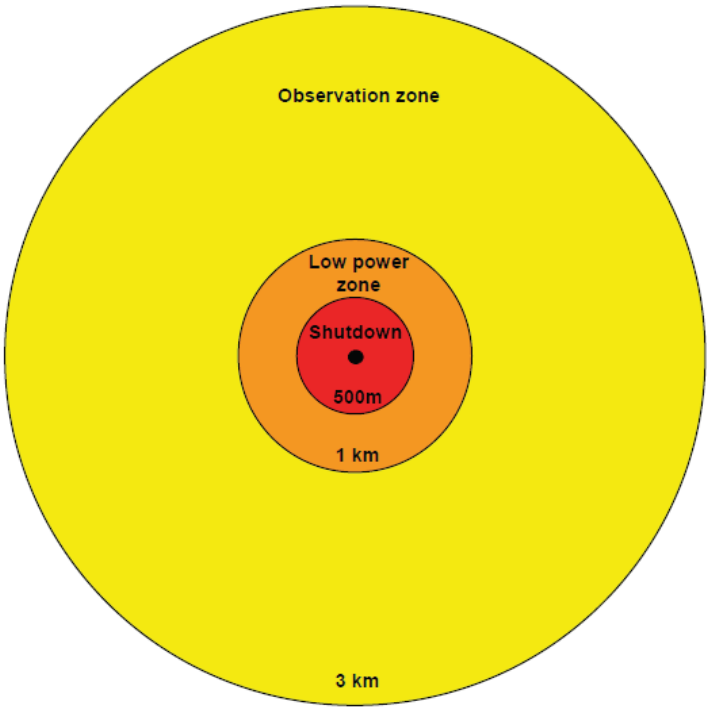


Diagram 1: Precaution zones surrounding the acoustic source for surveys that meet the criteria for a **1km low power zone**.

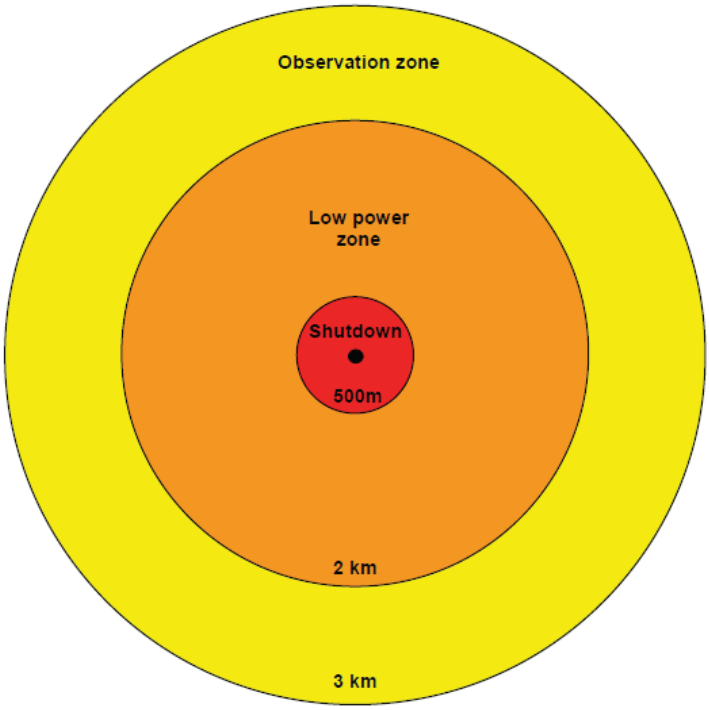


Diagram 2: Precaution zones surrounding the acoustic source for all other surveys (**2km low power zone**)

Figure 28: Precaution Zones for vessels emitting acoustic sources near whales (DEWHA, 2008)

8.8 Cetaceans, Seals

8.8.1 Background

Whales are known to transit past Tasmania during their seasonal migrations (northwards from May and southwards from September to December), and could use Ringarooma Bay as part of their route. The EPBC Act Protected Matters Report listed several whale and dolphin species that potentially have habitat in the area. Seals occur in many bays of Tasmania and are curious creatures. It is possible that the latter may be encountered during the proposed exploration survey work. Disturbance from geophysical survey work has been discussed in the previous section (Section 8.7), however disturbance may also occur to marine mammals from the presence of the vessel(s) and from the proposed vibracoring, gravity coring and grab sampling operations.

8.8.2 Performance Criteria

The following commonwealth and state regulatory instruments provide criteria to prevent or minimize disturbance to fauna directly or indirectly, e.g. by disturbance to their habitat and in particular, prevent or minimize disturbance to threatened and migratory species of cetaceans:

- *Environment Protection and Biodiversity Conservation Act*, 1999 (EPBC);
- EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales, September 2008;
- *Threatened Species Protection Act* 1995; and
- *Environmental Management and Pollution Control Act* 1994.

8.8.3 Avoidance, Mitigation and Management

- Surveys will be carried out early in the typical cetaceans migration period (May to December); TNT is currently planning to carry out the gravity coring in November-December 2012, and the vibracoring, grab and diver sampling in April 2013;
- The following precaution zones will be applied to gravity coring, vibracore, grab and diver sampling work (adapted from DEWHA, 2008 & Figure 28, below):
  - **Observation zone**: 3+ km horizontal radius from the vessel.
  - **Low power zone**: 1 km horizontal radius from the vessel.
  - **Shut-down zone**: 500m horizontal radius from the vessel.
- '**Pre-start**' observations will be made within a 3+ kilometre horizontal radius, for whales and seals; if a whale is sighted within the 3 kilometre zone a crew member or dedicated observer will stay on the bridge to continuously monitor the whale(s) whilst in sight;
- If a whale is sighted within or about the enter the 1km radius from the vessel (Low power zone), warnings will be provided to all operators to exercise caution in their underwater work;
- If a whale is sighted within or is about to enter within 500m from the vessel (the Shut-down zone), retrieval or despatch of sampling equipment (e.g. vibracore rig, grab bucket) will be halted until the whale(s) has moved beyond the 500m (Shut-down zone);

- If a whale(s) is/are sighted less than 300m from the vessel then the vessel speed will be reduced to 'no wake' and the vessel will move away from the whale(s) to increase the distance to over 300m;
- **Complete Stop Work** procedures will be implemented if seals or whales are sighted within 100m of the survey vessel;
- 10-minute continuous **whale and seal watch** will be held every hour during drilling or grab-sampling work;
- Responsibilities for monitoring and recording whale and seal sightings will be clearly identified and conveyed to vessel personnel.

Reporting
A report on the conduct of the survey, and any whale interactions, should be provided to the Department **within two months of survey completion**.

Sightings and survey information will be recorded within the **'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au**. Upon completion of the survey the information entered into this application should be exported as a text file and emailed to sightingsdata@aad.gov.au as per the instructions within the application. An emailed confirmation will be sent upon receipt of each submission.

The report is expected to require:

- the location, date and start time of the survey;
- name, qualifications and experience of any Marine Mammal Observers (or research scientists) involved in the survey;
- the location, times and reasons when observations were hampered by poor visibility or high winds;
- the location and time of any start-up delays, power downs or stop work procedures instigated as a result of whale sightings;
- the location, time and distance of any whale sighting including species where possible; and
- the date and time of survey completion.

8.9 Shipwrecks

8.9.1 Background

Four (4) known shipwrecks over 75 years old occur within Ringarooma Bay if these are encountered provisions under the *Historic Shipwrecks Act 1976* and *Historic Cultural Heritage Act 1995* will be triggered.

8.9.2 Performance Criteria

Proponents and their contractors must conform to all requirements of the *Historic Shipwrecks Act* 1976, and:

a. Must not damage, destroy or interfere with any historic shipwrecks or relics that may be encountered during the course of a proposed action without a permit;

b. Must not enter or conduct activities within a shipwreck protected zone without first obtaining a permit under the Historic Shipwrecks Act;

c. Must provide the Department's Maritime Heritage Section with written notification of the discovery of any suspected shipwreck or shipwreck relics identified during the course of the proposed action including:

   i. a detailed description of the remains of the shipwreck or of the relic. This could include sonar images, electronic data and digital photographs; and

   ii. a description of the place where the shipwreck remains or relic is located that is sufficiently detailed to allow it to be identified and re-located including navigation data and datum information.

Any proposed actions involving contact with the seabed, or operations in close proximity to the seabed, that could potentially damage, destroy or interfere with historic shipwrecks or relics, should include risk mitigation strategies to ensure both located and previously un-located historic shipwrecks are not disturbed. Operational protocols should be put in place to ensure that identified risks are appropriately dealt with and to prevent possible breaches of the *Historic Shipwrecks Act 1976*.

Depending on age, design and the types of materials used in construction, the remains of a historic shipwreck may be visible on the seafloor or could be fully or partly buried. Appropriate strategies could include desktop studies of the area to identify known or potential historic shipwreck locations, avoiding the areas surrounding known and suspected historic shipwrecks and identifying the physical remains of shipwrecks using detailed sonar, magnetometer or sub bottom profiling surveys of the areas to be impacted.

Under the current laws *(Historic Shipwrecks Act 1976* and *Historic Cultural Heritage Act 1995*) it is illegal to interfere with a protected shipwreck site without a permit from the managing authority.

Both laws require discoveries of a shipwreck or the possession of artefacts from protected shipwrecks to be reported. For the reporting of sites, permits, advice or information concerning Tasmania's shipwrecks and other maritime heritage places please contact:

Mike Nash
Maritime Archaeologist
Historic Heritage Section
Parks and Wildlife Service
134 Macquarie Street
Hobart 7000 Tasmania
Ph: 03 6233 2387
Fax 03 6224 0884
email - Mike.Nash@parks.tas.gov.au

8.9.3 Management of Exploration Works near and along the Seafloor

The following measures will be implemented to avoid damage to existing shipwrecks within Ringarooma Bay and provide any information obtained opportunistically on a shipwreck(s) during the geophysical survey.

- Depth sensing equipment will be used to ensure the vessel, line and geophysical equipment are kept at least 10-15m above the seabed at all times;
- Use underwater camera to check and confirm obstructions on the seabed prior to anchoring, vibracoring, grab sampling or other work near or on the seabed;
- Particular care will be taken in areas where there may be known shipwrecks (Figure 26);
- If a shipwreck is sighted, it will not be disturbed;
- Underwater photos, film or sonar will be taken if possible;
- The estimated location will be recorded as accurately as possible;
- The location and observations will be reported to Mike Nash on the details above.

8.10 Incidents and Accidents

8.10.1 Background

It is possible that the following incidents / accidents could occur to the survey vessel(s):

- spills of contaminating compounds into the marine environment;
- objects could be dropped;
- the vessel(s) could breakdown, run aground or capsize.

It should be noted that the risk rating for these events was assessed to be 'Low' (Table 19).

8.10.2 Performance Criteria

The following commonwealth and state regulatory instruments provide relevant criteria to prevent or minimize impacts from potential incidents from the proposed exploration work:

- National Plan to combat pollution of the sea by oil and other noxious and hazardous substances;
- *Environmental Management and Pollution Control Act* 1994;
- *Pollution of Waters by Oil and Noxious Substances Amendment Bill* 2004; and
- TasPlan – Tasmanian Marine Oil Spill Contingency Plan (February 2011).

8.10.3 Avoidance, Mitigation and Management

Spills:

- Only well maintained vessels with experienced crews will be used;
- Oils, chemicals and other potential contaminating liquids or materials will be stored in supplied dedicated storage containers and will be segregated as recommended on their respective MSDS;
- Refuelling will only occur in dedicated vessel refuelling facilities, which have all equipment and materials to deal with spill contingencies; and
- Spillages of fuel, oil or other pollutants of an amount **greater than 80 litres will be reported to the Designated Authority and to the State Environment Protection Authority (EPA) within 12 hours of any such spillage occurring**.

Objects overboard:

- Good housekeeping will be practised on board the vessel, e.g. efficient waste collection, segregation and enclosure;
- Whenever possible, materials / equipment handling tasks will be carried out within enclosed / walled areas of the vessel to prevent materials / equipment falling or rolling overboard;
- Survey work will be undertaken during calm seas which will minimise the chance of accidentally dropping objects overboard; and
- Underwater camera(s), diver(s) and cables will be used to retrieve any materials / equipment dropped overboard.

Breakdown, run aground or capsize:

- The vessel(s) hired will be well maintained and have a sufficient and experienced crew;
- Existing marine charts will be obtained prior to survey work;
- Bathymetric and seafloor data gathered during the surveys will be used, where possible, to inform vessel placement;
- Weather forecasts will be scrutinised ahead of and during all survey work;
- Survey work will be undertaken during calm seas;
- All solid waste containers will be capped with clippable lids;
- All liquid waste containers will be sealed;
- Emergency procedures will be developed and practised by the crew; and
- **Emergency service numbers will be recorded** prior to the surveys (refer to Section 9.1.5) and the DA and Emergency services **will be notified** of the timing, location and nature of the proposed surveys.

9. IMPLEMENTATION STRATEGY AND REPORTING

9.1 Implementation Strategy

9.1.1 Systems, Practices and Procedures

Table 20 outlines the Implementation Guide for all Avoidance, Mitigation and Management measures outlined in Section 8. The table lists all environmentally relevant activities, as listed in Table 19 and:

- allocates responsibilities for management of each activity;
- lists the relevant procedures to be implemented;
- lists the tools (e.g. report) through which performance will be assessed.

Overarching responsibilities will lie with:

- Mr Mike Woodbourne, TNT Mines' Marine Manager; and
- The Vessel Master.

Additional and delegated responsibilities are detailed in Table 21.

Performance criteria, avoidance, mitigation and management are detailed throughout Section 8 of the EP.

The main assessment tools will include:

- The Ordinary Report to the DA;
- The Waste Log Form;
- Incident report(s) to the DA;
- Sighting report(s) to the DA (as per 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au).

9.1.2 Roles and Responsibilities of Personnel

The following roles and responsibilities will be allocated to individual proponent representatives and crew members. Overarching responsibility for the implementation of the EP will lie with **Mr Mike Woodbourne, TNT Mines' Marine Manager**. The Vessel Master and survey crew will also have their responsibilities clearly outlined in their contracts, to which they will be bound by mutual agreement.

Table 20: Implementation Guide

Environmentally Significant Activities	Responsible Person(s)	Relevant Procedure or management measures	Measurement / assessment
Physical operation of vessel	Vessel Master & TNT Mines' Marine Manager	Section 8.3 of EP	**Ordinary report** to DA; community complaints
Use of local accommodation and supply outlets	Vessel Master & TNT Mines' Marine Manager	Section 8.3 of EP	**Ordinary report** to DA; community complaints
Fuel, oil and waste oil on board	Vessel Master & TNT Mines' Marine Manager	Section 8.4 and Section 8.10 of EP	**Ordinary report** to DA; **Waste Log Form**; **Incident report** to DA
Refuelling	Vessel Master & TNT Mines' Marine Manager	Section 8.4 and Section 8.10 of EP	**Ordinary report** to DA; **Incident report** to DA
Ballast water and unwanted marine pests	Vessel Master & TNT Mines' Marine Manager	Section 8.5 of EP	**Ordinary report** to DA; **Waste Log Form**
Liquid wastes, such as grey water and sewage	Vessel Master & TNT Mines' Marine Manager	Section 8.4 of EP	**Ordinary report** to DA; **Waste Log Form**
Chemicals, cleaning detergents and hazardous wastes	Vessel Master & TNT Mines' Marine Manager	Section 8.4 and Section 8.10 of EP	**Ordinary report** to DA; **Waste Log Form**; **Incident report** to DA
Solid wastes, such as packaging, domestic wastes, putrescibles, equipment consumables	Vessel Master & TNT Mines' Marine Manager	Section 8.4 of EP	**Ordinary report** to DA; **Waste Log Form**
Vibracore, gravity core, grab samples	Vessel Master & TNT Mines' Marine Manager	Section 8.6 of EP; Section 8.9 of EP	**Ordinary report** to DA; **Incident report** to DA
Disposal of waste water from the deck of the vessel (water from drilling, or rain, etc.)	Vessel Master & TNT Mines' Marine Manager	Section 8.3 of EP	**Ordinary report** to DA
Geophysical survey work – long armoured coaxial cable	Vessel Master & TNT Mines' Marine Manager	Section 8.7 of EP; Section 8.9 of EP	**Ordinary report** to DA; **Incident report** to DA; **Sighting Report** to DA (use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au)
Vessel anchoring	Vessel Master & TNT Mines' Marine Manager	Section 8.3 of EP; Section 8.9 of EP	**Ordinary report** to DA; **Incident report** to DA

Environmentally Significant Activities	Responsible Person(s)	Relevant Procedure or management measures	Measurement / assessment
Geophysical survey work - release of sound from acoustic source	Vessel Master & TNT Mines' Marine Manager	Section 8.7 of EP; Section 8.8 of EP; reference to DEWHA 2008 copied in EP Appendix B	**Ordinary report** to DA; **Incident report** to DA; **Sighting Report** to DA (use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au)
Dropping of objects overboard	Vessel Master & TNT Mines' Marine Manager	Section 8.10 of EP	**Ordinary report** to DA; **Incident report** to DA
Vessel breakdown, capsize, running aground	Vessel Master & TNT Mines' Marine Manager	Section 8.10 of EP	**Ordinary report** to DA; **Incident report** to DA
Vessel bulk	Vessel Master & TNT Mines' Marine Manager	Section 8.3, 8.8, 8.9 of EP	**Ordinary report** to DA; **Incident report** to DA; **Sighting Report** to DA (use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au)

Table 21: Roles and Responsibilities

Role	Responsibilities	Tasks
TNT Mines Marine Manager	Overarching responsibility to report to the DA and other regulators.	- **Ordinary report** to DA (as per Section 9.2.1); - **Incident report(s)** to DA (as per Section 9.2.2); - Review of EP 12 months after approval by DA.
	Meet the objectives listed in Section 8.2 of the EP.	Ensuring that the proposed avoidance, mitigation and management measures outlined in Table 19, and Sections 8.3 to 8.10 are implemented.
	To implement any additional conditions of approval.	Ensure all additional conditions of approval (of exploration licences) are implemented.
	Verifying that operations are being undertaken according to the EP.	Review any reports provided by the Vessel Master(s) and remain in regular contact to ensure the EP measures and any relevant conditions of approval are being complied with. Keep an **Internal Daily Log** of all exploration and related vessel activities.
	Ensure that the vessel masters(s) and survey crew(s) follow all avoidance, mitigation and management measures relevant to their work.	The **Contract** with vessel master(s) and with survey crew(s) will include their requirement to comply with the relevant requirements of the approved EP, as outlined in Table 19, and Sections 8.3 to 8.10. Any other relevant conditions of approval will also be included in their contractual requirements.
	Ensure the EP and procedures are updated	Update the procedures and EP as required, if significant changes are made, submit to DA for approval
TNT Mines Marine Manager and Vessel Master	Delegating responsibilities to relevant crew and survey staff as appropriate.	Delegate tasks to crew members or survey staff, provide the information relevant to the tasks and provide any training or induction needed. Maintain a **Training Log**.
Vessel Master	Safe operation of the vessel. Responsible for health, safety and environmental matters on the vessel.	Operate vessel safely with due regard to crew health and to all applicable environmental matters and measures as outlined in Table 19, and Sections 8.3 to 8.10 of EP, and any additional conditions of approval, as detailed by TNT and agreed in contractual terms. Maintain a **Daily Vessel Log**.
Vessel Master	Overarching responsibility to report to TNT management on all environmental matters, and in particular any matters delegated to the vessel master and his crew.	- Implement all tasks allocated; - Delegate to relevant crew; - Provide environmental induction and training as required, complete Training Log maintained by TNT Mines Marine Manager; - Report all environmental matters to TNT management. - Report any environmental incidents to TNT (Refer to Section 9.2.2).

Role	Responsibilities	Tasks
Vessel Crew and Survey Crew	Implement the responsibilities allocated to them	- Carry out all relevant tasks allocated; - Report on all relevant tasks allocated to the vessel master; - Complete any written reports or logs if required for a particular task; - Remain proactive regarding environmental matters as induction will provide general awareness of the key issued in Ringarooma Bay; - Survey crew to abide by their conditions of **Contract**

9.1.3 Training and Competencies

The vessel and survey crews will be licensed and experienced operators. Prior to leaving the initial supply port, an induction will be held with all vessel and survey crew members and vessel master(s) summarising the key environmental aspects and risks, as identified in Table 19 and throughout Section 8. Specific responsibilities will be allocated, as detailed above, and detailed information on individual tasks will be provided to each of the relevant people.

9.1.4 Monitoring, Auditing, Management of Non-conformances and Review

On a day-to-day basis, TNT Mines Marine Operations Manager will check all records such as **internal logs, waste logs**, and will be present during all vessel operations.

Incident reports and **Sighting reports** (use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au) will be completed and lodged with the DA, Tasmanian EP and Commonwealth authority on an as-required basis.

An **Ordinary report** of environmental performance during the exploration activities will be lodged with the DA on completion of the geophysical survey and sampling work. The Ordinary report will assess and audit the compliance of the exploration works against the criteria set out in the EP.

The **EP will be reviewed 12 months after its approval by the DA**. The EP review will include a check for currency against relevant environmental legislation and other requirements and will reflect any changes to proposed operations.

If significant changes to the proposed operations are made, the EP will be resubmitted to the DA for review and approval.

9.1.5 Emergency and Incident Response

The emergency and incident response process will follow the steps:

Detection => Response and Communication => Reporting

As soon as an emergency or incident situation is detected during vessel operations, initial response steps will be followed; once the emergency or incident is controlled, corrective actions and reporting will be instigated, as detailed below.

EMERGENCY AND INCIDENT RESPONSE

INITIAL RESPONSE

1. Determine exact location of emergency / incident
2. Alert all vessel and survey crew of emergency / incident
3. Determine whether people or animals have been injured and make safe where possible
4. Determine source of incident and rectify if possible
5. Phone **1 800 641 792 (RCC of AMSA)** if external emergency help is required

WHEN EMERGENCY / INCIDENT IS CONTROLLED, THEN:

6. Stabilise and monitor any affected crew
7. Instigate assistance to injured animals if practicable
8. Commence Emergency Log record of events
9. Instigate clean up / retrieval of any materials on vessel, sea or shore
10. Provide initial notifications to relevant parties (e.g. DA (refer to incident reporting requirements in Table 22 of EP), Tasmanian EPA, Proponent managers)
11. Complete Incident Report and circulate to all relevant parties
12. Spillages of fuel, oil or other pollutants of an amount greater than 80 litres must be reported to the Designated Authority (DA) and to the State Environment Protection Authority (EPA) within 12 hours of any such spillage occurring (Incident Report)

Maritime Emergency Services Contact details

The Rescue Coordination Centre (RCC) which works under the Australian Maritime Safety Authority (AMSA). The RCC operates a 24 hour Emergency numbers:

1 800 641 792 or +61 2 6230 6811

The RCC may either coordinate the search and rescue or may pass the coordination of the appropriate regional police organisation to conduct the search and rescue operations within their jurisdiction. The RCC can also coordinate medical evacuations and broadcasts maritime safety information.

Designated Authority (DA) Contact details

Mineral Resources Tasmania
Street Address: 30 Gordons Hill Road, Rosny Park, Tasmania
Postal Address: PO Box 56, Rosny Park, Tasmania, Australia 7018
Main Switchboard: (03) 6233 8377
Fax Number: (03) 6233 8338
Email: info@mrt.tas.gov.au
Contact: Mrs Carol Bacon

Tasmanian EPA Contact details

To notify the Director EPA of a pollution incident call the Pollution Incidents and Complaints Hotline number (24 hours a day, 7 days a week):

1800 005 171

The notification must include: full name, address and telephone contact details; date, time and duration of the incident; the type of pollutant or a description of the incident, discharge or emission; location of the incident, being as specific as possible; the source and cause of pollution if known; the extent or size of the area where the pollution is visible; anything else that is relevant to the incident; any photographs of the incident if possible, these can be sent at a later time.

Alternatively, if the incident has been resolved contact EPA by lodging the above information by email to **incidentresponse@environment.tas.gov.au**.

Proponent Contact details

Mr Michael Beer
Managing Director & CEO
TNT Mines Limited

Level 2, 34 Colin Street
West Perth WA 6005
Australia

T: (08) 6468 4578
M: 0412 945 818
E: mbeer@tntmines.com.au

9.1.6 Record Keeping

The following records will be kept during the exploration works on Ringarooma Bay:

- A **Training Log** of all staff working on the exploration vessel will be kept by TNT Mines' Marine Operations Manager;
- An **Internal Daily Log** of all exploration activities will be kept by TNT Mines' Marine Operations Manager;
- A **Waste Log form** will be kept by the Vessel Master of all wastes disposed to sea or land by the vessel during the exploration activities ;
- The Vessel Master shall keep his **Daily Vessel Log** of vessel activities;
- Copies of all **Incident reports, Sighting reports** or other correspondence during the vessel's exploration activities will be kept by TNT Mines' Marine Operations Manager.

An **Ordinary Report** will be issued on completion of the exploration works at Ringarooma Bay. This report will provide a synopsis of all activities, logs, incidents, sightings and other relevant information.

9.2 Reporting

9.2.1 Routine Reporting

Routine reporting will include the following items.

BEFORE undertaking the survey work:
notify DA, EPA and AMSA (details above in Section 9.1.5);

DURING the survey work:

- Internal reporting, including Daily Vessel log and Internal Daily log for the exploration crew (refer to Section 9.1.6);
- Waste logs (refer to Section 9.1.6, Table 19, Section 8.4 and Section 8.5);
- Sightings Reports for whales and seals (use 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au);
- Reporting of shipwrecks (refer to Section 8.9.3);

AFTER the survey work:
Ordinary Report (on completion of the marine exploration works) (refer to Section 9.1.4).

9.2.2 Incident Reporting

Incidents will be reported according to the requirements outlined in Table 22 and Section 9.1.5.

Table 22: Incident Reporting Requirements and Timing

Type	Requirement	Timing
Reportable	The operator must notify the DA of any unplanned event identified as having a 'moderate to catastrophic' consequence level during the exploration survey work e.g. breach of quarantine procedure, disturbance to a particular sensitivity associated with the project, etc.	Notify the DA verbally, as soon as practicable, but **within 12 hours; then in writing, within 3 days**
	80L or more of hydrocarbon or hazardous chemical discharged to sea	
	Death or injury to individual(s) from a Listed Species (Refer to Table 11 and Appendix F and Appendix B of the EP) during an activity	
	Unplanned impact caused to a matter of national environmental significance (NES) during an activity (as per the EPBC Act) (Refer to Table 11 of the EP).	
Recordable	Any incident arising from the activity that breaches a performance objective or standard identified in the EP e.g. small spill of hydraulic fluid (<80L), inadequate waste management, loss of equipment to the ocean, etc.	Notify the DA monthly, **on or prior to the 15th day of each month**

10. CONSULTATION

Consultation to January 2012 has been summarised and discussed in Section 6.8. As discussed in Section 6.8, consultation to date by TNT Mines has been undertaken with:

- the Delegated Authority – MRT, and the Commonwealth;
- complainants who responded to the public notices advertising the exploration licences; and
- geophysical surveys specialist contractors.

Additional consultation will be undertaken once the Commonwealth licences have been granted. TNT Mines will then liaise with the local community (Tomahawk and landowners surrounding Ringarooma Bay) to brief them on the project and address any additional concerns that may be raised.

Future consultation is expected to involve the following:

- a public notice (e.g. in newspaper and local shop) notifying of a public meeting;
- a public meeting in Tomahawk for all local residents and landowners;
- a public notice (e.g. in newspaper and local shop) notifying of actual timing of surveys;
- formal notification and reporting to authorities as outlined in Section 9.2.1.

11. REFERENCES

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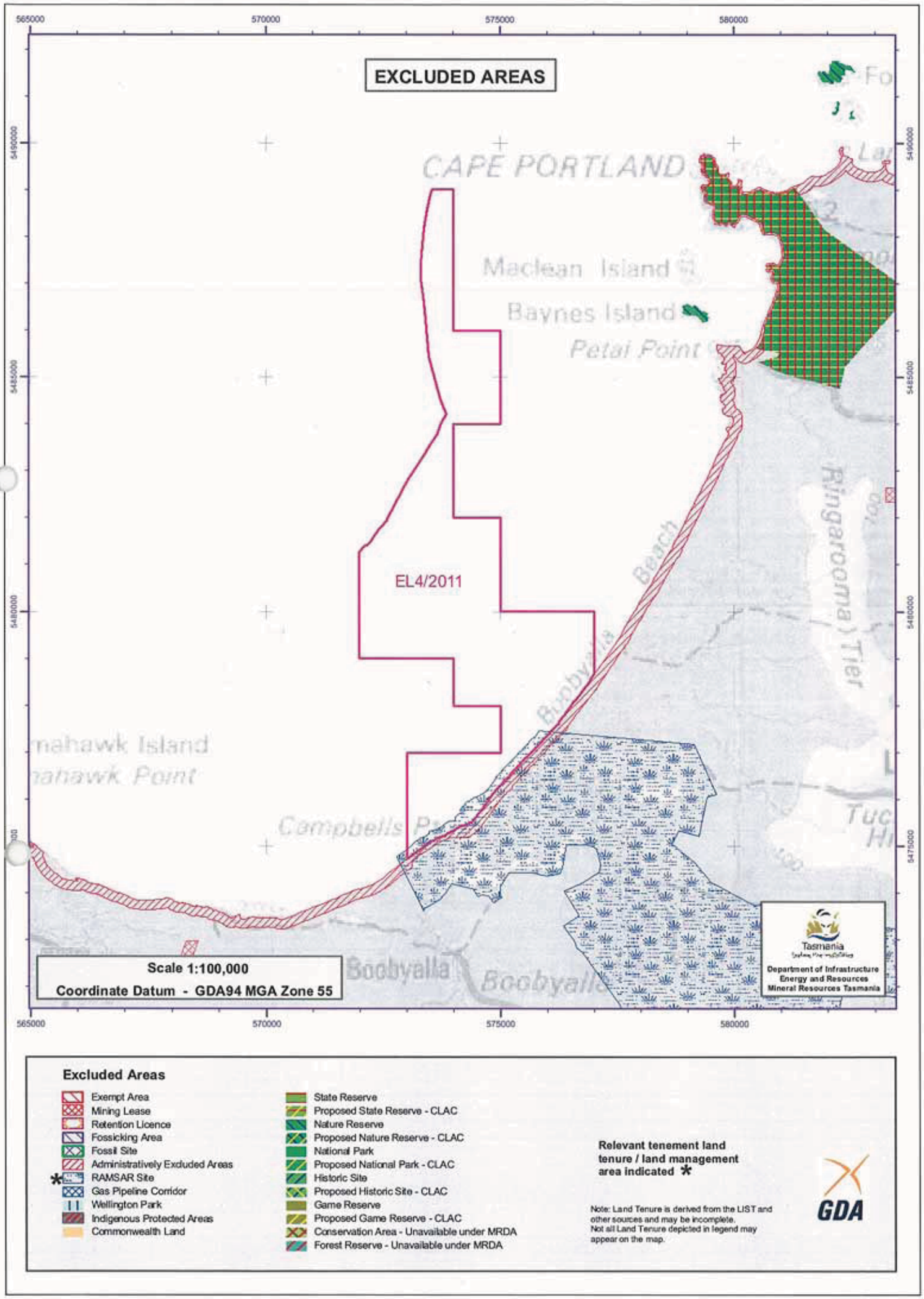
Appendix A - Excluded Areas from State Licences



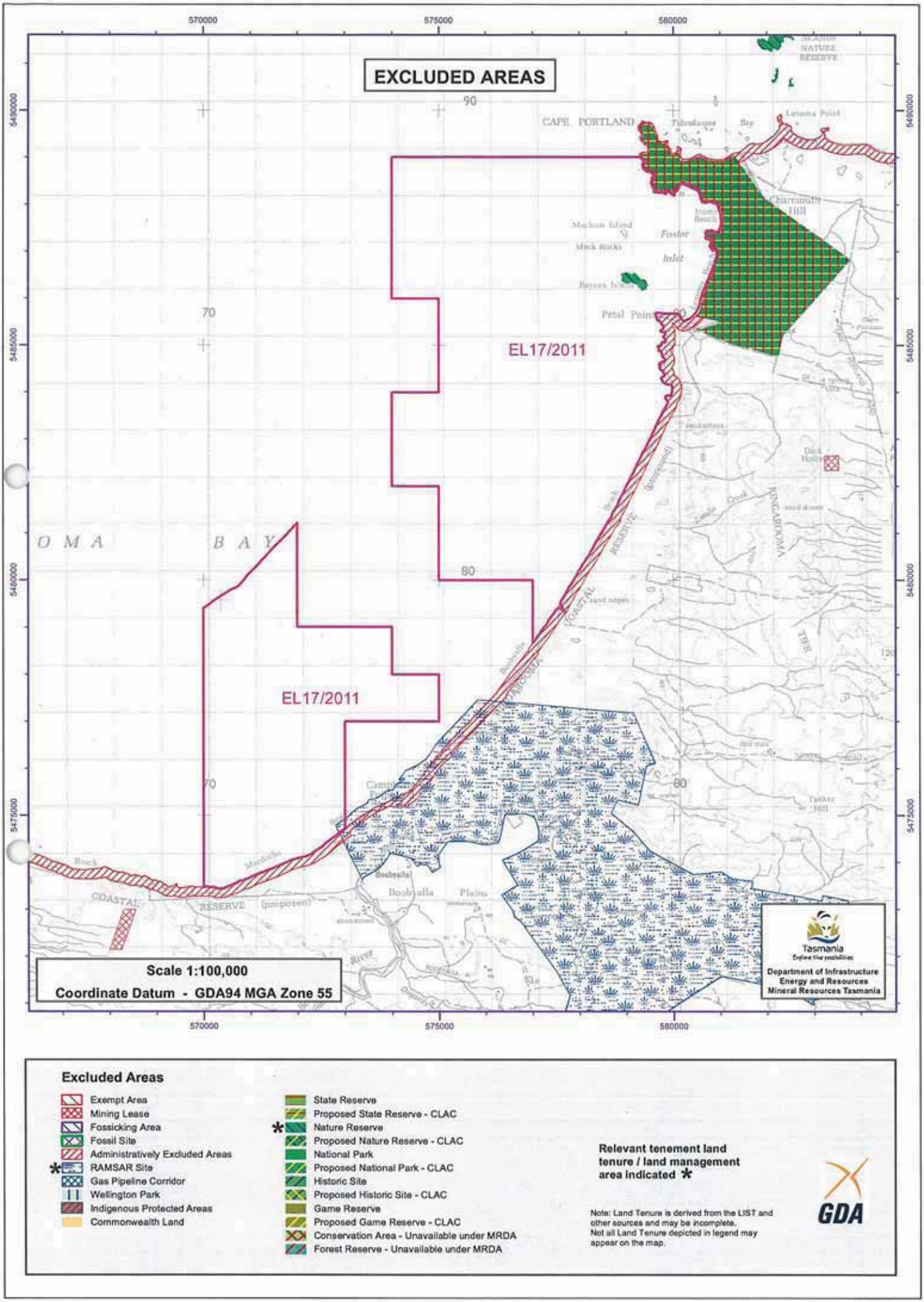
Excluded Areas

- Exempt Area
- Mining Lease
- Retention Licence
- Fossicking Area
- Fossil Site
- Administratively Excluded Areas
- * RAMSAR Site
- Gas Pipeline Corridor
- Wellington Park
- Indigenous Protected Areas
- Commonwealth Land
- State Reserve
- Proposed State Reserve - CLAC
- Nature Reserve
- Proposed Nature Reserve - CLAC
- National Park
- Proposed National Park - CLAC
- Historic Site
- Proposed Historic Site - CLAC
- Game Reserve
- Proposed Game Reserve - CLAC
- Conservation Area - Unavailable under MRDA
- Forest Reserve - Unavailable under MRDA

Relevant tenement land tenure / land management area indicated *

Note: Land Tenure is derived from the LIST and other sources and may be incomplete. Not all Land Tenure depicted in legend may appear on the map.

GDA



Excluded Areas

- Exempt Area
- Mining Lease
- Fossicking Area
- Fossil Site
- Administratively Excluded Areas
- * RAMSAR Site
- Gas Pipeline Corridor
- Wellington Park
- Indigenous Protected Areas
- Commonwealth Land
- State Reserve
- Proposed State Reserve - CLAC
- * Nature Reserve
- Proposed Nature Reserve - CLAC
- National Park
- Proposed National Park - CLAC
- Historic Site
- Proposed Historic Site - CLAC
- Game Reserve
- Proposed Game Reserve - CLAC
- Conservation Area - Unavailable under MRDA
- Forest Reserve - Unavailable under MRDA

Relevant tenement land tenure / land management area indicated *

Note: Land Tenure is derived from the LIST and other sources and may be incomplete. Not all Land Tenure depicted in legend may appear on the map.

GDA

Appendix B - DEWHA Protocols and EPBC Act Policy Statement 2.1 - Interaction between offshore seismic exploration and whales

Australian Government

Department of the Environment, Water, Heritage and the Arts

EPBC Act
Policy Statements

EPBC Act Policy Statement 2.1 –
Interaction between offshore seismic exploration and whales

Australian Government

Department of the Environment, Water, Heritage and the Arts

September 2008

1. AIM

The aim of this Policy Statement is to:

1. provide practical standards to minimise the risk of acoustic injury to whales in the vicinity of seismic survey operations;
2. provide a framework that minimises the risk of biological consequences from acoustic disturbance from seismic survey sources to whales in biologically important habitat areas or during critical behaviours; and
3. provide guidance to both proponents of seismic surveys and operators conducting seismic surveys about their legal responsibilities under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)[1].

This Policy Statement updates and replaces the previous Guidelines (May 2007). This Policy Statement should be read in conjunction with the associated Background Paper.

2. INTRODUCTION

Seismic surveying is widely used in the marine environment to define and analyse subsurface geological structures, mainly by the oil and gas exploration and production industry. Seismic surveying utilises a technique that directs acoustic energy (sound) into the rock beneath the sea floor from equipment towed behind a purpose-built seismic vessel. The loudest sound sources used in seismic survey operations are produced by air-guns which generate short, intense pulses of sound directed at the seafloor. The pulses are broad band, but most energy is concentrated in the 10 – 200 Hertz (Hz) frequency range, with lower energy levels in the 200 – 1000 Hz range. The air-guns are fired repeatedly as the ship traverses an area of interest. In a typical survey the sound levels from the air-gun array are in the range of 200 – 250 dB_{rms} re 1uPa at 1m. When acoustic energy reaches the different layers of rock under the sea bed, it may be reflected back to the surface of the water where waterproof microphones (hydrophones) can receive and record the reflected energy signals. The hydrophones capture the different sound waves which have been reflected back by the rock beneath the sea bed enabling a map to be made of these layers. The signals can then be processed into cross-sections and maps showing the geological structures below the sea floor. These can then be used to identify potential areas where oil and gas deposits may occur.

The effects of human made sound in the marine environment is a concern for marine life, particularly whales and dolphins that may be sensitive to certain sound levels, potentially resulting in physical and/or behavioral impacts. As the effects of seismic surveying on whales are not fully understood, precautionary mitigation measures aimed at preventing injury and minimising the risk of biologically significant behavioral changes should be applied to ensure their protection. Extensive research efforts over many years have been undertaken by the oil and gas industry, governments and other institutions to understand the possible effects from seismic exploration activities. This information has helped in preparing this Policy Statement. Gaps in knowledge still exist, highlighting the need for further research in this area and this Policy Statement may need to be amended as further information becomes available.

This Policy Statement has been written with the goal of minimising the likelihood of injury or hearing impairment of whales based on current scientific understanding. Calculations are primarily based on received sound energy levels that are estimated to lead to a temporary threshold shift (TTS) in baleen whale hearing. This Policy Statement is not intended to prevent all behavioral changes, which might occur in response to detectable, but non-traumatic sound levels. In fact, it is likely that whales in the vicinity of seismic surveying will avoid the immediate area due to an aversive response to the sound. This aversion is relied upon as a form of mitigation to prevent whales from approaching or being approached closely enough to cause acoustic injury from intense or prolonged sound exposure. At the scale of a seismic survey, such temporary displacements are unlikely to result in any real biological cost to the animals unless the interaction occurs during critical behaviours (e.g. breeding, feeding and resting), or in important areas such as narrow migratory corridors. In these biologically important habitats (defined in Section 4 below), where the displacement of whales may have a more significant or biologically relevant effect, the proponent is encouraged to conduct the survey at different times of year to avoid overlap with the presence of whales. If you propose to undertake a survey in an important habitat area you should refer the proposal to the Department. Such referrals will be considered on a case by case basis to assess the degree to which there is likely to be a significant adverse impact on whales.

[1] For the purpose of this policy statement, '**proponent**' means the party responsible for the seismic survey, and '**operator**' means the party conducting the seismic survey.

3. SCOPE OF THE POLICY STATEMENT

Under the EPBC Act, a number of whale species are listed as threatened and/or migratory species and are, subsequently, protected under the Act as matters of national environmental significance (NES). Whale species are also part of the Commonwealth marine environment, another matter of NES.

Whales and other cetaceans also have additional protections in the *Australian Whale Sanctuary*. The EPBC Act provides for offences for certain actions that adversely affect whales in the Australian Whale Sanctuary. The Act also provides for permits to be obtained in relation to actions affecting whales in the Australian Whale Sanctuary. Further information on legislative responsibilities regarding whales is provided in Section 5.

A full list of whale species known to occur in Australian waters can be found on the Department's web site at: www.environment.gov.au/whales.

3.1 Applicable Species

Not all whales hear the same acoustic frequencies. Seismic survey sound sources are generally focussed at frequencies below 200Hz. Based on the best available scientific information, it is generally understood that baleen whales and some toothed whales are likely to be sensitive to sounds in this lower frequency range.

Due to the difficulties in identifying whales to the species level, particularly at distance, appropriate management procedures (as recommended in Part A Standard Management Procedures and Part B Additional Management Procedures, below) should be applied whenever **whales** are, or might be, encountered. **'Whales'** includes baleen whales and larger toothed whales, such as, sperm whales, killer whales, false killer whales, pilot whales and beaked whales.

Smaller dolphins and porpoises that have peak sensitivities in the higher frequency ranges are likely to be less disturbed by these lower frequency sounds and less vulnerable to acoustic trauma. Accordingly, this Policy Statement does not apply to encounters with the smaller dolphins and porpoises.

3.2 Limitations of this Policy Statement

This Policy Statement does not provide definitive advice on avoiding significant impacts on whales for proposed seismic surveys, as different surveys may have unique consequences. The particular circumstances of each seismic survey have to be considered when decisions are made under the EPBC Act. This Policy Statement does not in any way limit the discretion or responsibilities of the Australian Government Environment Minister under the EPBC Act.

This Policy Statement does not address legal obligations under the *Offshore Petroleum Act 2006* or other relevant Australian Government, state or territory legislation. The person proposing to undertake a seismic survey is advised to contact the relevant authorities to address those obligations prior to undertaking seismic surveys.

The impact of sound from seismic acoustic sources is the subject of ongoing research in many parts of the world, including Australia. Updates and amendments to this Policy Statement and to the application of the EPBC Act as it relates to seismic survey activities will occur as our knowledge of whales and the impacts of sound improve.

4. POTENTIAL IMPACTS TO BE CONSIDERED

When planning a seismic survey, you should obtain as much information about the area in which you intend to survey and consider the timing, duration and intensity of the survey. One of the most important aspects of assessing the likelihood of potential impacts on whales, is determining whether the proposed survey will have a **low likelihood** or a **moderate to high likelihood** of encountering whales:

> Low likelihood: Spatially and temporally outside aggregation areas, migratory pathways and areas considered to provide biologically important habitat.
> Moderate to high likelihood: Spatially and/or temporally proximate to aggregation areas, migratory pathways and/or areas considered to provide biologically important habitat.

The likelihood of encountering whales in a given location must be examined on a case-by-case basis, and will provide guidance regarding the management procedures (as outlined in Section 6) that should be implemented to minimise the risk of impacts on whales.

In addition, it is necessary to identify whether the proposed survey will occur in a **biologically important habitat** of a whale species, defined as breeding, calving, or resting areas, or confined migratory routes or feeding areas. In such habitats, displacement from areas or activities that are important to whale survival or recovery may have a greater impact than elsewhere.

If information on the area or the likely impacts is unavailable, proponents may need to consider conducting research into the likely presence of whales in the area and the potential impacts that the proposed activity may have on **whales** (as defined in Section 3) and other matters of national environmental significance (see Section 5.1).

Limited information is currently available for a number of species, habitat areas and migration paths. Specific research activities are underway to improve our knowledge for a number of species and areas. Additionally, information from ongoing marine industries encountering whales (including the oil and gas exploration activities) will assist in improving our knowledge.

Proponents are encouraged to seek advice about the likelihood of surveys interacting with whales from the Department. Currently accessible information on whale distributions, migration times and conservation status is available on the web site at: www.environment.gov.au/whales.

In addition, local communities, conservation organisations, researchers, environmental consultants, state and territory governments, universities and museums are important sources of information on whale distribution, ecology and management.

Useful Resources

Species information: http://www.environment.gov.au/coasts/species/cetaceans/species.html

SPRAT – detailed species information: http://www.environment.gov.au/sprat

Humpback Whale Recovery Plan:
http://www.environment.gov.au/biodiversity/threatened/publications/recovery/m-novaeangliae/index.html

Southern Right Whale Recovery Plan:
http://www.environment.gov.au/biodiversity/threatened/publications/recovery/e-australis/index.html

Blue, Fin and Sei Whale Recovery Plan:
http://www.environment.gov.au/biodiversity/threatened/publications/recovery/balaenoptera-sp/index.html

5. LEGISLATIVE RESPONSIBILITIES

Under the EPBC Act there are two obligations that proponents must consider. The first is the obligation to refer proposals that have or are likely to have a significant impact on a matter of national environmental significance, for a decision about whether assessment and approval is needed (Parts 7 to 9 of the EPBC Act). Actions which may have such impacts are defined under the EPBC Act as 'controlled actions'. The second obligation is the need to apply for a permit (Part 13, Div 3, Subdivision F, of the EPBC Act), if the action may kill, injure, take or interfere with a cetacean in the Australian Whale Sanctuary. There are offence provisions for breaching these obligations.

5.1 Referrals

If a proposed seismic survey has or is likely to have a significant impact on a matter of national environmental significance, which includes listed threatened and migratory species, the action should be referred to the Australian Government Environment Minister under the EPBC Act (Part 7). An action taken in the Commonwealth marine area must also be referred if it is likely to have a significant impact on the 'environment', which may include impacts on whales and other species.

A referral may be determined by the Minister to be:

- Not a controlled action *(Further approval is not required if the action is undertaken in accordance with the referral)*;
- Not a controlled action, provided the action is undertaken in a particular manner (*Further approval is not required provided that the action is performed in a particular way, specified in the decision notice*); or
- A controlled action *(the action is subject to the assessment and approval processes under the EPBC Act*).

To date, the majority of seismic surveys referred under the EPBC Act have been determined not controlled actions provided they are undertaken in a particular manner.

The proponent should consider the adoption of appropriate mitigation measures before making a referral, as this may influence the decision on whether the proposed survey is determined to be a controlled action. If a seismic survey is determined to be a *controlled action*, it will require further assessment and approval under Part 8 and 9 of the Act. Further information on the assessment and approval process and timeframes is available at: http://www.environment.gov.au/epbc/assessments/index.html

If the likelihood of encountering whales is low, the chance of a seismic survey having a significant impact on a whale species should be minimal, provided that the proponent and the operator of the seismic survey adopt the measures outlined in Part A Standard Management Procedures (see Section 6.2).

While Part A Standard Management Procedures may be sufficient in locations where the likelihood of encounters with whales is low, the proponent may need to consider additional avoidance and mitigation measures for areas and/or seasons where the likelihood of encountering whales is moderate to high. In these circumstances, the proponent should not only apply Part A Standard Management Procedures, but should also consider measures like those outlined in Part B Additional Management Procedures (see Section 6.2).

In situations involving **biologically important habitats**, explicit justification for why the proposed survey should take place should be provided. It will be necessary to implement more extensive measures, such as greater precaution zones and additional marine mammal observer coverage. Such measures should be identified in the planning stage of a seismic survey. Accordingly, it is strongly suggested that the proponent discuss these situations with the Department in the planning stages. The appropriateness of any additional measures to be applied will be considered on a case by case basis.

A referral under the EPBC Act for a seismic survey should include all relevant and available information. This includes:

- Specific details on the location and timing of the survey (including maps with the survey route and bathymetry clearly marked);
- Specific details on the seismic sound sources to be used (i.e. airgun number, volume, pressure), and their operational characteristics like size, spacing (x,y,z) and depth of the seismic array, along with calculated operational source levels and sound propagation characteristics, if known. This information can be used to assess introduced sound energy and sound propagation;
- Details of whale species likely to occur in the area and any information known on the likelihood of encountering whales during the survey;
- Specific information on the management measures to be employed to detect whales and avoid interference or significant impacts;
- Details of any professional or trained observers to be employed in the application of the management measures;
- A copy of any environment management plans for the survey; and
- Details of any whale or other environmental research being conducted in association with the survey.

Matters of National Environmental Significance

In addition to considering impacts on whales, the proponent must also consider whether the survey operation is likely to have a significant impact on matters of national environmental significance, particularly:

- other listed threatened and migratory species;
- World and National Heritage areas; and
- The environment as a whole (including in relation to whales), if the action is in the Commonwealth marine area.

This Policy Statement should be read in conjunction with other relevant EPBC Act Policy Statements, in particular, the ***EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance*** (May 2006), which is a general source of guidance as to whether an action is likely to have a significant impact on a matter of national environmental significance.

This Policy Statement is one of a range of EPBC Act Policy Statements which provide more detailed guidance in relation to specific industry sectors and activities or specific places, species, or ecological communities which are protected under the EPBC Act. EPBC Act Policy Statements can be obtained from the Department's Community Information Unit on 1800 803 772 or can be downloaded from the web site at: www.environment.gov.au/epbc/policy/index.html

5.2 Permits

An action that will **kill, injure, take or interfere** (among other things) with a whale or dolphin within the Australian Whale Sanctuary and, for Australian nationals and companies, the waters beyond the outer limits of the Australian Whale Sanctuary, is an offence under Part 13 of the EPBC Act.

However, an action will not be an offence if:

- the proponent has referred the proposed action to the Minister, and the Minister has considered impacts on the Commonwealth marine area and approved the action under Part 9 of the EPBC Act; or
- a **permit** has been granted.

Permits will only be granted to injure, take or kill a whale or other cetacean in extremely limited circumstances. Accordingly, these circumstances are not discussed further in this Policy Statement.

The proponent must consider whether a permit is required. Permits issued in relation to seismic surveys in the circumstances relevant to this Policy Statement, would generally relate to interference with a whale or dolphin. 'Interference' is defined in the Act to include "to harass, chase, herd, tag, mark or brand" a whale or dolphin. Seismic surveys in Commonwealth waters have the potential to affect some aspects of whale behaviour, particularly if they are to be conducted at times and places when encounters with whales are likely.

A seismic survey will generally not interfere with whales if the survey is undertaken in an area and time where the likelihood of encountering whales is low and the appropriate measures outlined in Part A Standard Management Procedures and Part B Additional Management Procedures are undertaken.

If the seismic survey is within an area declared as a Commonwealth Marine Reserve and a management plan is not in operation, approval (under s359B(2) of the EPBC Act) from the Director of National Parks may also be required.

Further information on the permit system and process under the EPBC Act is available at: http://www.environment.gov.au/epbc/permits/index.html

6. MANAGEMENT MEASURES FOR ORGANISATIONS/VESSELS CONDUCTING SEISMIC SURVEYS IN AUSTRALIAN WATERS

The management measures are divided into two areas:

Precaution Zones: defines the *Observation, Low power* and *Shut-down* zones to be used based on the likely sound levels surrounding the seismic sound source(s). These precaution zones are to be used in the operational procedures that follow.

Management Procedures: defines the operational procedures which should be used when planning and carrying out seismic surveys. These include:

> Part A: Standard Management Procedures, which should be followed by all vessels conducting seismic surveys in Australian waters, irrespective of location and time of year, so as to avoid interfering with or having a significant impact on whale species. These procedures should be sufficient in areas that can be demonstrated, by available evidence, to have a **low likelihood** of encountering whales.
>
> Part B: Additional Management Procedures, which are designed to further minimise any possible impacts on individual animals or populations. These procedures may be employed in areas and/or seasons which have a **moderate to high likelihood** of encountering whales. These procedures are of particular importance in considering a seismic survey proposed to take place in a biologically important habitat.

Guidance for assessing the **likelihood** of encountering whales during a seismic survey is provided in Section 4.

6.1 Precaution Zones

Different seismic surveys will have varying acoustic propagation characteristics depending on many characteristics including the seismic array used, bathymetry of the survey area and temperature profile of the water column. Precaution zones should be delineated based on the sound levels whales are likely to receive. For example, a seismic air-gun array operating in shallow water will likely have much quicker attenuation of sound energy compared to a similar array operating in deep water. Accordingly, a survey producing lower sound levels as one ranges further from the seismic vessel should be able to operate with smaller precaution zones than a survey that produces higher levels at similar ranges.

For proposed seismic surveys that can demonstrate through sound modelling or empirical measurements that the received sound exposure level for each shot will not likely exceed 160dB re 1$\mu Pa^2 \cdot s$, for 95% of seismic shots at 1km range, the following precaution zones are recommended:

- *Observation* zone: 3+ km horizontal radius from the acoustic source.
- *Low power* zone: 1 km horizontal radius from the acoustic source.
- *Shut-down* zone: 500m horizontal radius from the acoustic source.

For all other proposed seismic surveys:

- *Observation* zone: 3+ km horizontal radius from the acoustic source.
- *Low power* zone: 2 km horizontal radius from the acoustic source.
- *Shut-down* zone: 500m horizontal radius from the acoustic source.

See Diagrams 1 and 2 below for an illustration of these zones. In the *observation* zone whales and their movements should be monitored to determine whether they are approaching or entering the *low power* zone. When a whale is sighted within, or is about to enter, the *low power* zone, the acoustic source should immediately be powered down to the lowest possible setting. When a whale is sighted within, or is about to enter, the *shut-down* zone, the acoustic source must immediately be shut down completely. Use the above values for application of both Part A Standard Management Procedures and Part B Additional Management Procedures outlined below.

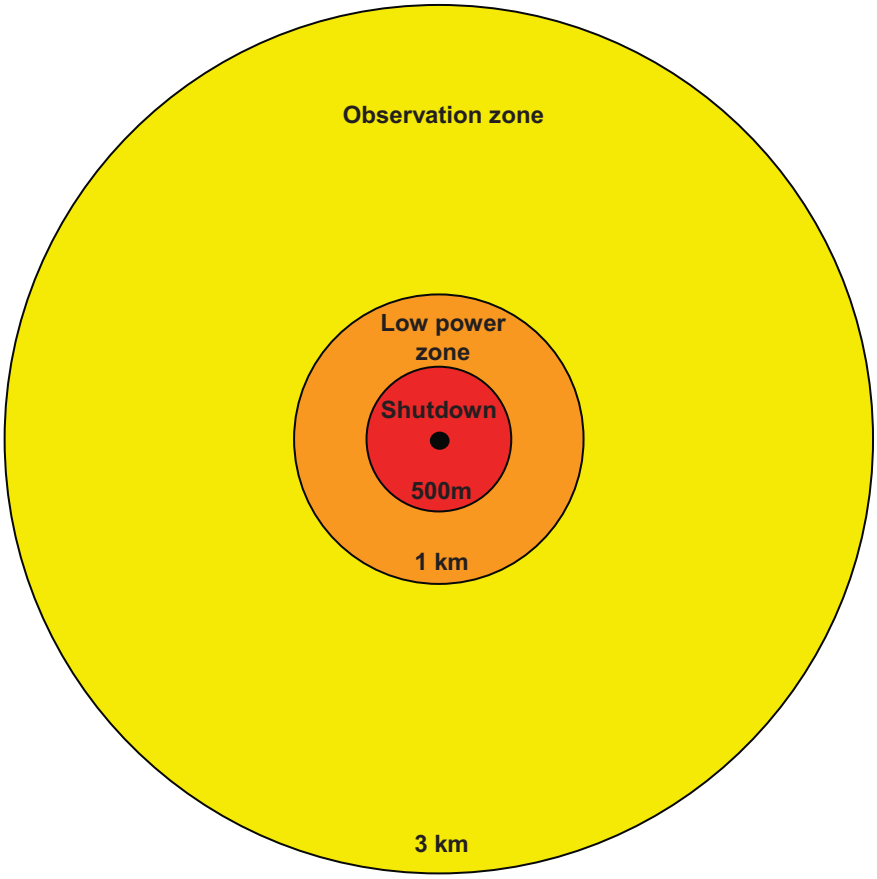


Diagram 1: Precaution zones surrounding the acoustic source for surveys that meet the criteria for a **1km low power zone**.

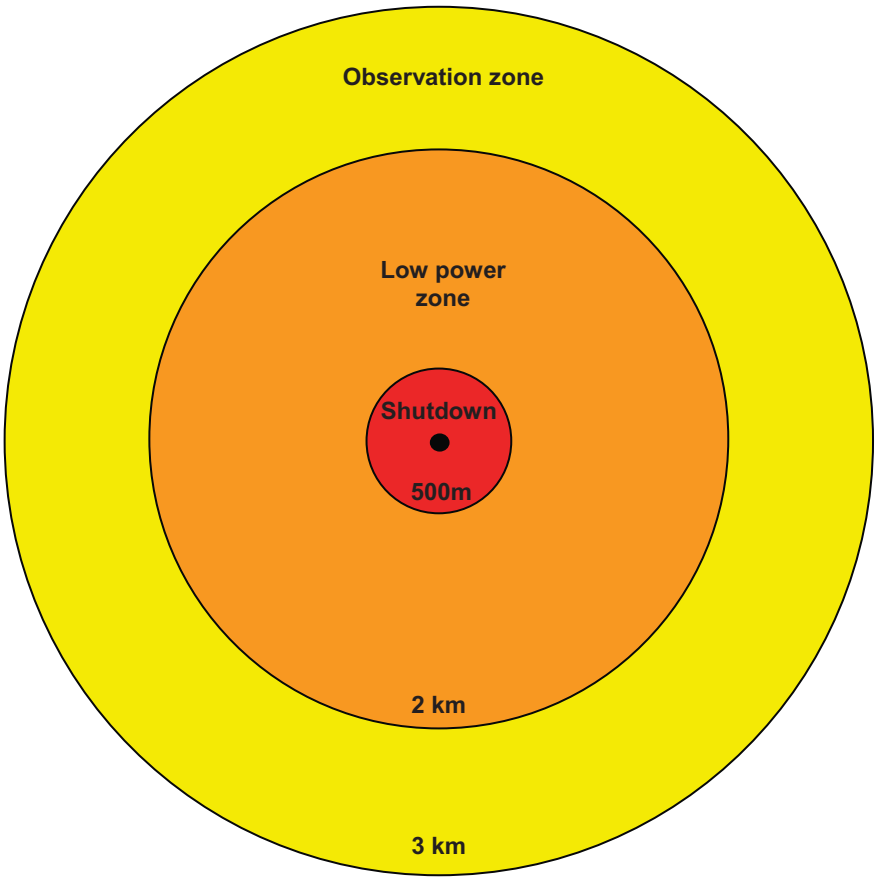


Diagram 2: Precaution zones surrounding the acoustic source for all other surveys (**2km low power zone**)

6.2 Management procedures

PART A. STANDARD MANAGEMENT PROCEDURES

These procedures should be followed by all seismic vessels conducting surveys in Australian waters irrespective of location and time of year.

Applicable Species: Due to the difficulties in identifying whales to the species level, particularly at distance, the following Standard Management Procedures should be applied whenever **whales** are encountered. **'Whales'** includes baleen whales and larger toothed whales, such as, sperm whales, killer whales, false killer whales, pilot whales and beaked whales. Other (smaller) dolphins and porpoises that have peak sensitivities in the higher frequency ranges are likely to be less disturbed by these lower frequency sounds and less vulnerable to acoustic trauma. Accordingly, these Standard Management Procedures do not apply to encounters with the smaller dolphins and porpoises. If there is doubt regarding the identification of the species, precaution should be shown and the procedures outlined below should be applied.

A.1. PRE-SURVEY PLANNING

Do not program seismic surveys in areas where and when whales are likely to be breeding, calving, resting or feeding. If proposed, these surveys and associated mitigation measures will need careful consideration and may require further assessment under the EPBC Act.

Example: The endangered Southern Right whale breeds and calves at particular sites along the coast of southern Australia, such as the Head of the Bight, SA and near Warrnambool, Vic, in the winter months. Seismic surveys should be planned to avoid such areas and times, or at a minimum demonstrate that the measures to be employed will not have an impact on animals at important times, this may include application of all or some of the measures outlined in the Part B Additional Management Procedures. The *Recovery Plans for Australia's Threatened Whales (Humpback, Southern Right, Blue, Fin and Sei) 2005-2010* contain detailed information on important habitat areas.

When planning seismic surveys, avoid where possible areas where and when whales are known or are likely to be migrating. Should it be necessary to conduct seismic surveys in areas where and when whales are known or are likely to be migrating then additional measures (see Part B Additional Management Procedures) to ensure that impacts and interference are avoided and/or minimised are necessary. Details of the measures to be applied should be included in any referral submitted under the EPBC Act.

Further environmental assessment of potential impacts may also be necessary if multiple seismic sources (e.g. two vessels on one project or multiple, adjacent projects) are to be operated in the same general area. Where a seismic survey is proposed, the proponent should liaise with government and industry bodies to ensure that surveys do not unnecessarily coincide or overlap.

The proponent should prepare an environmental management plan for the survey that details the management and operational measures that will apply throughout the survey to detect whales and avoid interference or significant impacts. The plan and measures employed should be based on the likelihood of encountering whales during the survey.

If during the operation of the survey the number of sightings/power-downs of whales are higher than were anticipated during the planning of the survey or the timing of the survey alters, the proponent should contact the Department to discuss any proposed additional management measures.

A.2. TRAINED CREW

The organisation conducting the survey should ensure that there is sufficient trained crew to fulfil the basic requirements outlined below. The trained crew members must have proven experience in whale observation, distance estimation and reporting.

A briefing should be provided to all crew on board the survey vessel (and any supporting craft) on environmental matters, including information on this Policy Statement, whale identification and the environmental legal obligations for companies operating in Australian waters.

Where possible, provide reference material, including this Policy Statement, the Department's Whale and Dolphin sighting report form and the APPEA CD Guide *Search Australian Whales and Dolphins* and provide appropriate visual aids, such as binoculars, on board the vessel to aid in the identification and reporting of any whales sighted.

A.3. DURING SURVEYS

All seismic survey vessels operating in Australian waters must undertake the following basic procedures during surveys irrespective of location and time of year of survey:

- Pre start-up visual observation
- Soft start
- Start-up delay
- Operations
- Power- down and Stop work

These procedures are defined and described in greater detail below.

A.3.1 Pre Start-up-Visual Observation

During daylight hours, visual observations (using binoculars and the naked eye from the bridge on the survey vessel or preferably a higher vantage point) for the presence of whales should be undertaken by a suitably trained crew member for at least **30 minutes** before the commencement of the Soft Start Procedure (see A.3.2). Observations should, where visibility allows, extend to 3+ km (the *Observation* zone) from the vessel but with particular focus on the *Low power* and *Shut-down* zones around the acoustic source (see Diagrams 1 and 2).

During these 30 minute observations, the observer should make observations around the whole of the vessel (360°) and towed array out to a 3km distance and, if possible, beyond 3kms.

A.3.2 Soft Start Procedure (also known as ramp-up)

If no whales have been sighted within the *Low power* and *Shut-down* zones during the pre start-up procedure, the soft start procedure outlined below may commence.

Soft start procedures should be used each time the acoustic sources are initiated, gradually increasing power over a **30-minute period**. Initiate soft start procedures by firing a single airgun. The preferred airgun to begin with should be the smallest airgun, in terms of energy output and volume. Additional acoustic source components should gradually be added in sequence until operating level is achieved. The full power operating level should be the minimum acoustic energy output that is necessary to achieve the survey's objectives.

A sequential ramp-up of the acoustic source is considered to be industry best practice, and is known as a 'soft start'. The slow increase in acoustic energy may alert whales in the area to the presence of the seismic array and enable animals to move and avoid (or stand off) at distances where injury is unlikely.

During daylight hours, visual observations by trained crew should be maintained continuously during soft starts to identify any whales within the precaution zones.

A.3.3 Start-up Delay Procedure

If a whale is sighted within the 3km observation zone during the soft start an additional trained crew member or marine mammal observer should also be brought to the bridge to continuously monitor the whale whilst in sight. If a whale is sighted within or is about to enter the *Low power* zone, the acoustic source should be powered down to the lowest possible setting (e.g. a single gun). If a whale is sighted within or is about to enter the *Shut-down* zone, the acoustic source should be shut down completely.

Soft start procedures should only resume after the whale has been observed to move outside the *Low power* zone, or when 30 minutes have lapsed since the last whale sighting.

A.3.4 Operations Procedure

During daylight hours, trained crew should undertake visual observations continuously during survey operations.

Operators should power down the acoustic source to the lowest possible setting when not collecting data, or undertaking soft start procedures (e.g. during line turns or when moving to another part of the survey area).

The firing of a single gun during turns is an industry standard and is generally considered a reasonable precaution. This sound source may alert whales in the area to the presence of the seismic array and reduce chances of entanglement or contact.

If the array is completely shut down or reduced to low power (e.g. for operational reasons or during line turns), observations for whales should continue. To restart the array the following procedures should take place:

- If no whales are sighted during the shut-down/low power period then start-up may commence using A.3.2 Soft Start Procedure and A.3.3 Start-up Delay Procedure.
- If whales are sighted during the shut down/low power period, or if observations for whales ceased, then start-up should not begin until pre start-up visual observations have been conducted, as outlined in A.3.1. Start-up may then commence using A.3.2 Soft Start Procedure and A.3.3 Start-up Delay Procedure.

A.3.5 Stop Work Procedure

If a whale is sighted within the 3km observation zone an additional trained crew member or marine mammal observer should also be brought to the bridge to continuously monitor the whale whilst in sight.

If a whale is sighted within or is about to enter the *Low power* zone, the acoustic source should be powered down to the lowest possible setting. If a whale is sighted or is about to enter the *Shut-down* zone, the acoustic source should be shut down completely.

Power-up of the acoustic source with soft-start procedures should only occur after the whale has been observed to move outside the *Low power zone*, or when 30 minutes have lapsed since the last whale sighting.

A.3.6 Night-time and Low Visibility Procedures

At **night-time** or at other times of **low-visibility** (when observations cannot extend to 3km from the acoustic source, e.g. during fog or periods of high winds), the following measures apply for start up and operations:

Start up may be commenced according to A.3.2 Soft-Start Procedure:

- provided that there have not been 3 or more whale instigated power-down or shut-down situations during the preceding 24 hour period; or
- if operations were not previously underway during the preceding 24 hours, the vessel (and/or a spotter vessel or aircraft) has been in the vicinity (approximately 10km) of the proposed start up position for at least 2 hours (under good visibility conditions) within the preceding 24 hour period, and no whales have been sighted.

Operations may proceed provided that there have not been 3 or more whale instigated power-down or shut-down situations during the preceding 24 hour period.

During **low visibility**, where conditions allow, continuous observations to spot whales should be maintained with a particular focus on the *Low power* and *Shut-down* zones. If whales are detected then the procedures outlined in A.3.5 Stop Work Procedures should apply.

If sightings of whales have been frequent or are higher than were anticipated during the planning of the survey, the proponent should contact the Department to discuss appropriate night-time provisions and whether additional management measures should be employed for day and/or night-time operations.

A.4 COMPLIANCE AND SIGHTING REPORTS

It is the responsibility of the proponent to maintain a record of procedures employed during operations. Such records should be auditable and account for aspects of the operation that relate to legislative approvals and regulations. Additionally, information on any whales (or other species) sighted during the survey may be useful in the planning and assessment of future marine industry activities.

A report on the conduct of the survey, and any whale interactions, should be provided to the Department **within two months of survey completion**. The report should, at a minimum, contain:

- the location, date and start time of the survey;
- name, qualifications and experience of any Marine Mammal Observers (or research scientists) involved in the survey;
- the location, times and reasons when observations were hampered by poor visibility or high winds;
- the location and time of any start-up delays, power downs or stop work procedures instigated as a result of whale sightings;
- the location, time and distance of any whale sighting including species where possible; and
- the date and time of survey completion.

Any whale sightings should be recorded on a sightings form. An example reporting form for cetaceans sightings is available online at http://www.environment.gov.au/epbc/publications/seismic.html

The Report and completed sighting forms should be emailed to portsandmarine@environment.gov.au or posted to:

Director
Ports & Marine Section
Approvals and Wildlife Division
Department of the Environment, Water, Heritage and the Arts
GPO Box 787
CANBERRA ACT 2601

PART B. ADDITIONAL MANAGEMENT PROCEDURES

For seismic surveys operating in areas where the likelihood of encountering whales is **moderate to high**, the application of additional measures, to ensure that impacts and interference are avoided and/or minimised, are necessary. The following measures are recommended, however, application of all these measures may not be necessary, applicable or possible for all seismic survey operations. In planning a seismic survey, the proponent should consider which of these measures best apply to their circumstances. Details of the measures to be applied should be included in any referral submitted under the EPBC Act. The proponent is strongly encouraged to seek advice from the Department about the likelihood of surveys interacting with whales and the management measures that may be necessary.

B.1 Marine Mammal Observers (MMO)

As the likelihood of encountering whales increases, the proponent should engage MMOs. MMOs should be trained and experienced in whale identification and behaviour, distance estimation, and be capable of making accurate identifications and observations of whales in Australian waters. The MMOs should assist other observers (e.g. trained crew) and be available to provide advice, should whales be encountered.

B.2 Night-time/Poor visibility

For surveys in areas where whales are expected to be encountered, the proponent should include appropriate management measures to detect (or predict) whale presence and apply measures to reduce the likelihood of encounters. Depending on the situation a range of measures may be appropriate, possible measures include:

- Limiting initiation of soft start procedures to conditions that allow visual inspection of the precaution zone;
- Daylight spotter vessel or aircraft searches of the night-time survey area to determine if whales are present; and
- Pre survey research (including surveys) to detect and identify likely whale concentration areas, such as: peak migration paths and times, key feeding sites (e.g. shelf breaks, sea mounts and trenches), or other aggregation areas.

B.3 Spotter Vessel(s) and Aircraft

Where the likelihood of encountering whales is high, spotter vessels/aircraft could be used to assist in detecting the presence of whales. Spotter vessels and aircraft may be usefully employed to determine the presence and likelihood of encountering whales during day and night-time operations; information that can then be used to re-design the survey or tracks to be run to avoid whales that are in the vicinity. Spotter vessels/aircraft should maintain continuous contact with the seismic survey vessel. An MMO should be employed on board both the survey vessel and the spotter vessel/aircraft.

B.4 Increased Precaution zones and Buffer zones

In some locations and circumstances it may be advisable to apply increased distances for the instigation of power-down procedures from those outlined in Part A Standard Management Procedures. For important habitats, such as feeding areas, when concentrations of food and whales are likely to occur, an increased low power zone (e.g. 3km) may be appropriate to ensure that disturbance or displacement of whales does not occur. Such a measure may not need to apply for the whole of the survey (time and area) but may be advisable for particular specific locations (e.g. along the shelf edge where food sources are most likely to occur).

For surveys being undertaken in the broad vicinity of known breeding or resting areas, a buffer (exclusion) zone should be established to ensure that operating survey vessels do not enter the vicinity where whales may be present. The size of the buffer zone should be established on a precautionary basis. Where available, scientific evidence and/or acoustic propagation modelling should be used to determine and justify the buffer zone.

B.5 Passive Acoustic Monitoring

Passive acoustic monitoring (PAM) is an emerging technology that has some limitations. Deployment of PAM with appropriate technologies and programs to detect whales in real time may provide an additional method of detecting and avoiding whales during surveys and may be particularly useful during night-time and low visibility operations. The use of PAM as a detection tool should be considered by the proponent and, if deployed, details should be provided on their intended use as part of any referral under the EPBC Act.

B,6 Adaptive Management

Where a survey is proposed in an area that is spatially and temporally on the edge of areas considered to provide biologically important habitat, the proponent may consider implementing adaptive management procedures to manage the potential increased likelihood of encountering whales. For example, they may cease all night time surveying if there are three consecutive days on which operators experience three or more whale-instigated shut down/power down situations. Adaptive management may also be used in conjunction with other measures described in Part B. For example, if aerial surveys identify whales in the region, increased buffer zones are implemented.

Appendix C - Legislation Summary

Appendix C: Summary Table of Relevant Acts, Conventions, Codes, Guidelines and Strategies

Note: ALL legislation applies **within the political jurisdiction under which it was developed and gazetted. The relevance to the activity is discussed in the last column.**

Aspect	Act / Regulations / Guideline	Summary	Relevance to Ringarooma Bay Exploration
		International	
Biodiversity	***Convention on Conservation of Nature in the South Pacific (Apia convention) 1976***	This Convention (also known as the Apia Convention), focuses on creation of protected areas in the South Pacific in particular national parks and national reserves. The Convention is currently undergoing a review. A protocol to the Convention was adopted in 2000 but has yet to come into force. This Protocol makes some technical amendments to the Convention and inserts a provision allowing the convention to be amended by agreement in the future. The Convention came into force globally in 1990. New Zealand ratified the agreement in 1990 and there are over 21 Pacific island member countries and four countries with direct interests in the region (as at March 2007). Australia is a signatory to the Convention.	Potential impacts to national parks and other reserves are assessed as relevant within this EP (Sections 6.3.2 and 6.3.3). The nearest national park to Ringarooma Bay is Mt Williams National Park, located over 20km to the east-southeast of Ringarooma Bay.
Biodiversity	***Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979***	The Convention aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Program, concerned with the conservation of wildlife and habitats on a global scale. The Convention was signed in 1979 and entered into force in 1983. Migratory species threatened with extinction are listed on Appendix I of the Convention and as of January 2011, there were 176 species listed.	The EPBC Act Protected Matters Report created on the 24 August 2011 by the Department of Sustainability, Water, Population and Communities (DSWPC) for the Ringarooma Bay area identified 49 listed migratory species that could potentially use the Ringarooma Bay area. These will be assessed and managed by reference to the National ***Environmental Protection and Biodiversity Conservation Act, 1999,*** within this EP (Sections 6.2, 6.3.1, 7.2, 7.3, 7.4 and 8).
Biodiversity	***Japanese/Australian Agreement on the Protection of Migratory Birds (JAMBA) 1981***	This agreement aims to maintain biodiversity of migratory birds in the Asia-Pacific Region, in particular migratory birds that travel between Japan and Australia. The treaty is an agreement between Japan and Australia.	The EPBC Act Protected Matters Report created on the 24 August 2011 by DSWPC for the Ringarooma Bay area listed 49 listed migratory species with the potential for habitat in the vicinity of Ringarooma Bay. Implications regarding potential impacts from proposed exploration works are discussed within this EP (Sections 6.2, 6.3.1, 7.2 and 8). The agreement is applied through the National ***Environmental Protection and Biodiversity Conservation Act, 1999*** and the State ***Threatened Species Protection Act 1995.***
Biodiversity	***Chinese/Australian Agreement on the Protection of Migratory Birds (CAMBA) 1988***	This agreement aims to maintain biodiversity of migratory birds in the Asia-Pacific Region, in particular migratory birds that travel between China and Australia. The treaty is an agreement between China and Australia.	The EPBC Act Protected Matters Report created on the 24 August 2011 by DSWPC for the Ringarooma Bay area listed 49 listed migratory species with the potential for habitat in the vicinity of Ringarooma Bay. Implications regarding potential impacts from proposed exploration works are discussed within this EP (Sections 6.2, 6.3.1, 7.2 and 8). The agreement is applied through the National ***Environmental Protection and Biodiversity Conservation Act, 1999*** and the State ***Threatened Species Protection Act 1995.***
Biodiversity	***Convention on Biological Diversity (1992)***	The Convention known informally as the Biodiversity Convention is an international legally binding treaty. The Convention has three main goals and offers guidance on the following: 1. conservation of biological diversity (or biodiversity); 2. sustainable use of its components; and 3. fair and equitable sharing of benefits arising from genetic resources. Australia signed the treaty on 18 June 1993.	The main principles applicable to the proposed exploration work are those relating to conservation of biological diversity (or biodiversity) and sustainable use of its components. These are applied through the National ***Environmental Protection and Biodiversity Conservation Act, 1999*** and the State ***Living Marine Resources Management Act 1995*** and therefore do not require further discussion under this Convention.
Diving	***Diving Medical Advisory Committee (2011)***	The work of the Diving Medical Advisory Committee is reflected in its series of guidance notes concerning various aspects of diving and diving medical practice. All current guidance is available for downloading from http://www.dmac-diving.org/guidance/	The guideline relevant to the exploration operation at Ringarooma Bay is the *Safe Diving Distance from Seismic Surveying Operations 2011*. Any diving activities relating to the project should be undertaken in reference to these guidelines.
General	***United Nations Convention on the Law of the Sea 1982***	The convention is also called the Law of the Sea Convention or the Law of the Sea treaty. It is an international agreement that resulted from the third United Nations Conference on the Law of the Sea (UNCLOS III), which took place from 1973 through 1982. The Law of the Sea Convention defines the rights and responsibilities of nations in their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. Australia is a signatory to the Convention.	Broadly applicable to general vessel operations.
Geophysical operations	**International Association of Geophysical Contractors (IAGC) -** ***Environmental Guidelines for Worldwide Geophysical Operations***	The association represents industry that provides geophysical services to the oil and gas industry. An Environmental Manual for Worldwide Geophysical Operations has been developed by IAGC.	May provide some general guidance, however it is focuses on the oil and gas industry.
Pollution Management	***International Convention for the Prevention of Pollution from Ships 1973***	The Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and also includes the Protocol of 1997 (Annex VI). The convention aims to minimise pollutions from ships such as oil, chemicals and harmful substances (sewage and garbage). Australia is a signatory to the Convention.	Generally applicable to vessel operations in Ringarooma Bay, however it is expected to have been addressed within the ***Environment Protection (Sea Dumping) Act 1981*** and other Commonwealth and State legislation.

Aspect	Act / Regulations / Guideline	Summary	Relevance to Ringarooma Bay Exploration
Pollution Management	***Convention on the Prevention of Marine Pollution by dumping of wastes and other Matter 1972, and the Protocol to International Convention on the Prevention of Marine Pollution by dumping of wastes and other Matter, November 1996***	The Convention (MARPOL) is an agreement to control pollution of the sea by dumping and to encourage regional agreements supplementary to the Convention. It covers the deliberate disposal at sea of wastes or other matter from vessels, aircraft, and platforms. It entered into force in 1975. As of 2005, there were 81 Parties to the Convention. Australia holds obligations under this Convention and addresses them in the Commonwealth Act: *Environment Protection (Sea Dumping) Act 1981.*	Exploration work proposed to be undertaken by TNT Mines will be in State and Commonwealth waters. The control of pollution of the sea by dumping is relevant to the proposed work and is regulated by the following national and state instruments, against which this proposal is being presented within this EP (Sections 8.3, 8.4, 8.5 and 8.10): ***- Environment Protection (Sea Dumping) Act 1981*** ***- Environment Protection and Biodiversity Conservation Act, 1999*** **(EPBC)** ***- National Environmental Protection Council Act 1994 (NEPC) and related National Environment Protection Measures*** ***- Environmental Management and Pollution Control Act 1994*** **(EMPCA)** ***- Dangerous Substances (Safe Handling) Bill 2005*** ***- Pollution of Waters by Oil and Noxious Substances Act 1987***
Wetlands	***Convention on Wetlands of International Importance Especially as Waterfowl Habitat (RAMSAR)***	The convention is an international treaty for the conservation and sustainable of wetlands, the convention, held every three years, aims to stem the progressive encroachment on and loss of wetlands now and in the future, it recognises the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. Australia is a signatory to the Convention.	Ringarooma Bay is adjacent to two listed RAMSAR wetlands; the Flood Plain Lower Ringarooma River and the Little Waterhouse Lake. These wetlands are both listed under the convention as Ramsar Wetlands of International Importance. The convention is applied through the National ***Environmental Protection and Biodiversity Conservation Act, 1999*** and the State ***Threatened Species Protection Act 1995.***
Commonwealth			
Biodiversity and heritage	***Environment Protection and Biodiversity Conservation Act, 1999*** **(EPBC)**	The Act provides for the protection of the environment in land and waters under control of the Commonwealth. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as matters of national environmental significance (NES). Matters of NES include: World Heritage properties, Ramsar wetlands, nationally threatened species and ecological communities, migratory species, Commonwealth marine areas and / or nuclear actions.	The EPBC Act Protected Matters Report created on the 24 August 2011 by DSWPC for the Ringarooma Bay area listed the following matters of NES in the vicinity of Ringarooma Bay; two Wetlands of International Significance (Ramsar; Little Waterhouse lake and the flood plain of Lower Ringarooma River), one Threatened Ecological Community, 45 listed threatened species and 49 listed migratory species. These are discussed in Sections 6.2, 6.3, 6.4, 6.5, 7.2, 7.3, 7.4 and 8 of this EP.
Biodiversity and heritage	***Environment Protection and Biodiversity Conservation Regulations 2000 (amended October 2011)***	Schedule 1 amends the ***Environment Protection and Biodiversity Conservation Regulations 2000***.	Part 8 of the regulations has regard to protection of Cetaceans. This is applied via the ***EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales, September 2008***
Biodiversity	***EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales, September 2008***	The aim of the policy is to: 1. provide practical standards to minimise the risk of acoustic injury to whales in the vicinity of seismic survey operations; 2. provide a framework that minimises the risk of biological consequences from acoustic disturbance from seismic survey sources to whales in biologically important habitat areas or during critical behaviours, and 3. provide guidance to both proponents of seismic surveys and operators conducting seismic surveys about their legal responsibilities under the ***Environment Protection and Biodiversity Conservation Act 1999*** **(EPBC Act)**.	The EPBC Act Protected Matters Report created on the 24 August 2011 by DSWPC for the Ringarooma Bay area listed several whale and dolphin species that potentially have habitat in the area. Under ***Policy Statement 2.1*** any whale sightings during the seismic survey should also be reported to the department and sightings information should submitted as follows: sightings and survey information should be recorded within the 'Cetacean Sightings Application' software which is available on request from sightingsdata@aad.gov.au. Upon completion of the survey the information entered into this application should be exported as a text file and emailed to sightingsdata@aad.gov.au as per the instructions within the application. An emailed confirmation will be sent upon receipt of each submission.
Environmental Management	***National Environmental Protection Council Act 1994 (NEPC)***	The National Environmental Protection Council (NEPC) is governed by Environmental Ministers from each State and the Commonwealth. The role of the NEPC is to create National Environment Protection Measures (NEPM).	There are no NEPMs that are strictly and directly relevant to the proposed exploration work.
Environmental Management	**Guidelines for the Preparation and Submission of an Environmental Plan, Under the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999** (as amended 20 December 2005)	These guidelines are issued by the Commonwealth Department of Resources, Energy and Tourism. They are intended to provide guidance to petroleum operators for the preparation and submission of an Environment Plan (EP) under the *Petroleum (Submerged Lands) (Management of Environment) Regulations 1999.*	There is currently no equivalent legislation or guidelines regulating offshore mineral exploration work in Tasmania. These guidelines have therefore been adopted by Mineral Resources Tasmania in lieu of offshore minerals exploration guidelines. This EP is therefore extensively structured on these guidelines, and has applied the guidance as relevant to the proposed mineral exploration work proposed by TNT Mines.
Hazardous waste	***Hazardous Waste (Regulation of Exports and Imports) Act 1989***	The purpose of this Act is to regulate the export and import of hazardous waste for the protection of human health with particular consideration to appropriate disposal. The original Act of 1989 only controlled movements of wastes that lacked financial value, usually destined for final disposal operations (for example, by incineration or landfill). In 1996, the Act was amended to include wastes that possess financial value, usually destined for recycling and recovery operations. The Act has had several amendments since 1989. The most recent amendment and current form of the Act is the ***Hazardous Waste (Regulation of Exports and Imports) Act 1989*** which incorporates amendments up to ***Statute Law Revisions Act 2011***. Commonwealth Law Identification: C2011C00203.	The Act is related to the transport of hazardous waste and you are required to follow it if you are a hazardous waste broker, agent or dealer; if you plan to move the hazardous waste out of Australia; if you produce hazardous waste that will be exported or if you import hazardous waste that will be disposed of in Australia. As TNT mines are conducting exploration at Ringarooma Bay and not managing hazardous waste then this Act does not apply.

Aspect	Act / Regulations / Guideline	Summary	Relevance to Ringarooma Bay Exploration
Heritage	***Historic Shipwrecks Act 1976***	The Act protects all shipwrecks and associated relics that are 75 or more years old, regardless of whether their physical location is known. More recent shipwrecks may be declared as historic under the Act by the Minister. The jurisdiction of the Commonwealth Historic Shipwrecks Act 1976 is not limited to Commonwealth marine areas, as defined by the *Environmental Protection and Biodiversity Conservation Act 1999*. It applies to the coastal waters of the Australian States and Territories to the low water mark. The Commonwealth *Historic Shipwrecks Act 1976* applies to Australian Commonwealth waters extending from the low water mark to the outer edge of the continental shelf. The State *Historic Cultural Heritage Act 1995* applies to shipwrecks that lie within the state waters of Tasmania (harbours, enclosed bays, estuaries, rivers and lakes).	There are 4 known historic shipwrecks in the area of Ringarooma Bay. These are discussed in Section 6.5.3. TNT Mines Ltd will be aware of their locations while conducting the exploration work. If shipwrecks are encountered the Act will be triggered and measures discussed in Section 8.9 will be implemented. In special circumstances when a shipwreck is considered highly significant or vulnerable a 'Protected Zone' may be declared around the site, requiring a permit from the management authority to enter. There are currently no 'Protected Zones' in Tasmania.
Heritage	***Aboriginal and Torres Strait Islander Heritage Protection Act 1984***	This Act takes precedence over the *Aboriginal Heritage Act 1972* and the state *Aboriginal Relics Act 1975* and deals with Aboriginal cultural property in a broad sense.	Potential impacts from the proposed exploration work to Aboriginal Heritage are discussed in Section 6.5.1 of the EP.
Heritage	***Native Title Act 1993***	The Act came into effect on 1 January 1994. It supports and codifies the Mabo decision and facilitates the process of granting native titles. It also established the National Native Title Tribunal which registers, hears and determines native title claims.	This Act is not strictly applicable to the proposed mineral exploration work to be carried out by TNT Mines at Ringarooma Bay.
Navigation	***Navigation Act 1912***	The Act supersedes the ***Merchant Shipping Act 1894***. Commonwealth Law Identification: C2011C00829. The act relates to navigation and shipping.	This Act would be broadly applicable to the operation of vessels which will be operating under contract to TNT Mines for the exploration work. The vessel operators will be required to be licensed and qualified for the work for which they will be contracted (Section 8.3.3).
Offshore minerals	***Offshore Minerals Act 1994***	This Act replaces the former *Minerals (Submerged Lands) Act 1981* which was in force since February 1990. The *Offshore Minerals Act 1994* provides the legal framework for the exploration and recovery of minerals, other than petroleum, on Australia's continental shelf.	Under the *Offshore Minerals Act 1994*, Mineral Resources Tasmania (MRT) is the Designated Authority for the proposed Ringarooma Bay minerals exploration work.
Offshore Petroleum Exploration Management	***Offshore Petroleum and Greenhouse Gas Storage Act 2006***	Offshore petroleum operations beyond coastal waters (beyond three nautical miles or 5.5km from the territorial sea baseline) are governed by Commonwealth legislation known as the *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. In Tasmanian coastal waters (within three nautical miles or 5.5km from the territorial sea baseline), exploration for petroleum is governed by mirror State legislation, the *Petroleum (Submerged Lands) Act 1982*.	This Act is not strictly applicable to the proposed mineral exploration work to be carried out by TNT Mines at Ringarooma Bay, however the guidelines issuing from the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999 (as amended 20 December 2005) are adopted by Minerals Resources Tasmania since no offshore minerals exploration guidelines currently exist.
Pollution Management	***Protection of the Sea (Civil Liability) Act 1981***	The Act has had several amendments since 1981. The most recent amendment and current form of the Act is the ***Protection of the Sea (Civil Liability) Act 1981*** which incorporates amendments up to ***Statute Law Revisions Act 2011***. The Act relates to the civil liability for pollution damage. Commonwealth Law Identification: C2011C00159.	This Act would be triggered in the event of damage occurring from pollution generated by the exploration work (Section 8.10).
Pollution Management	***Environment Protection (Sea Dumping) Act 1981.***	This Act was developed in conjunction with the *Convention on the Prevention of Marine Pollution by dumping of wastes and other Matter 1972.* Under the *Sea Dumping Act*, the Commonwealth aims to minimise pollution threats by: 1. prohibiting ocean disposal of waste considered too harmful to be released in the marine environment and 2. regulating permitted waste disposal to ensure environmental impacts are minimised. The *Sea Dumping Act* is related to the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Great Barrier Reef Marine Park Act 1975* and the *Sea Installations Act 1987*.	Exploration work proposed to be undertaken by TNT Mines will be in State and Commonwealth waters. The control of pollution of the sea by dumping is relevant to the proposed work and is regulated by the following national and state instruments, against which this proposal is being presented within this EP (Sections 8.3, 8.4, 8.5 and 8.10): ***- Environment Protection and Biodiversity Conservation Act, 1999*** **(EPBC)** ***- National Environmental Protection Council Act 1994 (NEPC) and related National Environment Protection Measures*** ***- Environmental Management and Pollution Control Act 1994*** **(EMPCA)** ***- Dangerous Substances (Safe Handling) Bill 2005***
Pollution Management	***Protection of the Sea (Prevention of Pollution from Ships) Act 1983***	The Act has had several amendments since 1983. The most recent amendment and current form of the Act is the ***Protection of the Sea (Prevention of Pollution from Ships) Amendment (oil transfers) Act 2011***. The Act relates to the protection of the sea from pollution by oil and other harmful substances discharged from ships. Commonwealth Law Identification: C2011C00633.	This Act applies to prevention of pollution from the vessels which will be contracted by TNT Mines for the exploration work (Sections 8.3, 8.4, 8.5 and 8.10).
Pollution Management	***Protection of the Sea (Oil Pollution Compensation Fund) Act 1993***	The Act has had several amendments since 1993. The most recent amendment and current form of the Act is the ***Protection of the Sea Legislation Amendment Act 2008***. The Act relates to oil pollution damage. Commonwealth Law Identification: C2010C00167.	This Act applies to prevention of pollution from oil from the vessels which will be contracted by TNT Mines for the exploration work (Sections 8.3, 8.5 and 8.10).
Pollution Management	***Protection of the Sea (Harmful Anti-fouling Systems) Act 2006***	The Act relates to the protection of the sea from the effects of harmful anti-fouling systems. The current Commonwealth Law Identification: C2010C00146.	The Act applies to the process of anti-fouling of marine vessels and structures. TNT Mines will be engaging contractors to carryout the remote sensing work on local Australian vessels. Contractual terms will require that the lease vessel(s) are appropriately maintained (Section 8.3.3) and no antifouling works will be undertaken during the duration of the works.
Pollution Management	***ANZECC Code of Practice for Antifouling and In-water Hull Cleaning and Maintenance (1997)***	The Code provides guidance on best-practice approaches for the application, maintenance, removal and disposal of antifouling coatings and the management of biofouling and invasive aquatic species on vessels and movable structures in Australia and New Zealand. The code has been re-visited with the ***DRAFT Antifouling and In-water Cleaning Guidelines*** which is currently under review with submissions closing date in November 2011.	The code applies to the process of anti-fouling of marine vessels and structures. TNT Mines will be engaging contractors to carryout the remote sensing work on local Australian vessels. Contractual terms will require that the lease vessel(s) are appropriately maintained (Section 8.3.3) and no antifouling works will be undertaken during the duration of the works.

Aspect	Act / Regulations / Guideline	Summary	Relevance to Ringarooma Bay Exploration
Pollution Management	***Protection of the Sea (Prevention of Pollution from Ships) Act 1983 & Protection of the Sea Legislation Amendment Bill 2010***	*A Bill for an Act to amend the law in relation to the protection of the sea, and for related purposes*. Commonwealth Law Identification: C2010B00026.	This Act applies to prevention of pollution from oil from the vessels which will be contracted by TNT Mines for the exploration work (Sections 8.3, 8.4, 8.5 and 8.10).
Pollution Management	***National Plan to combat pollution of the sea by oil and other noxious and hazardous substances***	The National Plan outlines State/Territory and industry roles and responsibility for prevention, preparation, response and recovery to oil spills. ***Pollution of Waters by Oil and Noxious Substances Amendment Bill 2004*** is relevant to Tasmania.	This Act applies to prevention of pollution from oil, noxious or hazardous substances from the vessels which will be contracted by TNT Mines for the exploration work (Sections 8.3, 8.5 and 8.10).
Quarantine	***Quarantine Act 1908 and regulations***	The Act has had several amendments since 1908. The most recent amendment and current form of the Act is the ***Quarantine Act 1908 and regulations*** which incorporates amendments up to ***Acts Interpretation Amendment Act 2011***. The Act relates to Quarantine. Commonwealth Law Identification: C2011C001886.	This Act would only be applicable if an overseas vessel(s) or overseas materials and equipment were to be contracted or used for the TNT Mines exploration work. This is not expected to be the case.
Water Quality	***Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) (ANZECC)***	The main objective of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (the Water Quality Guidelines) is: to provide an authoritative guide for setting water quality objectives required to sustain current, or likely future, environmental values [uses] for natural and semi-natural water resources in Australia and New Zealand.	If marine water quality ambient monitoring is required as part of the latter phases of this project, then this publication will become important guidance in the process of establishing baselines against established water quality values, such as primary industries, recreational and aesthetic. It is considered unlikely that this document will be used as part of this EP for exploration work.
		State	
Air Quality	***Environmental Protection Policy (Air Quality) 2004***	Developed under EMPCA by the Tasmanian State Government, this policy provides a framework for the management and regulation of both point and diffuse sources of emissions to air for pollutants with the potential to cause environmental harm. The Policy came into effect on 1 June 2005.	The general principles of this policy apply to air emissions which may occur from the proposed exploration work at Ringarooma Bay. The only emissions to air are likely to be from the use of motors on boats. TNT Mines will include as a condition of contract that all equipment used on its contracted vessels will need to be maintained according to manufacturer's instructions (Section 8.3.3 of the EP).
Biodiversity	***Living Marine Resources Management Act 1995***	The Act promotes sustainable management of living marine resources. It deals with fisheries and issues on how to preserve the habitats of fish and provides for regulation of any activities that have the potential to impact on fish.	This Act focuses on fishery-related activities. Areas of Ringarooma Bay are used periodically for scallop dredging and other commercial and recreational boating and fishing activities. As part of its consultation work, TNT Mines have noted the presence of a scallop and fish fishery at Ringarooma Bay, and has committed to minimising impacts from its exploration work on these fisheries. Stakeholder consultation outcomes are discussed in Sections 6.8 and 10 of the EP. Mitigation measures are discussed in Section 8 of the EP. TNT Mines Ltd should be aware that Fisheries may enter their vessel under this Act to ensure no illegal fishing is occurring.
Biodiversity	***Threatened Species Protection Act 1995***	The Act provides for the protection and management of native flora and fauna, while enabling and promoting their conservation. Flora and fauna are classified according to their level of threat as endangered, vulnerable or rare in the schedules of the Act.	The Act applies to the Ringarooma Bay exploration project. This Act is addressed in Section 6.3.1 of the EP.
Biodiversity	***State Coastal Policy Validation Act 2003 & the State Coastal Policy 1996***	The Act validates the *State Coastal Policy 1996*. The Policy applies to State water and up to 1km inland from the high water mark. The Policy aims to promote sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity.	This policy is applicable to the proposed exploration work, and where relevant, principles of the State Coastal Policy 1996 are incorporated within this EP – these are likely to include predominantly provisions detailed under the Natural Resources and Ecosystems sections of the Policy.
Dangerous Goods	***Dangerous Substances (Safe Handling) Bill 2005***	The Bill provides guidelines for handling and managing dangerous substances.	TNT Mines Ltd will follow the relevant sections of the Bill and appropriate MSDS's where applicable.
Development Management	***Land Use Planning and Approvals Act 1993***	The Act regulates land use and development through Council planning schemes and planning permits. The Act also considers heritage values.	This Act is not triggered for the proposed exploration work.
Environmental Management	***Environmental Management and Pollution Control Act 1994*** **(EMPCA)**	EMPCA manages and regulates environmental issues and pollution and defines which activities are regulated by the local Council and which are regulated by the State. Any activities that have the potential to cause environmental harm must be considered and may be regulated under EMPCA. The Act can be used as an enforcement tool to ensure compliance and notices can be implemented to prevent or remediate environmental harm.	This Act applies to the proposed exploration work and its intent is incorporated within Section 8 of the EP.
Heritage	***Aboriginal Relics Act 1975***	The objective of the Act is to ensure the protection and management of Aboriginal cultural heritage sites, places and objects.	This Act is applicable across Tasmania, however it is considered unlikely that it will be triggered during the proposed exploration work within Ringarooma Bay.
Heritage	***Historic Cultural Heritage Act 1995***	The Act identifies and protects areas of non-Indigenous historical and cultural significance, including: 'aesthetic, historic, scientific or social values for past, present or future generations'. The Commonwealth *Historic Shipwrecks Act 1976* applies to Australian Commonwealth waters extending from the low water mark to the outer edge of the continental shelf. The State *Historic Cultural Heritage Act 1995* applies to shipwrecks that lie within the state waters of Tasmania (harbours, enclosed bays, estuaries, rivers and lakes). The jurisdiction of the Commonwealth *Historic Shipwrecks Act 1976* is not limited to Commonwealth marine areas, as defined by the *Environmental Protection and Biodiversity Conservation Act 1999*. It applies to the coastal waters of the Australian States and Territories to the low water mark.	There are 4 known historic shipwrecks in the area of Ringarooma Bay. These are discussed in Section 6.5.3. TNT Mines Ltd will be aware of their locations while conducting the exploration work. If shipwrecks are encountered the Act will be triggered and measures discussed in Section 8.9 will be implemented. Under both these Acts all shipwrecks and their associated artefacts which were lost over 75 years ago are automatically protected. Shipwrecks that occurred less than 75 years ago may also be individually protected under these Acts if they are considered to be significant. In special circumstances when a shipwreck is considered highly significant or vulnerable a 'Protected Zone' may be declared around the site, requiring a permit from the management authority to enter. There are currently no 'Protected Zones' in Tasmania.

Aspect	Act / Regulations / Guideline	Summary	Relevance to Ringarooma Bay Exploration
Noise	***Environmental Protection Policy (Noise) 2009***	Developed under EMPCA by the Tasmanian State Government this policy protects the environmental values of the acoustic environment including the wellbeing of individuals and the community and ensures that acoustic values are not exceeded above recommended levels.	The general principles of this policy apply to noise emissions which may occur from the proposed exploration work at Ringarooma Bay. The main noise emissions are likely to be from the use of motors on boats, and possibly from general activities on the vessels. TNT Mines will include as a condition of contract that all equipment used on its contracted vessels will need to be maintained according to manufacturer's instructions (Section 8.3 of the EP). Exploration hours may also be restricted to daylight hours between the hours of 7am and 6pm (Section 6.3.2 of the EP).
Offshore minerals	***Offshore Minerals Act 1994 – Guidelines for Applicants – Applications for Exploration Licences covering standard blocks***	The guidelines have been developed by MRT to assist applicants wishing to apply for offshore mineral exploration licences, and to provide a broad outline of the rights and obligations involved. This document covers offshore mineral exploration licences, which are applicable in Commonwealth territorial waters adjacent to Tasmania. The guidelines should be read in conjunction with the Commonwealth ***Offshore Minerals Act 1994*** and in particular sections 50-72.	Under the *Offshore Minerals Act 1994*, Mineral Resources Tasmania (MRT) is the Designated Authority for the proposed Ringarooma Bay minerals exploration work.
Pollution Management	***Petroleum (Submerged Lands) Act 1982***	Offshore petroleum operations beyond coastal waters (beyond three nautical miles or 5.5km from the territorial sea baseline) are governed by Commonwealth legislation known as the *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. In Tasmanian coastal waters (within three nautical miles or 5.5km from the territorial sea baseline), exploration for petroleum is governed by mirror State legislation, the *Petroleum (Submerged Lands) Act 1982*.	This Act is not strictly applicable to the proposed mineral exploration work to be carried out by TNT Mines at Ringarooma Bay, however the guidelines issuing from the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999 (as amended 20 December 2005) are adopted by Minerals Resources Tasmania since no offshore minerals exploration guidelines currently exist.
Pollution Management	***Mineral Resources Development Act 1995***	This Act provides for the development of mineral resources consistent with sound economic, environmental and land use management. The Director of Mines is responsible for the implementation of the Act and Mineral Resources Tasmania, within the Department of Infrastructure Energy and Resources, administers the Act.	The State exploration leases applied for by TNT Mines will be issued under this Act. Conditions associated with the leases will be enforceable under the Act.
Pollution Management	***Mineral Exploration Code of Practice – Edition 5 - 2012***	The purpose of this Code is to provide an outline of the current procedures which must be followed to obtain exploration approvals, and at the same time to give useful, practical information on the expected standards of exploration activities. The Code also details the controls and monitoring procedures which are currently in place.	This code has limited relevance to the proposed exploration work within the marine area of Ringarooma Bay. Some of its principles will be applicable, however most are covered by the **Guidelines for the Preparation and Submission of an Environmental Plan, Under the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999** (as amended 20 December 2005) issued by the Commonwealth Department of Resources, Energy and Tourism.
Pollution Management	***Pollution of Waters by Oil and Noxious Substances Amendment Bill 2004.***	This Bill amends the ***Pollution of Waters by Oil and Noxious Substances Act 1987*** which superseded the ***Oil Pollution Act 1961***.	This Act applies to prevention of pollution from oil and noxious substances from the vessels which will be contracted by TNT Mines for the exploration work (Sections 8.3, 8.4 and 8.10).
Pollution Management	***TasPlan – Tasmanian Marine Oil Spill Contingency Plan (February 2011)***	Tasmania is committed to supporting the National Marine Oil Spill Contingency Plan (under the National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances) by maintaining oil spill response capability in State Waters. TasPlan applies to actual or potential oil spills in Tasmanian State waters and adjacent shorelines. In addition, under the National Plan arrangements, Tasmania is the designated Combat Authority where oil spilled outside Tasmanian State waters impacts or has the potential to impact on Tasmanian shorelines.	Any oil (and potentially noxious or hazardous substances) spills from the vessels to be used for proposed exploration work will need to be managed in a manner consistent with the Plan (Section 8.10).
Waste Management	***Tasmanian Waste and Resource Management Strategy 2009***	The Strategy has been developed to provide broad guidance and a strategic framework for solid waste management and resource recovery initiatives and programs.	Waste management principles embodied within the Strategy are incorporated within the EP, under Sections 8.3, 8.4 and 8.5.
Water Quality	***State Policy on Water Quality Management 1997***	This Policy's objective is to achieve the sustainable management of Tasmania's surface water and groundwater resources by protecting or enhancing their qualities while allowing for sustainable development in accordance with the objectives of Tasmania's Resource Management and Planning System.	This Policy applies to the proposed exploration work with regards to the management of ballast waters (Section 43 of the Policy) and the management of sewage and other wastes from vessels (Section 41 of the Policy). These are discussed in Sections 8.3, 8.4 and 8.5 of the EP.
Water Quality	***Water Management Act 1999***	The objectives of the Act are to promote sustainable use and facilitate economic development of water resources and to maintain ecological processes and genetic diversity for aquatic ecosystems.	This Act is not likely to apply to the Ringarooma Bay exploration by TNT Mines Ltd as it relates to land based activities and freshwater resources, neither of which apply to the proposed vessel-based exploration program. TNT Mines Ltd is aware that this Act may be triggered if any land based activities are included as part of the exploration work.
Weed Management	***Weed Management Act 1999***	The *Weed Management Act 1999* is the principal legislation concerned with the management of declared weeds in Tasmania.	There are no Declared Weeds listed for the marine environment so the legislation is not relevant to the project.

Appendix D - MGS Specification for Survey

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21 December 2011

SURVEY BUDGET – REVISION 5

MGS SPECIFICATION FOR SURVEY

RINGAROOMA BAY MARINE GEOPHYSICAL & HYDROGRAPHIC SURVEY

FOR

TNT MINES LTD

Contact Person: Dr. Peter J Ramsay (PhD, Pr. Sci. Nat., Cert. Prof. Hydrographic Surveyor Level 1 - CPHS 1

Email: ramsay@marinegeosolutions.com

TABLE OF CONTENTS

1. INTRODUCTION

Following a discussions on 20 December at TNT Mines offices, I have pleasure in submitting a new quotation to conduct a 1,081 line km hydrographic & marine geosphysical survey on the vessel *MV Dell Richey II* in Ringarooma Bay.

Marine GeoSolutions Pty Ltd (MGS) has some of the best instrumentation and expertise for producing high-resolution geophysical products and MGS staff are highly experienced in hydrography and marine geophysics and all the scientists are registered hydrographic surveyors (Levels 1 & 2) and are current members of the SSSI (Appendix A). The quality standards of MGS's data, maps and report are acknowledged in the industry as being world-class.

2. COMPANY INFORMATION

Marine GeoSolutions Pty Ltd is a specialist hydrographic and marine geophysical survey company operating from Perth (Australia) & Durban (South Africa) and is co-owned by Dr Peter J Ramsay & Mr. Warwick R Miller. The directors of the company have a very strong background in marine geology, sedimentary processes and 44 years of combined experience in marine geophysical surveying and consultancy. The company's strength is to provide solutions to problems that defy standard investigative methods, by developing new and innovative ways to use the available technology. This combination of experience, expertise and innovation creates a formidable survey team.

Marine GeoSolutions Pty Ltd is a dynamic company that offers a total solution to all near-shore survey requirements. This includes all facets of project management, including; desktop studies, survey planning, data acquisition, sediment sampling, ore reserve calculations, map generation and report writing. All tasks are performed in-house, which facilitates quick turn-around times on all projects. Marine GeoSolutions Pty Ltd core business is offshore mineral exploration and geophysical site investigation surveys for marine construction and dredging programmes. In addition to offshore mineral exploration and site investigation surveys, the company has experience in a number of other fields which are listed below.

Services offered include:

- Advanced marine geophysical surveying
- Near shore and continental shelf mapping
- Heavy mineral and diamond resource surveys
- Well-site investigations
- Multibeam bathymetric surveys
- Vibrocoring surveys
- Marine GIS
- Harbour development surveys.
- Wreck and pipeline surveys.
- Seafloor/harbour debris surveys.
- Marine engineering site surveys.

3. HSE COMPLIANCE

MGS has the following detailed business management systems in place:

- Safety Management System (Office & Offshore)
- Quality Management System
- Environmental Management System
- Business Continuity Plan
- Sustainable Development Policy

The company is an approved vendor to major international mining companies (such as Rio Tinto and BHP Billiton) and complies with all the relevant marine safety standards. Company personnel have attended offshore survival courses and have passed the relevant medical examinations. A copy of our OHS policy is appended (Appendix B). Health and safety plans, safety procedure documentation, risk assessments and quality manuals are available for each facet of the survey operation. MGS has an excellent safety track record. The annual company man hours are approximately 10,890 with zero incidents, zero loss time injuries and zero total days lost from 2005 to 2010.

A combination of MGS's & Richey Fishing's HSE systems will be used for the survey under the umbrella of TNT

Mines HSE requirements.

4. MGS PROJECT TRACK RECORD

MGS has conducted over 95 hydrographic and geophysical survey projects since 2001 for clients such as Rio Tinto, Chevron, BHP Billiton, PRDW, Svitzer, Jan De Nul and Fremantle Ports (Appendix C). MGS has an exceptional track record in marine geophysics and hydrography and the quality standards of MGS's data, maps and reports are acknowledged in the industry as being world-class. See Appendix D for letters of reference.

Selected projects include:

Fort Dauphin Port Development Surveys (Rio Tinto/Baird & Associates) – Mr Jeff MacNabb (jmacnabb@baird.com)
These surveys involved detailed mapping and sampling for a proposed Port construction area in Madagascar for Rio Tinto. The surveys involved the determination of all the geotechnical rock and sediment properties using bathymetry, side-scan sonar, pinger & boomer sub-bottom profiling, vibrocoring, underwater drilling and sampling. Both the consulting engineers (Baird & Associates) and the client were extremely impressed with MGS's ability. Completed in Jan 2005.

RBM (Rio Tinto) Offshore Heavy Mineral Surveys – Mr Andrew Denton or Mr John Selby (andrew.denton@rbm.co.za or john.selby@rbm.co.za)
These surveys involved the mapping of complex mineral resources on the continental shelf using bathymetry, side-scan sonar, pinger & boomer sub-bottom profiling, magnetics, induced polarisation, vibrocoring and bulk sampling surveys to determine an ore reserve model for areas of the shelf. These surveys were extremely innovative and received wide acclaim from the client. Completed in June 2007.

Durban Harbour Widening & EPRC Surveys – Mr Jo Dresner (jdresner@prdw.co.za)
This project involved the collection of multibeam bathymetry, single-beam bathymetry, side-scan sonar, pinger & boomer sub-bottom profiling and vibrocoring to provide all the basal data for the future engineering projects in the Port of Durban. The project also involved the detailed multibeam mapping of quaywalls to assess potential damage. These data have had wide acclaim from PRDW, NPA & HMG. Completed in December 2008.

Marine Surveys for the Agulhas Current Alternative Energy Project – Mr Terence Govender (govenkm@eskom.co.za)
This involved the collection of multibeam bathymetry, side-scan sonar and pinger sub-bottom profiling data to map the seafloor to determine suitable sites for the possible deployment of current turbines to generate electricity. Working in extremely difficult sea conditions, MGS achieved excellent quality data and exceeded the client's expectations. Completed in February 2008.

Oil Pipeline Geophysical Survey (PetroSA) – Mr Jo Dresner (jdresner@prdw.co.za)
The project involved the collection of single-beam bathymetry, multibeam bathymetry, side-scan sonar and boomer and pinger sub-bottom profiling data to map the seafloor to determine suitable pipeline routes on the shelf offshore of Coega. MGS achieved remarkable data quality in inclement sea conditions and received acclaim from the client and consulting engineers. Completed in February 2010.

Harbour Berth Survey (Bulk Connections) – Mr Iain Geldhart (IainG@bulkconnections.com)
This was an innovative multibeam echosounder survey of berths and quaywalls within a Port to optimise the berth usage and locate any quaywall engineering defects. The survey made use of advanced MBES processing and PPK positioning and motion compensation to achieve ultimate precision. Completed in May 2010.

Magnetic Survey of Port Hedland (Jan De Nul) - Mr Emmanuel De Ridder (survey.porthedland@jandenul.com)
This involved the collection of high resolution magnetic data to map ferrous targets in the harbour floor which might prove hazardous to dredging. Completed in January 2011.

Heritage Marine Geophysical Survey at Onslow (Chevron) – Dr Glen Young (Glen.Young@chevron.com)
This survey involved the collection of very high resolution multibeam, side-scan sonar, pinger and magnetic data to map the area around the Onslow 1896 Jetty to assess the heritage implications of the structure. Completed in September 2011.

5. METHOD STATEMENT

MGS proposes to mobilise all instrumentation (1,300 kg) and personnel to Tasmania and mobilisation of the survey vessel will be conducted in Devonport. The team will consist of very experienced marine geophysicists and hydrographic surveyors. Specialised brackets will be fabricated to mount the multibeam and pinger transducers and various booms will be fabricated to accommodate the boomer system on the vessel. All instrumentation will be mobilised, installed and calibrated on the vessel. Survey control and two tide gauges will be established and installed at Ringarooma Bay to precisely monitor tidal levels to a defined datum for the duration of the survey operations. All data will be acquired according to the strictest international standards and the survey conducted according to International Hydrographic Organisation (IHO) S-44 standards, US Army Corp of Engineers (USACE EM 1110-2-1003) standards following the IMCA S 003 Rev 1 guidelines for surveys.

MGS will conduct the survey using RTG GPS, multibeam echosounding, inertial navigation system, digital side-scan sonar, pinger sub-bottom profiling, boomer sub-bottom profiling and magnetic profiling.

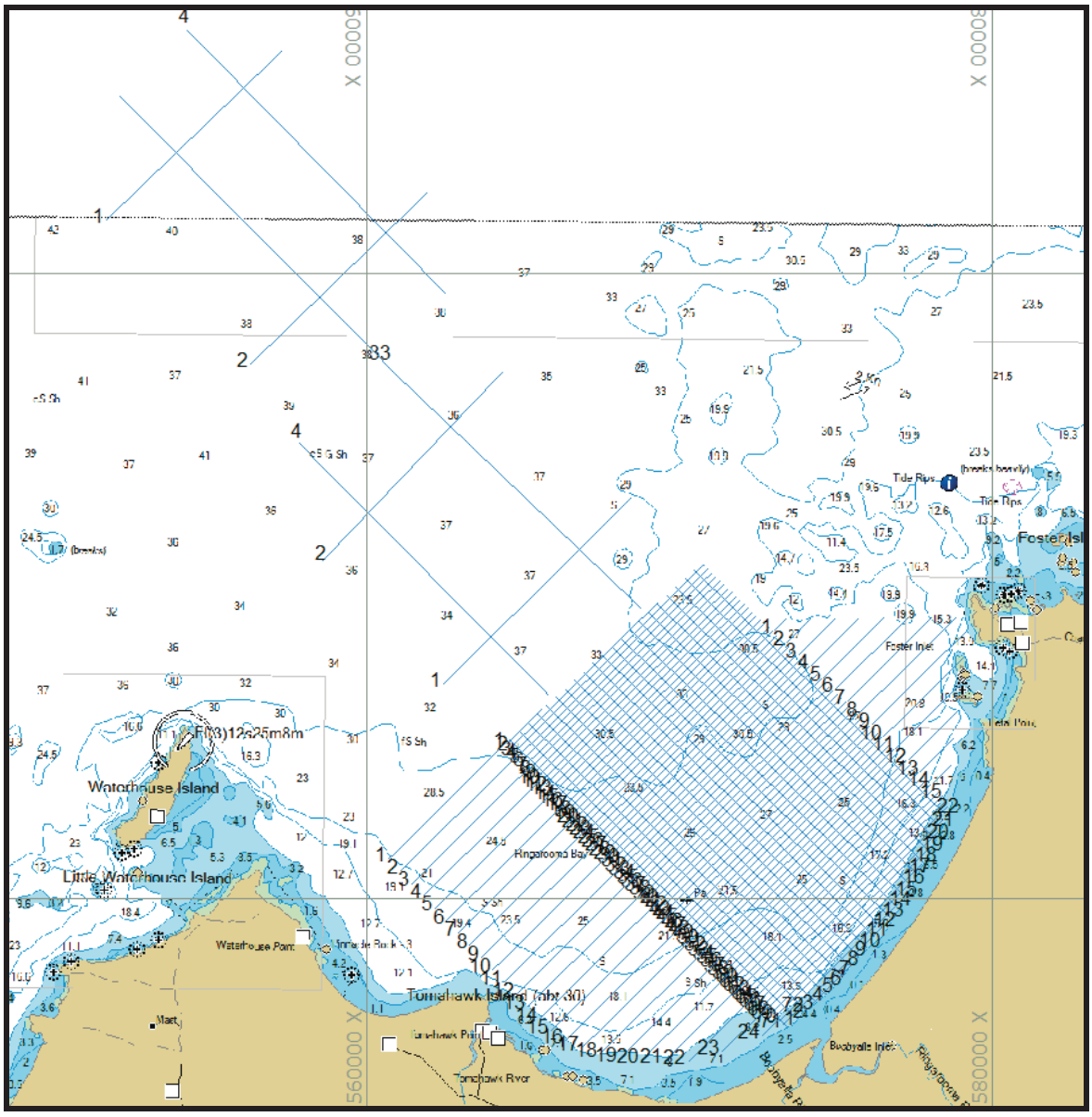
- The multibeam bathymetry data accurately measures the tidally-corrected water depth to produce a highly accurate digital terrain model of the seafloor and a contour bathymetry map.
- The side-scan sonar produces an aerial "photograph" of the seafloor showing rock outcrops and different sediment types (gravel, mud, sand, etc.) and shipwrecks or debris.
- The pinger sub-bottom profiling data will penetrate ± 10 m into the unconsolidated sediments to map the upper sediments with high resolution.
- The boomer sub-bottom profiling data will penetrate ± 40 m into the unconsolidated sediments to map the deeper geological layers and channels.
- The magnetometer data will detect magnetic minerals such as magnetite which can be associated with the cassiterite and hence can be used as proxy data for the cassiterite concentration. ***Shallow magnetic basement may reduce the magnetometer's ability to detect magnetic minerals in the unconsolidated sediment.***

MGS owns and maintains a full suite of the most advanced hydrographic and marine geophysical instrumentation available on the market (see Section 6.2 to 6.8). These instruments are considered to be robust and extremely reliable for this type of survey and MGS have not had any major failures of instruments in the past six years. For this proposal we have elected to use the following instrumentation:

- C-Nav RTG GPS
- Reson Seabat 7101ER multibeam echosounder
- Applanix POSMV 320 inertial navigation system
- Sound velocity profiler
- Klein 3000 digital side-scan sonar
- CSW-7 side-scan sonar winch
- 300 J Design Projects/Applied Acoustics 300 J boomer system (spare hydrophone)
- 4 kHz GeoAcoustics pinger system
- SeaSpy or Geometrics magnetometer
- Full digital acquisition system (HyPack, Klein and CodaOctopus)

Survey operations will be conducted during daylight hours only and the vessel will anchor at night in a safe area. **An estimated acquisition rate would be 40 line km per survey day during daylight hours only**. Should the weather conditions deteriorate, the Master and Party Chief may elect to return the vessel to Devonport to seek safe anchorage. The vessel will occasionally need to resupply fuel, water & food in Devonport. A detailed line km plan has been developed to cover the tenement areas and the total survey line kilometres will be approximately 1,081 line km which should take approximately 27 days to complete, without any stoppages due to inclement weather, instrumentation or vessel breakdowns and refuelling. The survey line plan for each of the survey blocks is tabulated overleaf in priority of survey importance and is plotted on the hydrographic chart of the area.

SURVEY BLOCK	LINE SPACING	TOTAL LINE KM
BLOCK A MAIN	180 m coast parallel & 400 m coast normal (593 line km & 260 line km, respectively)	853
BLOCK B	Two coast parallel & two coast normal line only	40
BLODC C	Two coast parallel & two coast normal line only	40
BLOCK A SW EXTENSION	540 m coast normal only	113
BLOCK A NE EXTENSION	540 m coast normal only	35
		1081



Hydrographic chart of Ringarooma Bay showing the survey line plan.

This area will be surveyed using a very sophisticated multibeam echosounder which has been configured to collect bathymetry and Snippets backscatter seafloor information to accurately define the seafloor topography. The echosounding data will be corrected for tidal variations using two tide gauges deployed in the area. The tide gauges will be accurately surveyed with respect to Chart Datum and AHD and the collected tidal data will be fully corrected for barometric pressure changes using a calibrated barometer installed on site. Sound velocity profiles will also be collected twice daily to correct the bathymetric data for water column sound velocity changes as this method is much

more accurate than conducting a "bar check". A series of parallel survey lines will be collected in the area prior to the survey to conduct a "patch test" on the data. A "patch test" is used to calibrate multibeam echosounder installations for offsets in time, roll, pitch, and heading. The accuracy of measured depths in the multibeam hydrographic survey will be precisely determined using the most advanced error budget methods. The total sounding error in a measured depth at the 95 percent confidence level, after systematic and system specific errors have been removed, shall not exceed 0.25 m (IHO Special Order standards). The maximum allowable error in measured depth includes all inaccuracies due to residual systematic and system specific instrument errors; the velocity of sound in water; static vessel draft; dynamic vessel draft; heave, roll, and pitch; and any other sources of error in the actual measurement process. The hydrographer will document in the survey report the methods used to minimize the errors associated with the determination of depth (corrections to echosoundings).

The side-scan sonar towfish will be towed on a 300 m armoured cable approximately 10-15 m above the seafloor; this altitude will be maintained using a dedicated side-scan sonar winch. The towfish will be accurately positioned using a cable counter connected to the navigation PC and the application of advanced towfish layback algorithms. Both 100 kHz and 500 kHz data will be recorded and a scan range of 100 m, providing a 200 m swathe has been specified.

The sub-bottom profiling survey will involve the collection of boomer and pinger seismic data as a combination of two different frequencies will greatly aid in achieving the desired results. The pinger transducer will be hull mounted whilst the boomer transducer and hydrophone array will be "tethered and towed" at a fixed distance behind the vessel. The pinger and boomer data will be acquired simultaneously on separate seismic acquisition systems, using a custom-built trigger box to negate acoustic interference between the two systems. MGS is the only company able to simultaneously collect both seismic profiling systems without data interference. All navigation will be accomplished using DGPS positioning, while trigger rates, sweep rates and band pass filtering will be adjusted to maximise and enhance the seismic data. All data will be digitally stored on internal hard drives of the seismic acquisition systems.

The magnetometer will be towed behind the side-scan sonar using a tandem tow array and the magnetometer elevation off the seafloor by adjusting the tow cable length using a sonar winch. Magnetometer positioning will be accomplished using layback algorithms.

The corrections and calibrations that will be applied to the data are:

- DGPS precision test
- Multibeam bathymetry patch tests
- Water profile sound velocity corrections
- Multibeam bathymetry error budget calculations to prove IHO Special Order compliance
- Seismic velocity corrections for water column and saturated sediments

5.1 DATA PROCESSING, MAP GENERATION & REPORT

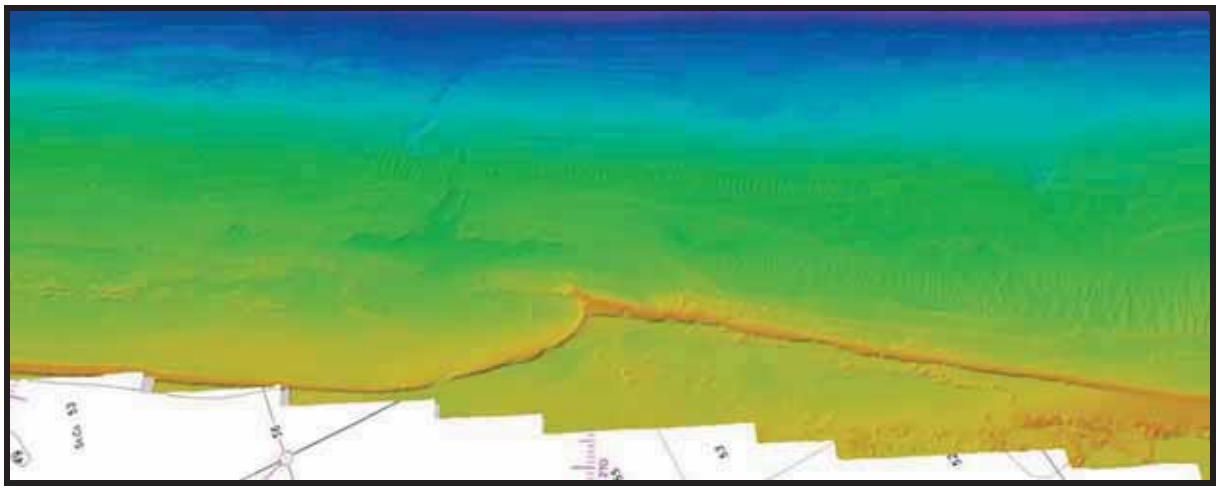
MGS will have highly experienced geophysicists and hydrographic surveyors on-board the vessel with MSc & PhD degrees to assess the data and recommend modifications to the survey line plan to achieve the client's objectives. The multibeam bathymetry, side-scan sonar, sub-bottom profiling data and magnetic data will be processed in MGS's offices using a suite of sophisticated software (see Section 6.9).

Map products will be produced in the MGA Zone 55 coordinate system and the survey products will include:

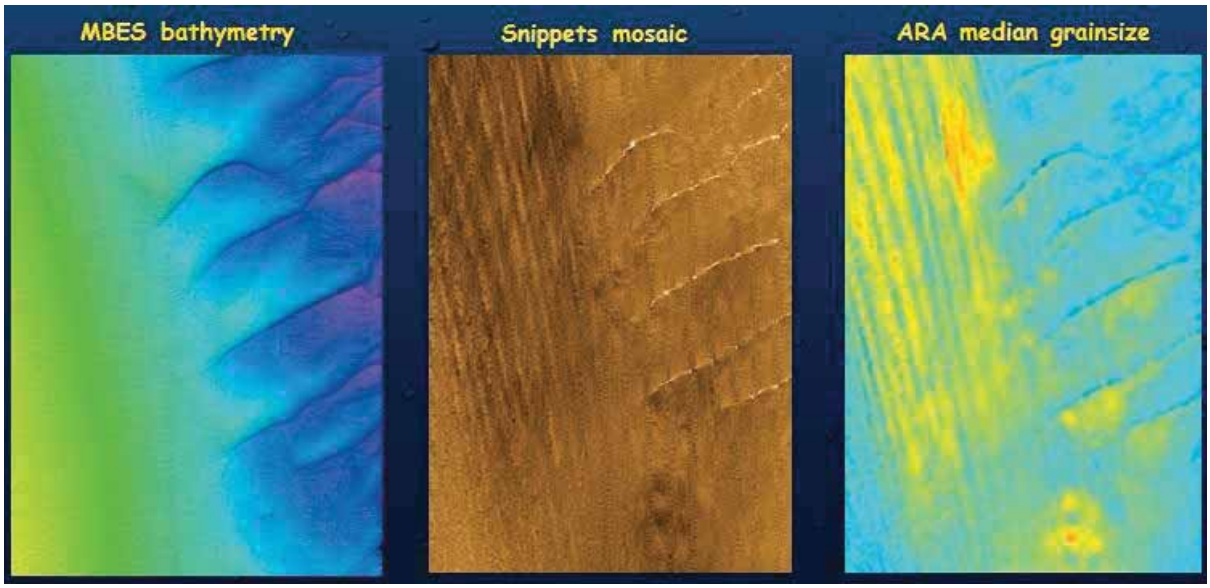
- Colour contour bathymetry maps and digital terrain model
- Optional backscatter mosaic and sediment classification.
- Side-scan sonar mosaic (100 kHz or 500 kHz) depending on which frequency shows the best geological features.
- Seafloor geology map from side-scan sonar data.
- Sub-bottom profiling isopach sediment thickness maps showing all interpreted geological layers.
- Bedrock elevation contour map.
- Ten cross-section profiles of the data showing all the interpreted horizons.
- Colour total field magnetic map of the showing deep magnetic anomalies (i.e. basement)
- Colour first vertical derivative map of the showing shallow magnetic anomalies (in sediments).
- Copies of all digital data and maps produced in ArcView 9.3 format on DVD-ROM.
- One copy of A0 maps and detailed report (2 x copies) on the findings.

5.2 SURVEY DATA EXAMPLES

Multibeam bathymetry image showing complex geological formations.

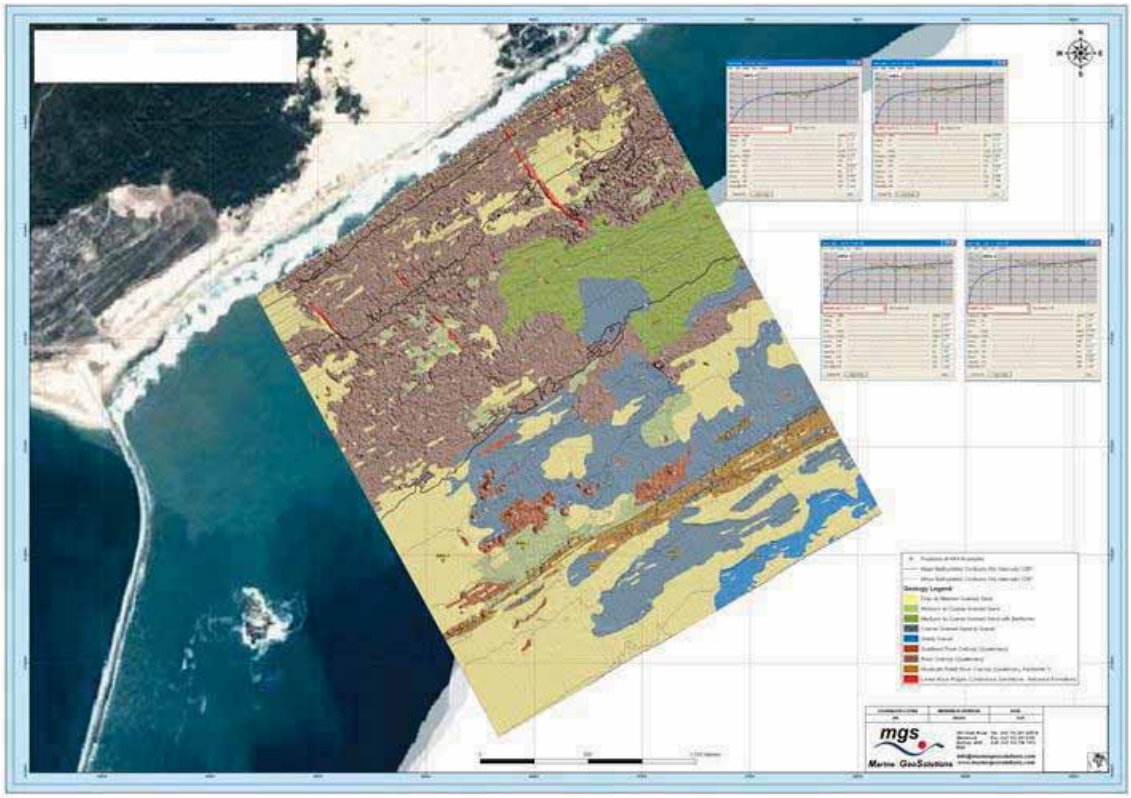


Multibeam bathymetry image of the shelf showing calcarenite outcrops and palaeo-river channels.

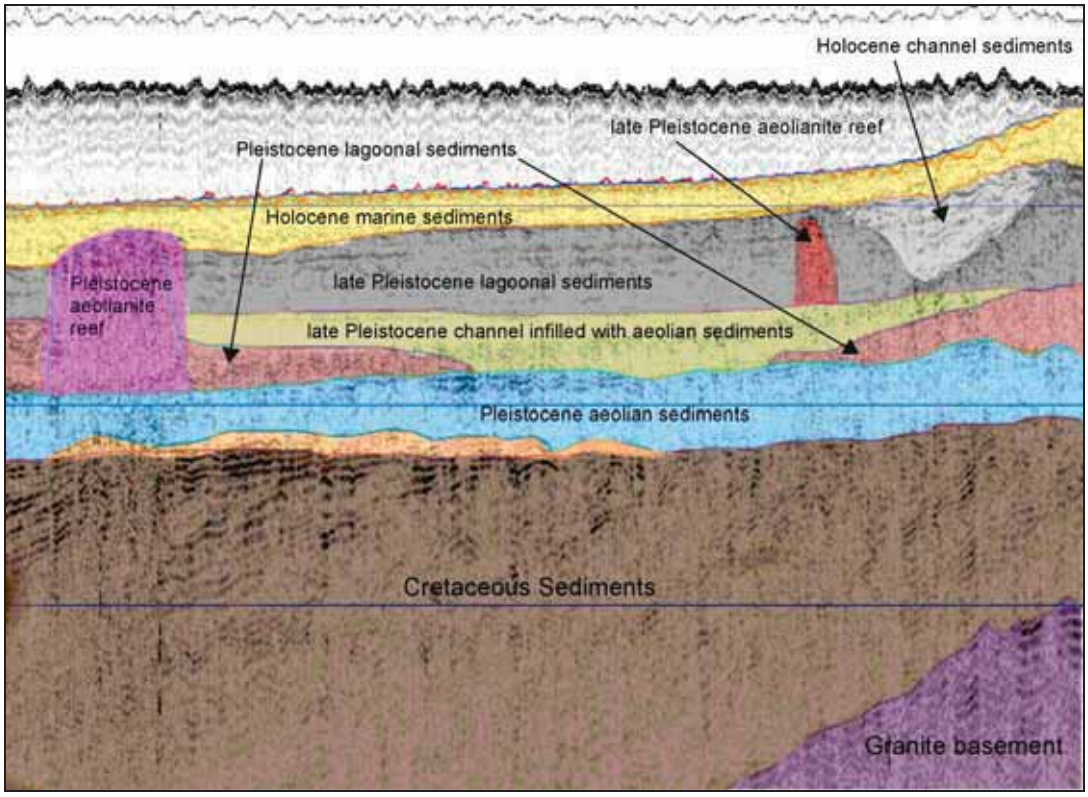


Detailed backscatter processing showing the MBES digital terrain model, backscatter mosaic and backscatter extracted sediment grainsizes.

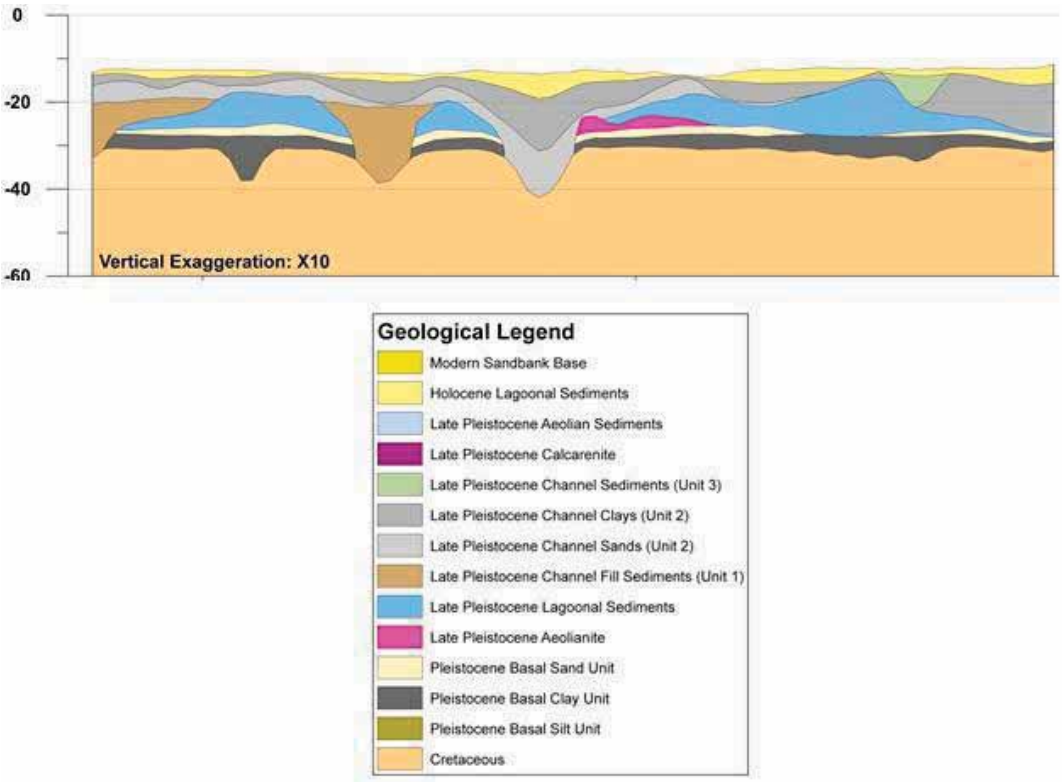
Side-scan sonar mosaic of the seafloor.



Seafloor geology map showing rock outcrops and different sediment types.



Interpreted Boomer seismic profile showing the regional stratigraphy off the coastline.



Interpreted Boomer & Pinger seismic profile with geological legend.

Image showing magnetic anomalies in a Port entrance.

6. EQUIPMENT

MGS owns and maintains a full suite of the most advanced hydrographic and marine geophysical instrumentation available on the market. Valid calibration certificates are available for all instrumentation on request. MGS also have some of the most up-to-date and advanced software for processing the survey data in a quick turnabout time.

6.1 Survey Vessel

The vessel is 25 m long and has a draft of 2.6 m and can accommodate 12 people.

Survey vessel *MV Dell Richey II*.

6.2 Positioning

The navigation system for the survey will consist of a C-Nav 2050 RTG differential GPS system, which is capable of decimetre accuracy, interfaced as an auxiliary GPS input into an Applanix POSMV 320 system to provide highly accurate positioning of approximately 7 cm accuracy. The C-Nav 2050 sensor consists of a 10-channel dual frequency precision GPS receiver, two additional channels for receiving Satellite Based Augmentation System (SBAS) signals and an L-Band demodulator for reception of the StarFire Network APS correction service. With the C-Nav 2050 interfaced to the POSMV, high precision navigation data was output to *HyPack Max* navigational software package at an update rate of 10 Hz.

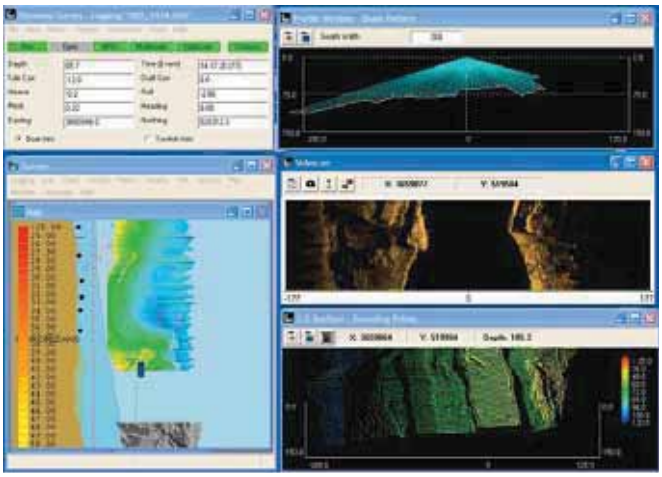
C-Nav 2050 RTG system and Applanix POS MV

6.3 Multibeam Echosounding

A RESON SeaBat 7101ER multibeam echosounder with a 240 kHz transducer will be used for the survey. This is a 1.5°x1.5° system with a variable beam spacing of 101, 239 beams or 511 beams that acquire a 150° bathymetric swath across the seafloor to produce a swath of up to 7.4 times water depth. The system has range resolution of 1.25 cm and can measure depths of up to 300 m. **This sonar also records quality Snippets and average backscatter data together with full water column information if required.** The SeaBat 7101ER multibeam echosounder will be interfaced to an Applanix POS MV motion reference unit. The POS MV is a tightly coupled system, which provides accurate attitude, heading, heave, position, and velocity data, and is the best system for use with multibeam sonar systems. The multibeam system will be calibrated with a Valeport Mini-SVS sound velocity sensor at the transducer head and a Navitronic SVP-15 sound velocity profiler and all bathymetric data will be acquired using HyPack HySweep software.

RESON SeaBat 7101 ER multibeam echosounder.

POS-MV motion reference unit



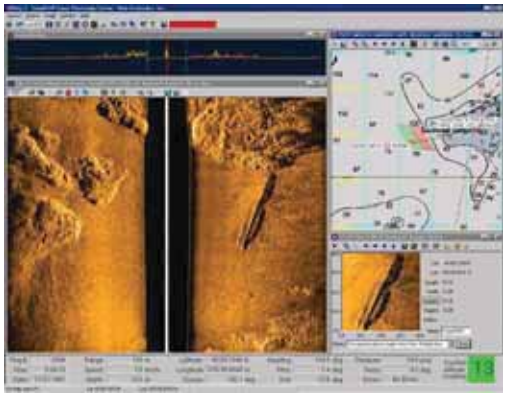
Hypack HySweep acquisition and processing software

Reson SVP-15 sound velocity profiler

6.4 Digital Side-Scan Sonar

A Klein System 3000 digital side-scan sonar, with a dual frequency (100/500 kHz) digital tow-fish will be used to acquire the side-scan sonar data. The Klein System 3000 is a high-resolution sonar and ranks amongst the most advanced sonar systems available in the world. The system is based on new transducer designs as well as advanced circuitry recently developed for the Klein multibeam focused sonar. Acquisition of the sonar data is accomplished using a surface mounted TPU (top processing unit) and Klein's *SonarPro* PC based software. Due to the water depth in the survey area, the side-scan sonar will be attached to our CSW-7 sonar winch with 300 m of armoured coaxial cable. Cable lengths will be measured using a T-Count cable counter.

Klein 3000 side-scan sonar towfish.



SonarPro acquisition system

CSW-7 side-scan sonar winch

T-Count cable counter

6.5 Pinger Sub-Bottom Profiling

A *GeoAcoustics* GeoPulse sub-bottom profiler, which is capable of achieving 10 metres of penetration with resolutions of better than 0.2 metres in the vertical plane, will be used to collect shallow penetration sub-bottom profiles. This system utilises a four transducer array which will be hull mounted. A separate hydrophone array can be utilised if desired. The transmitter output power is 10 kW and the operating frequencies are 2-7 kHz. The receiver has a built-in filtering system including a swell filter. The sub-bottom profiling data is digitally captured by the Octopus 360 seismic acquisition system. Data is interpreted using in-house designed software that captures the profiled data in an ASCII X,Y, Z format ready for 3-D modelling.

Pinger transducer array

Pinger acquisition system

6.6 Boomer Sub-Bottom Profiling

A high frequency (300 J) Design Projects "boomer" will be used to collect medium penetration seismic profiles with a penetration of 40 m to 50 m with a resolution of better than 0.3 metres in the vertical plane. An Applied Acoustic Engineering CSP1000 power supply will be used to power the "boomer" up to a maximum energy output of 1000 J per second. A Design Projects 8 element hydrophone array will be used in conjunction with an Octopus 360 seismic processor to acquire and store the seismic data in SEG-Y format on an internal hard-drive. The Octopus 360 will be used for real-time processing, digital recording and as a post-processing workstation. Onboard processing facilities of the Octopus 360 include swell filtering, stacking, time varied band pass filtering, time varied gain, and auto bottom tracking. ***The pinger and boomer data will be acquired simultaneously on separate seismic acquisition systems, using a custom-built trigger box (Timer 2 system) to negate acoustic interference between the two systems.***

Boomer seismic profiling system

Timer 2 system

High voltage power supply

Octopus 360 acquisition system

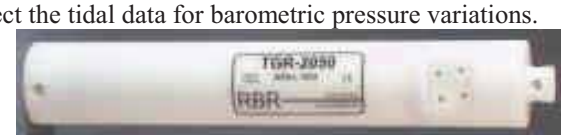
6.7 Marine Magnetometer

Marine Magnetics SeaSpy (or Geometrics 882) magnetometer will be used to collect the magnetic data. The SeaSpy operates using Overhauser sensors which provide a high-resolution output, with a sensor sensitivity of 0.015 nT (nanoTesla), resolution of 0.001 nT, absolute accuracy of 0.2nT and a maximum sampling rate of 4 Hz. The advantage of this Overhauser magnetometer is that its specifications do not degrade over time, and thus never requires realignment or recalibration. As absolute instruments, these magnetometers are themselves reference standards and do not require calibration. The magnetometer will be towed behind the side-scan sonar as a tandem tow system.

SeaSpy magnetometer and tandem tow system with the side-scan sonar.

6.8 Tide Gauge

Two RBR TGR 2050 tide recorders will be used to acquire tidal variation data for the duration of the survey. These will deployed underwater and surveyed very accurately with respect to the defined datum. A calibrated barometer will also be deployed to correct the tidal data for barometric pressure variations.



Tide gauge

6.9 Processing Software

Marine GeoSolutions owns a full spread of hydrographic, geophysical and mapping processing software which will be used to produce the data products. The software includes:

- HyPack Max
- Navlog side-scan processing software
- Navlog sub-bottom processing software
- IVS3D Fledermaus
- ERMapper
- AutoCAD
- ArcGIS 9.3
- Intrepid
- ERDAS Imagine
- Intrepid
- Surfer 10
- Grapher 5
- Didger

7. ALLOCATION OF RESOURCES

The following MGS personnel will be allocated full time to the project for the entire duration (see Appendix A for short CV of Ramsay & Miller):

Dr. Peter Ramsay, PhD, Pr.Sci.Nat, Cert. Prof. Hydrography 1	Director, hydrographer & geophysicist
Mr. Richard Miller, MSc, Pr.Sci.Nat, Cert. Prof. Hydro. 1	Director, hydrographer & geophysicist
Mr. Douglas Slogrove, Dip Elec Eng., Cert. Prof. Hydrography 2	Hydrographic surveyor/engineer
Mr. Philippe Van Den Bossche, MSc, Pr.Sci.Nat, Cert. Prof. Hydro. 2	Marine geophysicist & hydrographer

The following Gantt charts are presented as estimation on how long the project will take to conclude. The total project will take 13 weeks to complete.

SURVEY SCHEDULE

PHASE	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12	Wk 13
Mob													
Survey													
Demob													
Reporting													

8. SCHEDULE OF PRICES

RINGAROOMA BAY SURVEY	COST
	A$
Specialised bracket manufacture on the MV Dell Richey II	
Mobilisation/demobilisation to Devonport (incl. all preparation time, airfreight, air flights, insurance & vessel crew)	
Installation & removal of instrumentation on vessel in Devonport (4 days) – MGS costs.	
Installation & removal of instrumentation on vessel in Devonport (4 days) – Vessel cost plus 10%	
Transit from Devonport to Ringarooma and return (2 days – vessel, personnel & instrumentation - per day)	
Vessel costs for survey ($ per day including fuel, lubes & port charges) -27 days	
Marine geophysical & hydrographic survey - estimated at 27 days ($ per day)	
Data processing, map production & report	
TOTAL	
MGS daily standby rate	
Vessel daily standby rate at sea (plus 10%)	
Vessel daily standby rate in port (plus 10%)	
Optional backscatter processing (maps, grainsize & reporting)	
Further development of the scope of work will be charged at $ /hour	

NOTE

- Quoted prices EXCLUDE GST and are valid for 60 days from date of issue.
- MGS's HSE system is compliant with Australian and WA State laws but client modifications required to the HSE system will be charged at an hourly rate of $ /hour.
- Vessel costs quoted include fuel, lubes, port charges and MGS's 10 % vessel management fee. All vessel costs will be separately itemised on the invoices.
- The prices quoted cater for a fixed mobilisation/demobilisation, instrument installation and processing/reporting costs. The transit costs, survey costs and vessel costs are based on a day rate.
- The quotation **excludes** the risk for inclement weather, client delays, vessel breakdown & instrumentation breakdown, which is borne solely by the client. The **daily standby rate** for inclement weather and other delays is **$ for the survey team, $ for the vessel at sea and $ for the vessel in port**.
- No provision has been made for the time and costs of inductions for the survey team or vessel crew and the cost of any specialised medicals will be claimed back from the client.
- To reduce costs only one set of instrumentation will be provided. If equipment is damaged in transit or during the survey then the client is liable for the **daily standby rate (MGS & vessel)** and additional airfreight to mobilise replacement equipment.

- The mobilisation/demobilisation cost must be paid prior to mobilisation. Balance of survey costs paid after survey is completed and the reporting costs after delivery of the final products.
- Payment terms are strictly 30 days from date of invoice. **Interest will be levied for late payment of invoices at the current overdraft rate of the National Bank of Australia.**

APPENDIX A - DIRECTOR'S SHORT CV

DR PETER J. RAMSAY

Residence: 5 Yabbara Ave, Burns Beach, Perth, WA, 6028, Australia.
Business: Marine Geosolutions Pty Ltd, PO Box 303, Joondalup DC, WA, 6919, Australia.
Telephone: (+61) 45 925 5120 (M)
Fax: (+61) 8 9200 5012
E-Mail: ramsay@marinegeosolutions.com

Date of Birth: 18 August 1964
Marital status: Married (2 children)
Hobbies: Archery, four-wheel drive trails, SCUBA diving & conservation.

PROFESSIONAL QUALIFICATIONS

1986 BSc (Geology III & Applied Geology III)
1987 BSc Honours (Engineering Geology)
1992 PhD (Marine Geophysics) - Dissertation title: "Sedimentology, coral reef zonation, and Late Pleistocene coastline models of the Sodwana Bay continental shelf, northern Zululand"
1997 Registered Professional Natural Scientist (Pr. Sci. Nat.) in the fields of marine geophysics & hydrography.
2008 Certified Professional (Hydrographic Surveyor Level 1) - IHO CAT A.
2009 Registered member of the SSSI.

SCIENTIFIC & CONSULTING EXPERTISE

- Specialist in hydrographic surveying, marine geophysics and advanced geophysical post-processing techniques.
- Extensive experience in the use of real-time differential GPS & RTK, inertial navigation systems, multibeam bathymetry, side-scan sonar, seismic profiling systems and a qualified scientific diving supervisor & ski-boat skipper.
- Computer skills include the development and use of geophysical post-processing software, HyPack, GIS systems, AutoCAD, ER-Mapper & Surfer.
- Specialist in offshore and coastal heavy mineral exploration.
- Heavy mineral sand ore reserve evaluations.
- Oil & gas well site investigation surveys.
- Experienced in coastal erosion and coastal management studies including nearshore and offshore sediment movement.
- Palaeoclimate studies using cores from long-lived coral domes.
- Past part-time lecturer in the School of Geology & Computer Science at the University of Natal, Durban. Courses lectured include: Second & third year Sedimentology, Honours Quaternary geology and palaeoclimatology, and various short courses on marine geology.

SCIENTIFIC EMPLOYMENT EXPERIENCE

1988-1989 Research Officer at the CSIR, Division of Water Technology in Durban, working on estuarine sedimentology & geochemistry.
1989-1994 Marine Geologist, SA Geological Survey in Durban. Involved in mapping and surveying of the southeast African continental shelf and undertaking coastal sedimentology studies.
1995-2001 Manager of the Marine Geoscience Unit of the Council for Geoscience (Geological Survey), working on development advanced marine geophysical post-processing software for seafloor mapping applications. Science manager of various coastal and marine projects. Consultant to numerous mining, environmental and para-statal organisations.
2001-date Director and co-owner of Marine GeoSolutions Pty Ltd specialising in marine mineral exploration, seafloor mapping, harbour development surveys and geophysical software development.

PUBLICATIONS

1 book & 4 book contributions, 14 international refereed papers, 25 conference abstracts and 140 consultancy reports.

R.W. MILLER

Residence:	16 Prince Charles Road, Westville 3630, South Africa.
Business:	Marine GeoSolutions (Pty) Ltd, 105 Clark Road, Glenwood, Durban 4001, South Africa.
Telephone:	(+2731) 2014287 (B), (+2731) 2661153 & (+2783) 780 7013 (C)
Fax:	(+2731) 2010358
E-Mail:	miller@marinegeosolutions.com
Date of Birth:	13 May 1964
Marital status:	Single
Hobbies:	Fly fishing & SCUBA diving

PROFESSIONAL QUALIFICATIONS

- BSc (Geology III & Applied Geology III)
- BSc Honours (Engineering Geology)
- MSc (Geophysics & Sedimentology) – Dissertation title: "The bathymetry, sedimentology and seismic stratigraphy of Lake Sibaya – northern KwaZulu-Natal
- Department of Manpower Scientific Diver
- Registered professional natural scientist (Pr.Sci.Nat.) in the field of marine geophysics.
- Certified Professional (Hydrographic Surveyor Level 1) - IHO CAT A.
- Registered member of the Australian Spatial Sciences Institute.

SCIENTIFIC AND CONSULTING EXPERTISE

- Specialist in marine geophysics and coastal sedimentology.
- Experienced user of marine geophysical equipment including; real-time differential GPS, digital echo-sounders, seismic profiling systems & side-scan sonar.
- Experienced in nearshore geophysical surveys including coastal engineering site investigations and harbour breakwater surveys.
- Computer skills include geophysical data base management and map production.
- Computer modelling of topographic and ore reserve data.
- Heavy mineral sand ore reserve evaluations.
- Experienced in marine sediment coring, logging and facies interpretation including grain-size statistical analyses.
- Specialist in seismic data interpretation and charting.
- Other skills include contract negotiation, client liaison and project management.
- Past Part-time lecturer in the School of Geology & Computer Science at the University of KZN.

SCIENTIFIC EMPLOYMENT EXPERIENCE

1990-1991	Temporarily employed as a research geologist by De Beers Marine.
1991-2001	Employed by the Council for Geoscience as a Marine geophysicist and coastal sedimentologist involved in research and consulting.
2001-date	Director and shareholder of Marine GeoSoloutions (Pty) Ltd specialising in marine mineral exploration, seafloor mapping, submarine cable surveys and geophysical software development.

PUBLICATIONS

Four international publications, 7 conference abstracts, 6 scientific reports and 110 consultancy reports.

APPENDIX B – OCCUPATIONAL HEALTH & SAFETY POLICY

Marine GeoSolutions is committed to providing a safe and healthy work place for all employees, contractors, visitors and public.

Marine GeoSolutions considers that safety is a function of doing business, which allows employees to perform their tasks to their maximum potential and efficiency in a planned, organised and controlled manner without undue risk to their safety or health.

To that effect Marine GeoSolutions has developed a safety management system that is integrated with all organisational activities. All Managers, Employees, Contractors and Visitors have a responsibility to work safely, to take all reasonable care for their own safety and health and that of their fellow employees, contractors, visitors and the public and to take remedial action where workplace hazards are identified.

Marine GeoSolutions is committed to a goal of achieving zero incidents and injuries and will take the following steps to achieve this goal;

- Ensure work safety conditions are maintained.
- Establishing programs and procedures for managing workplace risks;
- Complying with all relevant State Safety and Workers Compensation legislation requirements;
- Involving employees in the development and implementation of the programs and procedures, through the Safety Consultation system;
- Ensure that information on hazards in the workplace and training in how to work safely is passed onto to all personnel;
- Committing adequate and appropriate resources to enable us to achieve these goals.
- Continuously monitoring and improving our systems towards achievement of zero incidents and harm to employees, contractors, visitors and the public.

The Directors accepts responsibility for safety and the monitoring thereof. It is the responsibility of the Management Team to ensure the development, implementation and review of the programs and procedures are undertaken on a regular basis.

This policy will be reviewed every twenty four months, by the undersigned.

Peter J. Ramsay
Director
20th September 2010

Richard W. Miller
Director
20th September 2010

APPENDIX C - PROJECT WORK EXPERIENCE (2001-2011)

CLIENTS	PROJECT DESCRIPTION	LOCATION	PERIOD	EQUIPMENT USED
Richards Bay Minerals (Rio Tinto)	Geophysical survey auditing of dredge mining operations	Richards Bay	Nov 2001	Pinger seismic profiler & vibrocoring
Richards Bay Minerals (Rio Tinto)	Geophysical surveying and determination of offshore heavy mineral resources on the continental shelf. Production of ore reserve GIS model	East coast shelf of South Africa	Jan 2002 - Dec 2002	Side-scan sonar, pinger & boomer seismic profilers, echosounder & magnetometer
National Research Foundation	Geophysical mapping & GIS of submarine canyons for the identification of Coelacanth habitats	East coast shelf of South Africa	Mar 2002- Apr 2002	Multibeam echosounder (Reson 8111)
National Ports Authority	Durban Port development studies - proposed jetty planning	Durban harbour	Mar 2002- Apr 2002	Boomer seismic profiler & echosounder
Durban Municipality	Geophysical survey & GIS of Durban's marine effluent outfalls	Durban	Jun 2002 - Jul 2002	Side-scan sonar & echosounder
Richards Bay Minerals (Rio Tinto)	Development of a Pond Bottom Sensor to audit dredge mining operations	Richards Bay	Oct 2002	Newly developed instrumentation
Smit-Pentow	Survey of the *Jolly Rubino* wreck site to locate toxic debris	St Lucia	Nov 2002	Side-scan sonar
Grinaker/LTA/ Intebeton	Bathymetric auditing of Port dredging operations for quaywall contruction	Durban	Nov 2002 - May 2003	Echosounder & DGPS
Dormac	Offshore search for lost ship's anchors	Durban	Nov 2002	Side-scan sonar
National Research Foundation	The development of an expert marine geographical information system to provide an environmental and economic decision support system for coastal tourism	East coast	Oct 2002 - May 2003	Various geophysical instruments
National Underwater Marine Agency	Search for the wreck of the *SS Waratah*	Eastern Cape shelf	Jan 2003	Side-scan sonar
Rio Tinto	Geophysical and coring survey for proposed harbour development	Madagascar	Mar 2003 - Jun 2003	Side-scan sonar, pinger & boomer seismic profilers, echosounder & vibrocorer
National Ports Authority	Geophysical and coring survey for the widening of Durban harbour	Durban	Jul 2003 – Apr 2004	Side-scan sonar, pinger & boomer seismic profilers, echosounder & vibrocorer
National Ports Authority	Quayside debris survey of Durban harbour	Durban	Jul 2003	Side-scan sonar
Richards Bay Minerals (Rio Tinto)	Development of a Pond Bottom Sensor II to audit dredge mining operations	Richards Bay	Aug 2003 – Oct 2003	Newly developed instrumentation

National Research Foundation	Development of a GIS system for Coelacanth habitat mapping	East coast of Africa	Sep 2003 – Dec 2003	GIS system
National Underwater Marine Agency	GIS database on the *SS Waratah* possible locations	Eastern Cape shelf	Nov 2003 – Dec 2003	GIS system
Mhlathuze Water	Mapping of Mhlathuze marine outfalls for engineering design	Richards Bay	Jan 2004	Side-scan sonar & echosounder
National Ports Authority	Geophysical and coring survey for the delineation of an offshore borrow site	Richards Bay	Mar 2004 – Aug 2004	Side-scan sonar, pinger, echosounder & vibrocorer
Reef Mappers	Geophysical mapping of coral reefs for environmental purposes	Sodwana Bay	Feb 2004 – Nov 2004	Side-scan sonar & echosounder
National Underwater Marine Agency	Search for the wreck of the *SS Waratah*	Eastern Cape shelf	Apr 2004 – Jun 2004	Side-scan sonar
Smit Salvage BV	Survey of the *Tasmin Spirit* wreck site to locate debris	Karachi, Pakistan	Apr 2004	Side-scan sonar
SAPREF	Geophysical survey & GIS of Durban's oil pipeline	Durban	Jun 2004 – Jul 2004	Side-scan sonar
Sasol	Geophysical & oceanographic survey of proposed oil pipelines offshore Mozambique	Inhassoro, Mozambique	Jul 2004 – Sep 2004	Side-scan sonar, ADCP, CTD, tide, diving survey
National Ports Authority	Quayside debris survey of Durban harbour	Durban	Jul 2004 – Aug 2004	Side-scan sonar
Richards Bay Minerals (Rio Tinto)	Geophysical survey auditing of dredge mining operations	Richards Bay	Oct 2004	Pinger seismic profiler & piston coring
Rio Tinto	Detailed geophysical and underwater excavation survey for proposed harbour development	Madagascar	Oct 2004 - Jan 2005	Side-scan sonar, pinger & boomer seismic profilers, echosounder, vibrocorer & drilling
Metoc	Side-scan sonar mosaic production from client data	UK	Oct 2004	Side-scan sonar processing
EGS	EASSy submarine cable landing site visits	SA, Mozambique & Madagascar	Feb 2005	-
Mhlathuze Water	Mapping of Mhlathuze marine outfalls for engineering design	Richards Bay	Feb 2005	Side-scan sonar & echosounder
Protocon	Coring survey for the delineation of an offshore borrow site	Cape Town	Feb 2005	Vibrocorer
Group 5	Moma Jetty geophysical investigation for foundation conditions	Mozambique	May 2005	Side-scan sonar, boomer seismic profiler, echosounder, jet probing

Richards Bay Minerals (Rio Tinto)	Geophysical survey auditing of dredge mining operations	Richards Bay	May 2005	Pinger seismic profiler
Richards Bay Minerals (Rio Tinto)	Development of five additional Pond Bottom Sensors to audit dredge mining operations	Richards Bay	May 2005 – Oct 2005	Newly developed instrumentation
Richards Bay Minerals (Rio Tinto)	Coring and bulk sampling of offshore heavy mineral resources on the continental shelf. Production of ore reserve model	East coast shelf of South Africa	Jul 2005 – Sep 2005	Vibrocorers and bulk sampling system
National Ports Authority	Multibeam & side-scan sonar of offshore dredge disposal site	Richards Bay	Jul 2005 – Aug 2005	Multibeam echosounder (8101) & side-scan sonar
Durban Point Development Company	Multibeam survey of the Vetch's Pier area	Durban	October 2005	Multibeam echosounder (8101)
National Ports Authority	Multibeam & side-scan sonar of offshore dredge disposal site	Richards Bay	Jan 2006 – Mar 2006	Multibeam echosounder (8101) & side-scan sonar
Protekon	Saldanha Bay iron ore jetty geophysical survey	Saldanha Bay	Feb 2006 – Apr 2006	Boomer, pinger seismics, side-scan sonar & echosounding
Jan de Nul	In & out multibeam echosounder surveys in Durban Port	Durban	Mar 2006	Multibeam echosounder (8101)
African Coelacanth Ecosystem Programme	Boomer seismic profiling of shelf & slope	Northern KZN shelf	Apr 2006	Boomer seismic profiler
PRDW	Multibeam & geophysical survey for Durban harbour widening	Durban	Apr 2006 – Jun 2006	Multibeam (8101), single-beam, side-scan sonar, pinger & boomer seismics
Protekon	Vibrocoring & jet probing for Durban harbour widening	Durban	Jun 2006 – Jul 2006	Vibrocorer & jet probe
SAPREF	Oil pipeline survey	Durban	May 2006	Multibeam (8101) & side-scan sonar
PRDW	Dredge disposal site survey	Durban	Aug 2006	Multibeam (8101) & side-scan sonar
BHP Billiton	Chongoene Jetty geophysical investigation for foundation conditions	Mozambique	Aug/Sept 2006	Side-scan sonar, boomer & pinger seismic profilers & echosounder
Richards Bay Minerals (Rio Tinto)	Re-evaluation of offshore mineral resource	Richards Bay	Sept 2006	Desktop study
PRDW	Offshore sand resource survey	Cape Town	Oct 2006	Boomer seismic profiler & echosounder

eLAN Developments	Desalination plant survey	Blythedale	Nov 2006	Side-scan sonar, pinger seismic profiler & echosounder
Transnet/HMG	Durban Port survey	Durban	Dec 2006 /Feb 2007	Multibeam (8101), side-scan sonar, pinger & boomer seismics & vibrocoring
Richards Bay Minerals (Rio Tinto)	Induced polarisation evaluation	Seattle, USA	Jan 2007	Technical evaluation
PD Naidoo & Associates	Dredge disposal site survey	Saldanha Bay	Feb 2007	Side-scan sonar & echosounder
Exxaro Resources	Offshore jetty design survey	Madagascar	Mar 2007	Side-scan sonar & echosounder
Richards Bay Minerals (Rio Tinto)	Induced polarisation survey of offshore mineral lease	Richards Bay	May/Jun 2007	IP arrays
Svitzer Wjis Muller BV	Survey of CP Valour wreck site	Azores	May 2007	Side-scan sonar
Dredging International	Durban entrance multibeam in-survey	Durban	May/Jun 2007	Multibeam (8101)
Dredging International	Durban entrance magnetic survey	Durban	Jun 2007	Magnetometer
National Ports Authority	Multibeam survey of offshore dredge disposal site	Richards Bay	Jul 2007	Multibeam echosounder (8101)
National Ports Authority	Quayside debris survey of Durban harbour	Durban	Jul 2007 – Aug 2007	Side-scan sonar
Coastal Enviro Services	Dredge spoil disposal study	Durban	Aug 2007	Multibeam echosounder (8101) & side-scan sonar
PRDW	Iron ore jetty survey	Saldanha Bay	Aug 2007	Multibeam echosounder (8101)
Eskom	Marine current turbine feasibility study	Eastern Cape shelf	Nov 2007-Feb 2008	Multibeam echosounder (8101), side-scan sonar, pinger SBP & grab sampling
Richards Bay Minerals (Rio Tinto)	Geophysical & vibrocoring survey auditing of dredge mining operations (MPE)	Richards Bay	Jan 2008	Pinger seismic profiler & vibrocorer
HMG	Seismic profiling for Port expansion	Richards Bay	Feb 2008	Boomer seismic profiler
HMG	Quaywall damage mapping	Durban	Mar 2008	Multibeam echosounder (8101)
HMG	Offshore borrow & fill studies	Richards Bay	Apr 2008	Desktop
SAPREF	Oil pipeline survey	Durban	May 2008	Multibeam (8101), side-scan sonar & SBP

Rohde Nielsen	Dredging area auditing	Cape Town	Apr 2008	Pinger seismic profiler & echosounding
SRK	Submarine telecom cable desktop study	SE shelf & slope	Jun 2008	Desktop
Richards Bay Minerals	Offshore aeromagnetic survey	Mtunzini	May 2008 - Jul 2008	Aeromag system
National Ports Authority	Quayside debris survey of Durban harbour	Durban	Jun 2008 – Jul 2008	Side-scan sonar
eTekwini Municipality	Marine outfalls survey	Durban	Jun 2008 – Jul 2008	Multibeam (8101), side-scan sonar & SBP
Petra Diamonds	Mining slimes dam survey	Pretoria	Sep 2008 – Oct 2008	Pinger seismic profiler
Transnet	Offshore dredge borrow and disposal survey	Richards Bay	Oct 2008 – Nov 2008	Multibeam (8101), side-scan sonar & SBP
ACER	Multibeam survey of the seafloor for artificial reef emplacement	Cape Vidal	Nov 2008	Multibeam (8101)
PRDW	Island View Quaywall mapping survey	Durban	Nov 2008	Multibeam (8101)
SAPREF	Resurvey of the SBM pipeline	Durban	Nov 2008	Multibeam (8101), side-scan sonar
National Ports Authority	Quayside debris survey of Maydon Whalf	Durban	Jan 2009	Side-scan sonar
Dredging International	Port entrance seismic & hydrographic survey	Durban	Apr 2009	Boomer, pinger SBP & single-beam bathymetry
PetroSA	SPM hydrographic & geophysical survey	Coega	Jun 2009 – Jan 2010	Side-scan sonar , boomer, pinger SBP & single-beam bathymetry
Viking Development Group	Geophysical surveys for sand borrow sites in Vietnam	Tuy Hoa - Vietnam	Jul 2009	Boomer SBP & single-beam bathymetry
National Ports Authority	Quayside debris survey of Durban harbour	Durban	Aug 2009	Side-scan sonar
PetroSA	SPM route multibeam surveys	Coega	Dec 2009 – Jan 2010	Multibeam (8101), side-scan sonar
PetroSA	Seawater intake geophysical survey	Coega	Jan 2010 – Feb 2010	Multibeam (8101), side-scan sonar, boomer & pinger SBP.
Bulk Connections	Quaywall mapping survey	Durban	Apr 2010 – May 2010	Multibeam (7101)
SAPREF	Oil pipeline survey	Durban	May 2010	Multibeam (7101), side-scan sonar & SBP
SAPREF	Erosion study	Durban	Nov 2010 – Dec 2010	Multibeam (7101), side-scan sonar & SBP
Rio Tinto	New Zealand iron sands review	New Zealand	Oct 2010	Desktop

DOF Subsea /Chevron	Wheatstone optimization survey	Exmouth	Dec 2010	Multibeam (7125), side-scan sonar, SBP & vibrocoring
Jan De Nul	Magnetic survey	Port Hedland	Jan 2011	Magnetometer
Fremantle Port	Advanced multibeam survey	Fremantle	Mar 2011	Multibeam (7101)
PRDW	Marine geophysical survey of Matola	Maputo	Apr 2011	Side-scan sonar, boomer, pinger SBP & single-beam bathymetry
Rio Tinto	Side-scan sonar & seismic data processing & interpretation	New Zealand	May 2011 – Jun 2011	Desktop
PRDW	Port development marine geophysical survey at Quelimane	Mozambique	Jun 2011 – Jul 2011	Boomer SBP & single-beam bathymetry
Chevron	Marine geophysical survey of the Onslow 1896 Jetty site	Onslow	Aug 2011	Multibeam (7101), side-scan sonar, pinger SBP & magnetometer
Chevron	Marine geophysical survey of the Wheatstone Trunkline KP0 – KP12	Onslow	Aug 2011	Multibeam (7101), side-scan sonar, pinger SBP
Chevron	Beadon Creek port survey	Onslow	Aug 2011	Multibeam (7101) & side-scan sonar
Sasol	Hydrographic & geophysical survey in the Mozambique Channel	Moz Channel	Oct 2011 – Nov 2011	Single-beam bathymetry & side-scan sonar
Iluka Resources	Heavy mineral deposit exploration	Australia	Nov 2011	Desktop

APPENDIX D - LETTERS OF REFERENCE

Referees Report for Dr Peter J Ramsay

This report is written by Duncan Mallace, the Managing Director of NetSurvey Limited. Duncan Mallace holds a B. Sc. in Surveying Science from the University of Newcastle Upon Tyne, UK, an IHO Category A accredited course and also fully accredited with the Royal Institution of Chartered Surveyors in the UK.

I have known Peter for approximately seven years. When we met Peter was working for the Council of Geosciences in South Africa and I was working for Octopus Marine Systems. Peter started up his company Marine Geosolutions in 2001. Marine Geosolutions placed a contract with Octopus to perform a multibeam survey as part of a project that Peter had to examine Coelacanth habitats. This project was very successful and received worldwide recognition. This was also Peter's first involvement in multibeam bathymetry data.

Since that contract Marine Geosolutions purchased their own multibeam bathymetry system (a RESON Seabat 8101) and an Applanix POS MV 320 inertial system. This purchase is indicative of the high level of quality in Peter's survey work. He could have chosen cheaper options for both types of system but instead chose the option that would render the best quality data.

Marine Geosolutions, under Peter's guidance have now become recognised worldwide as leaders in the field of multibeam bathymetry and hydrographic surveying in general and have undertaken surveys for charting, environmental studies, marine geology and also recently for civil engineering purposes in the port of Durban.

To achieve the highest quality deliverables, Peter has either written his own software or developed strong ties with leading survey software companies to help achieve the joint goal of producing software that will meet his requirements while helping the software companies generate sales by providing an enhanced product to the market. An example of this is the Point Cloud software. Developed in-house at Marine Geosolutions to aid processing and interpretation of multibeam bathymetry data, it has since been included in the most recent release of HYPACK software suite (probably the most successful hydrographic software package in terms of the number of licenses sold.

Peter and I talk often about the latest trends and technological advances in hydrographic surveying. He has written numerous papers and made numerous studies into the minute

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detail of different aspects of survey data collection and processing, which I personally have learnt a great deal from.

Dr Peter J Ramsay will be an excellent addition to the Spatial Sciences Institute. His thirst for knowledge will result in active dialogue to the benefit of all.

Yours faithfully,

Duncan Mallace
Managing Director

e: duncan@netsurvey.co.uk

HYPACK®, Inc.

Date: 20 February 2008

To: Whom it may concern

Subject: Letter of Recommendation for Marine GeoSolutions, Durban, S.A.

Dear Sir of Madam,

HYPACK develops software for the hydrographic survey industry. Our clients include national survey agencies and private firms who conduct surveys for cartography and dredging support.

Over the last several years, we have had the opportunity to work closely with Marine GeoSolutions (MGS) of Durban, South Africa. What first caught my eye about MGS were their stunning final products showing their multibeam survey results. As we developed a closer relationship with MGS, I discovered that their excellent work was a result of the meticulous calibration of their systems and an advanced understanding of the equipment and the science behind it.

My conversations with Dr. Peter Ramsay and Warwick Miller at MGS have led to several enhancements in our HYPACK® and HYSWEEP® software packages. When potential HYPACK® users want to see what can be done with our software, I show them samples of MGS surveys.

If I had a requirement for any type of hydrographic survey work, I would feel very fortunate if MGS was involved.

Pat Sanders
President

HYPACK, Inc., 56 Bradley Street, Middletown, CT 06457; Phone (860)-635-1500; Fax (860)-635-1522; www.hypack.com

PRESTEDGE RETIEF DRESNER WIJNBERG (PTY) LTD

CONSULTING PORT AND COASTAL ENGINEERS

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P O Box 50023, Waterfront, 8002, South Africa
Tel: +27 21 418 3830 Fax: +27 21 418 3834 E-mail: info@prdw.co.za

To whom it may concern.

20 February 2008

Marine bathymetric surveys and sub-bottom profiling form a fundamentally important input to our requirements for design in the coastal environment. The accuracy of such work is of vital importance to our ability to deliver reliable and cost effective solutions to our clients.

Marine GeoSolutions (Pty) Ltd have performed numerous hydrographic and geophysical surveys for us over a number of years.

We have found them to deliver a consistently superior product at all times, and can commend them for their high level of expertise, their adherence to stringent international quality standards, and their ability to meet onerous time constraints.

In our opinion Marine GeoSolutions offer a service of world class quality, and we have no hesitation in recommending them for marine hydrographic and geophysical survey work.

Yours faithfully
PRESTEDGE RETIEF DRESNER WIJNBERG (Pty) Ltd

JHE DRESNER

Appendix E - Near Shore Seabed Mapping Excerpts for Ringarooma Bay

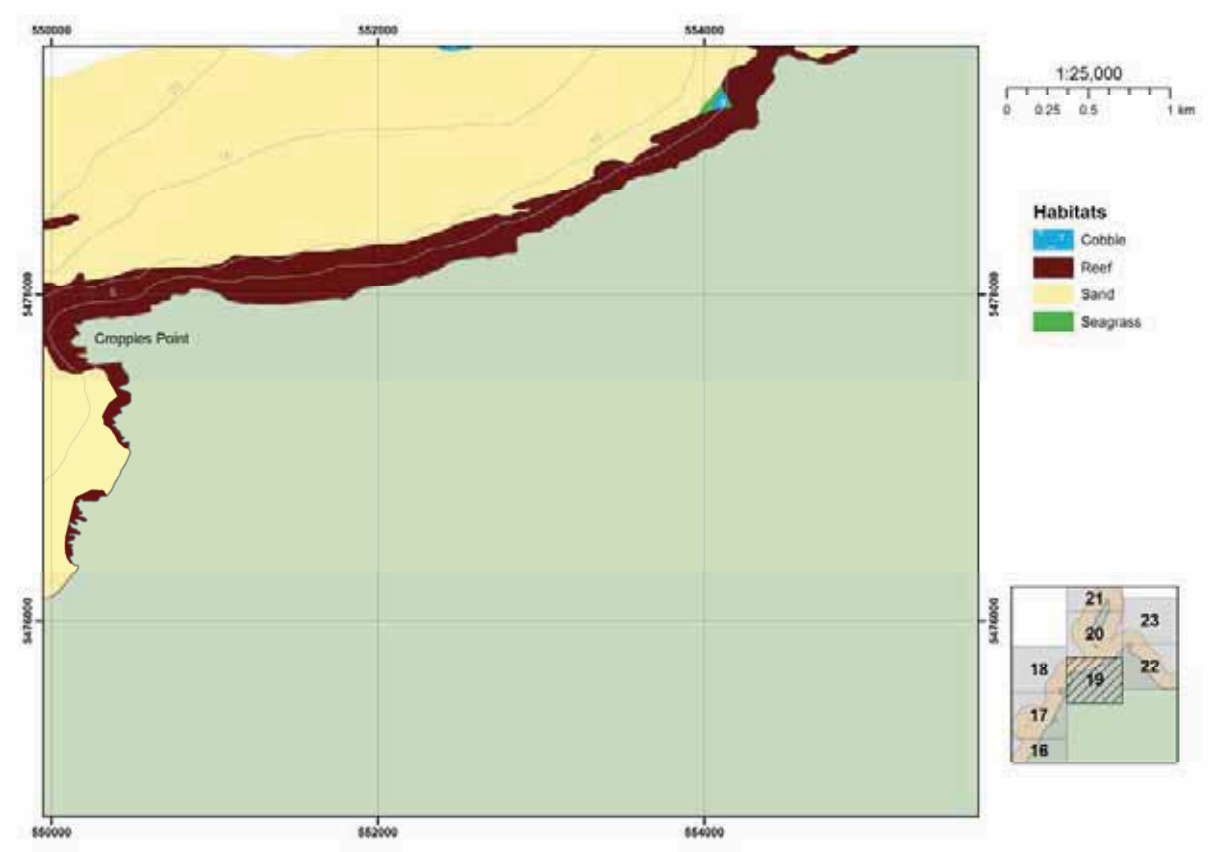


Figure 62. Tamar River to Swan Island map series map 19 showing habitats and bathymetry off Croppies Point.

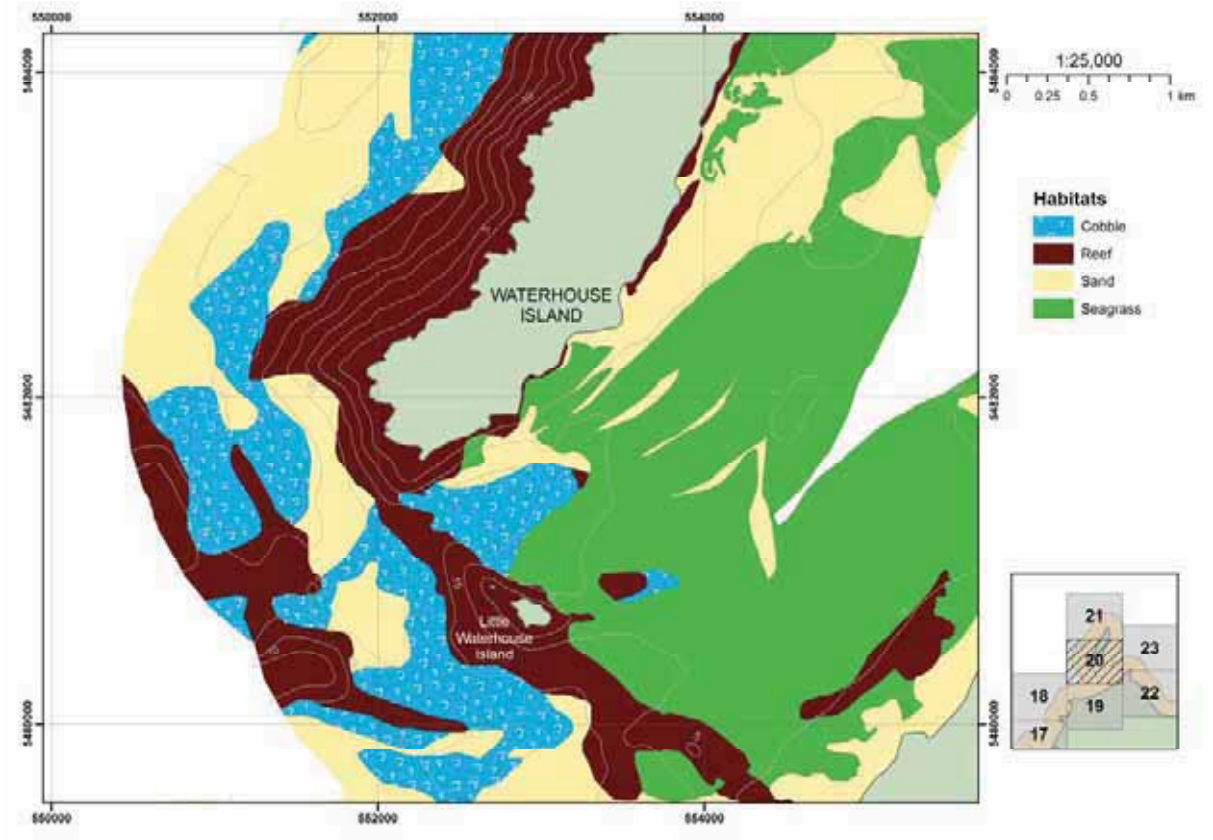


Figure 63. Tamar River to Swan Island map series map 20 showing habitats and bathymetry around southern Waterhouse Island.

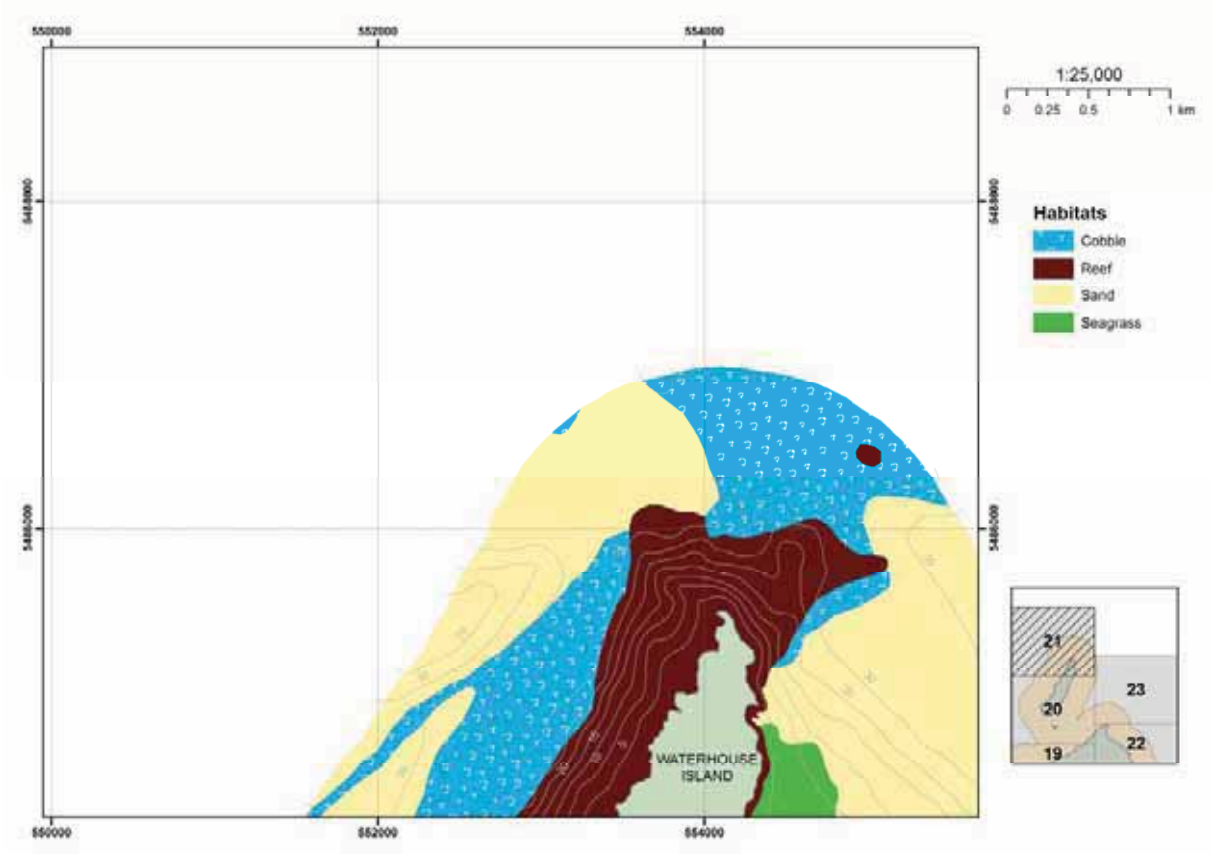


Figure 64. Tamar River to Swan Island map series map 21 showing habitats and bathymetry around northern Waterhouse Island.

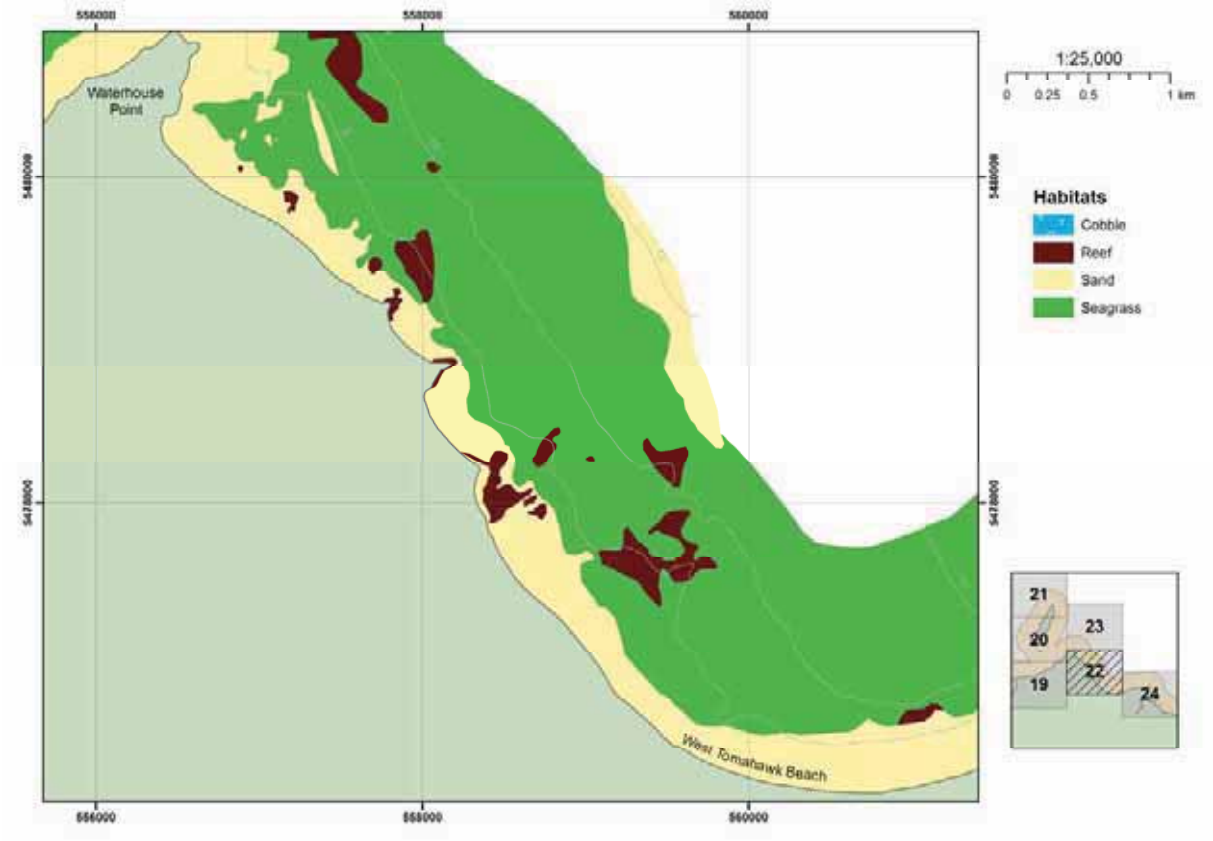


Figure 65. Tamar River to Swan Island map series map 22 showing habitats and bathymetry off Waterhouse Point and West Tomahawk Beach.

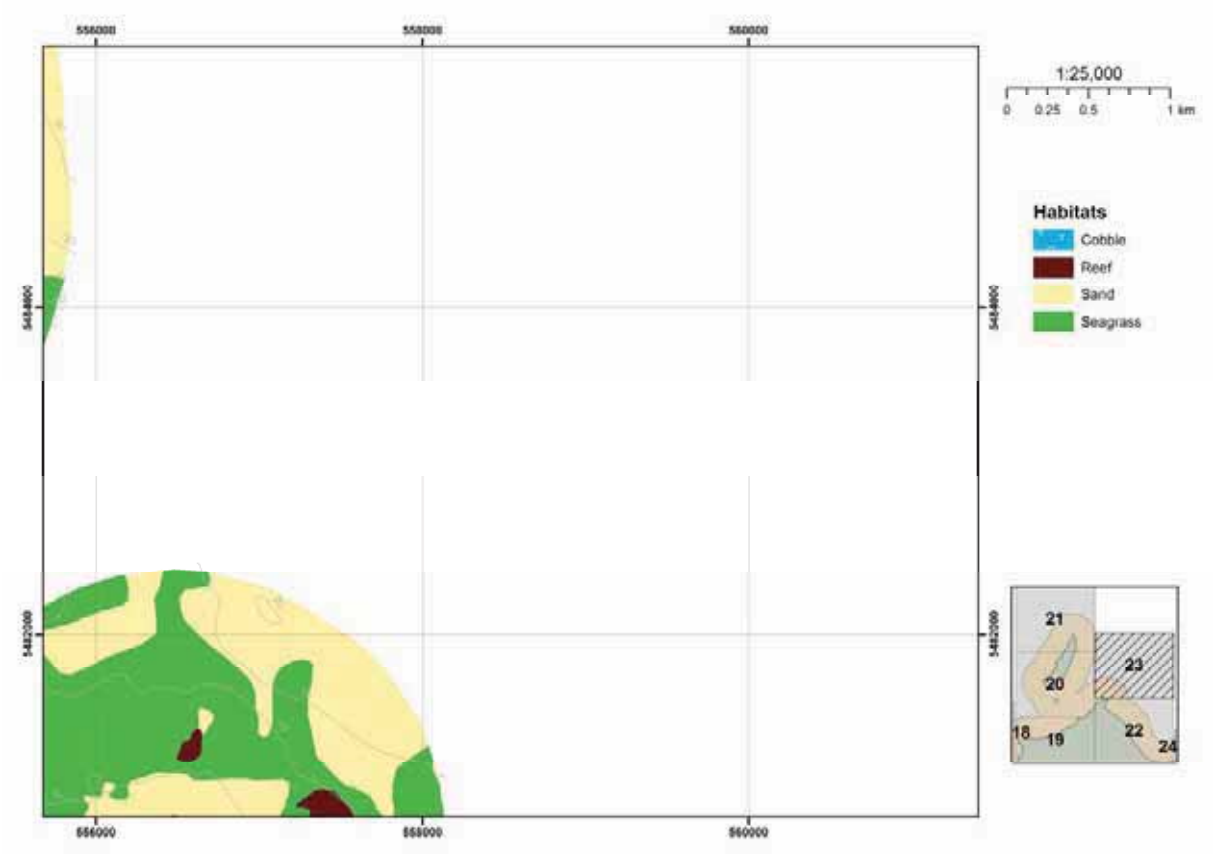


Figure 66. Tamar River to Swan Island map series map 23 showing habitats and bathymetry off Waterhouse Point.

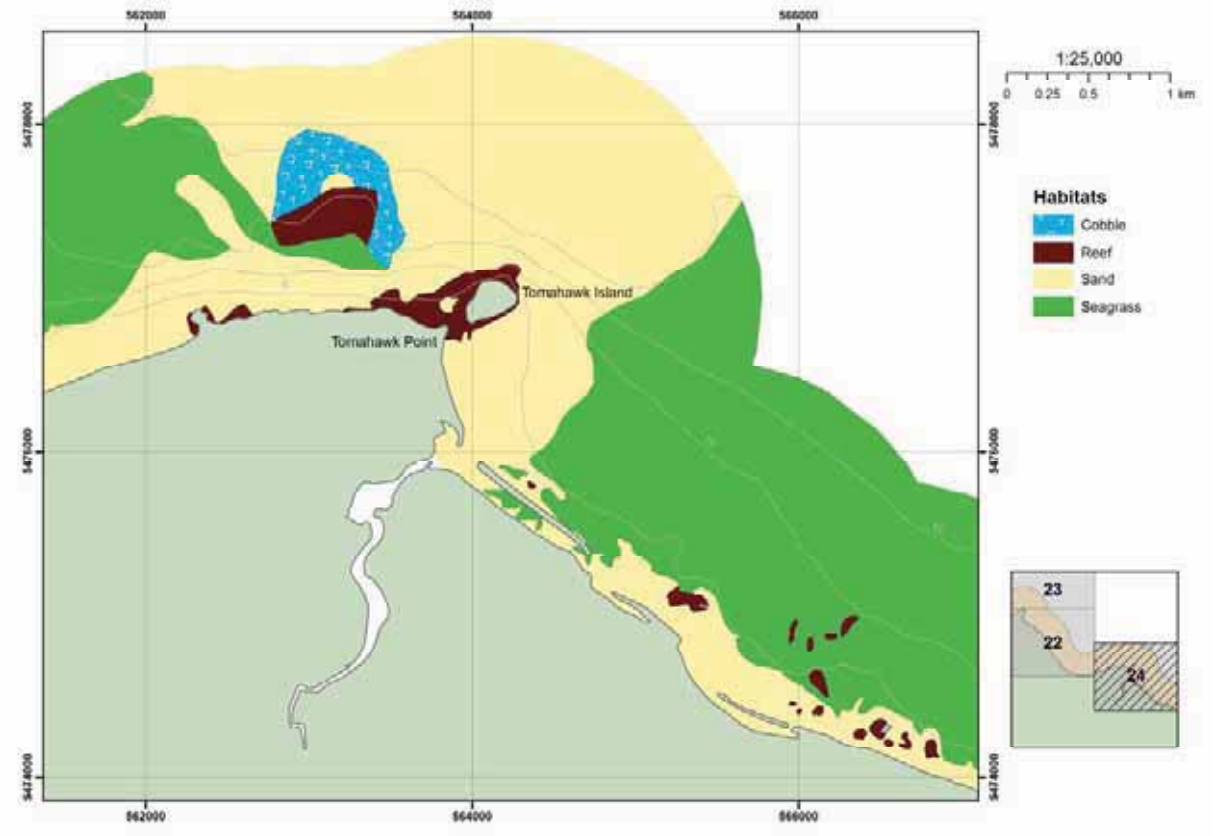


Figure 67. Tamar River to Swan Island map series map 24 showing habitats and bathymetry off Tomahawk Island.

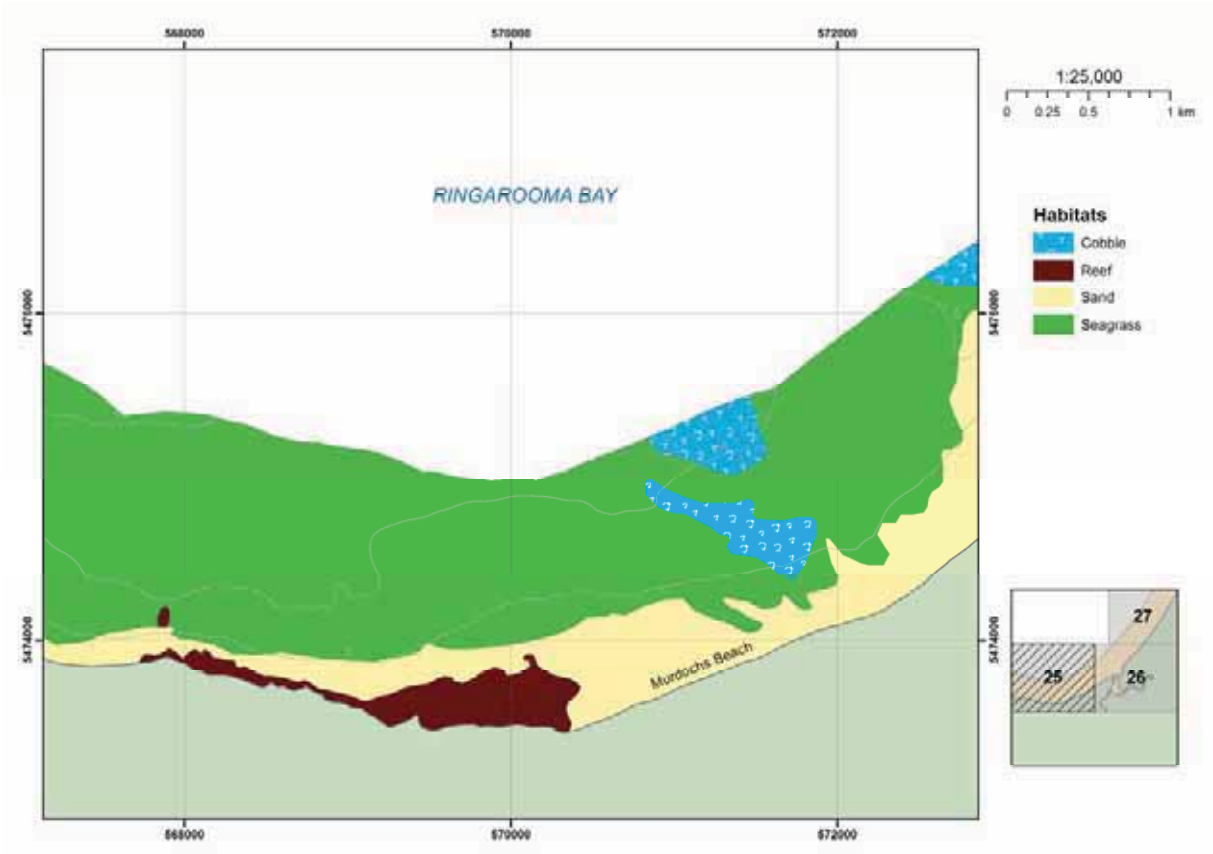


Figure 68. Tamar River to Swan Island map series map 25 showing habitats and bathymetry off Murdochs Beach.

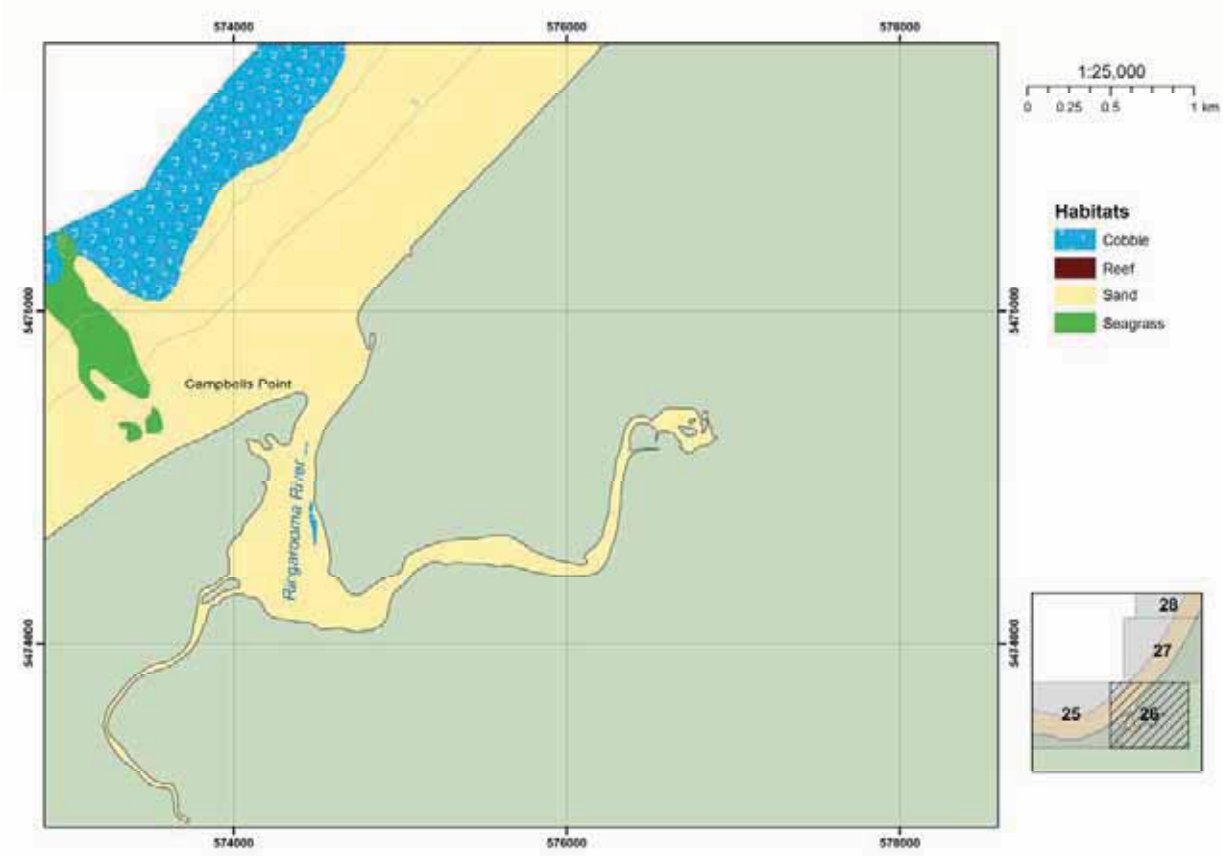


Figure 69. Tamar River to Swan Island map series map 26 showing habitats and bathymetry off Campbells Point

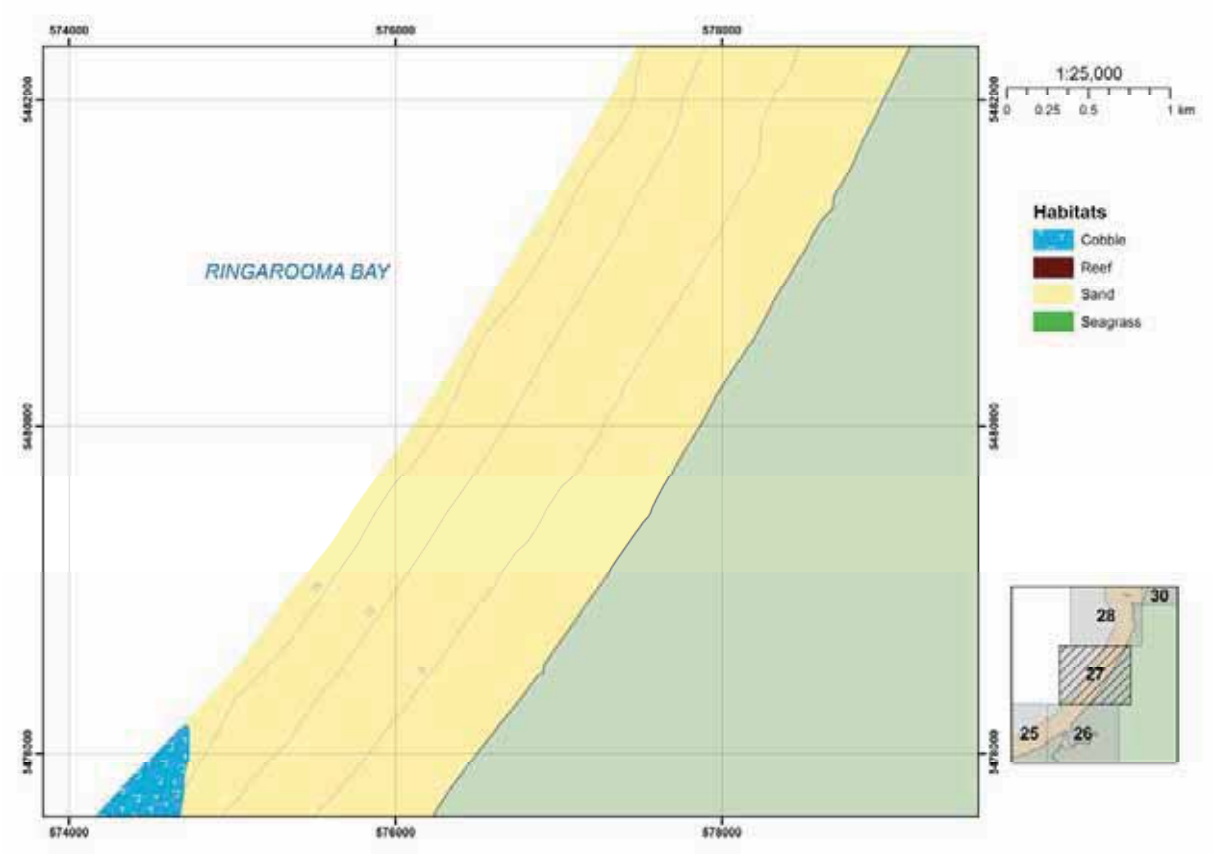


Figure 70. Tamar River to Swan Island map series map 27 showing habitats and bathymetry off Boobyalla Beach.

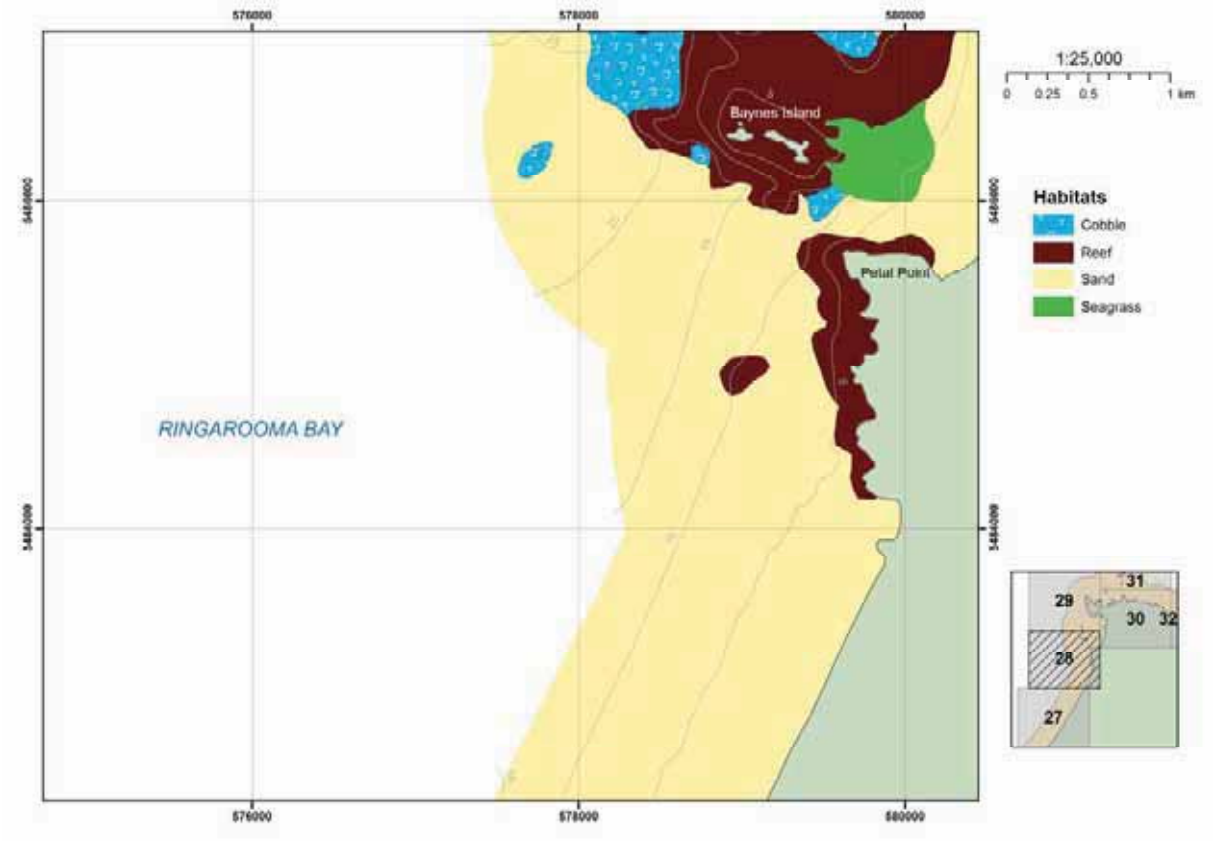


Figure 71. Tamar River to Swan Island map series map 28 showing habitats and bathymetry south of Baynes Island and Petal Point.

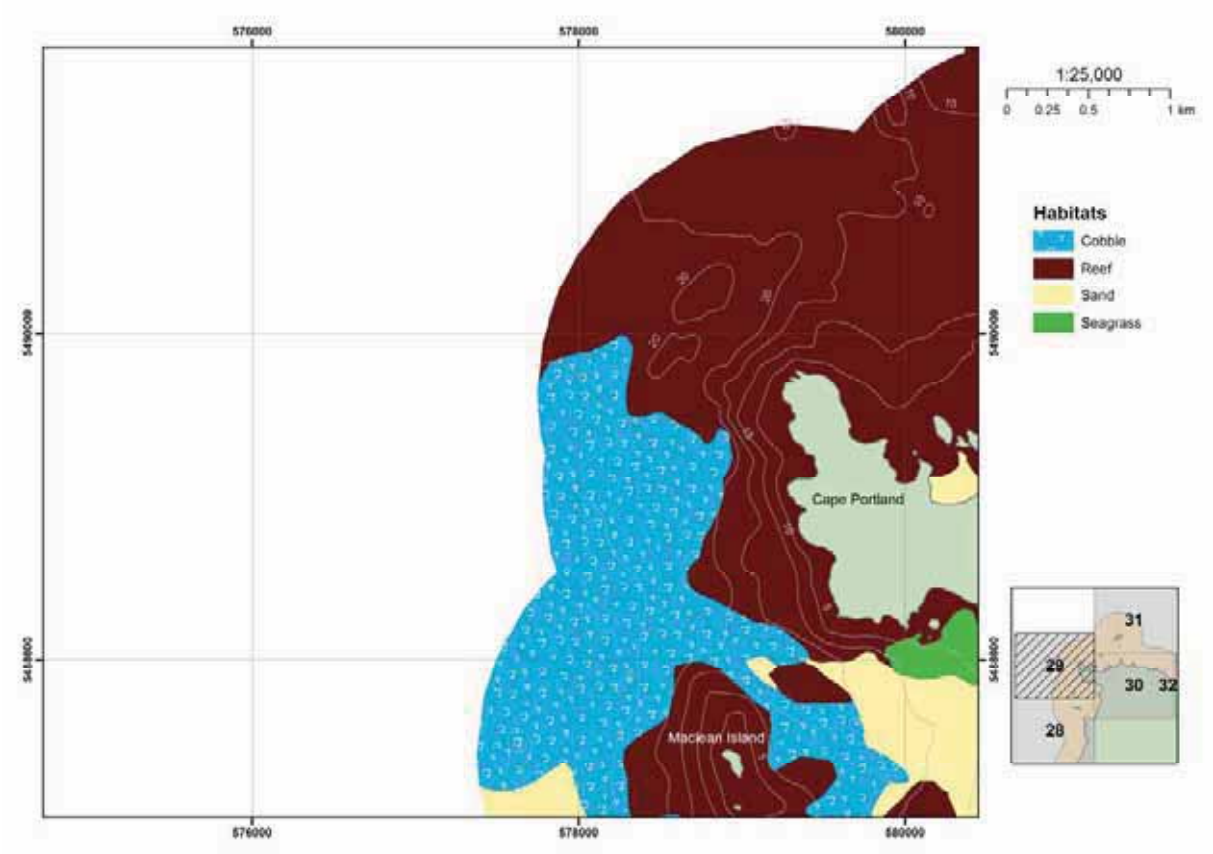


Figure 72. Tamar River to Swan Island map series map 29 showing habitats and bathymetry around Cape Portland.

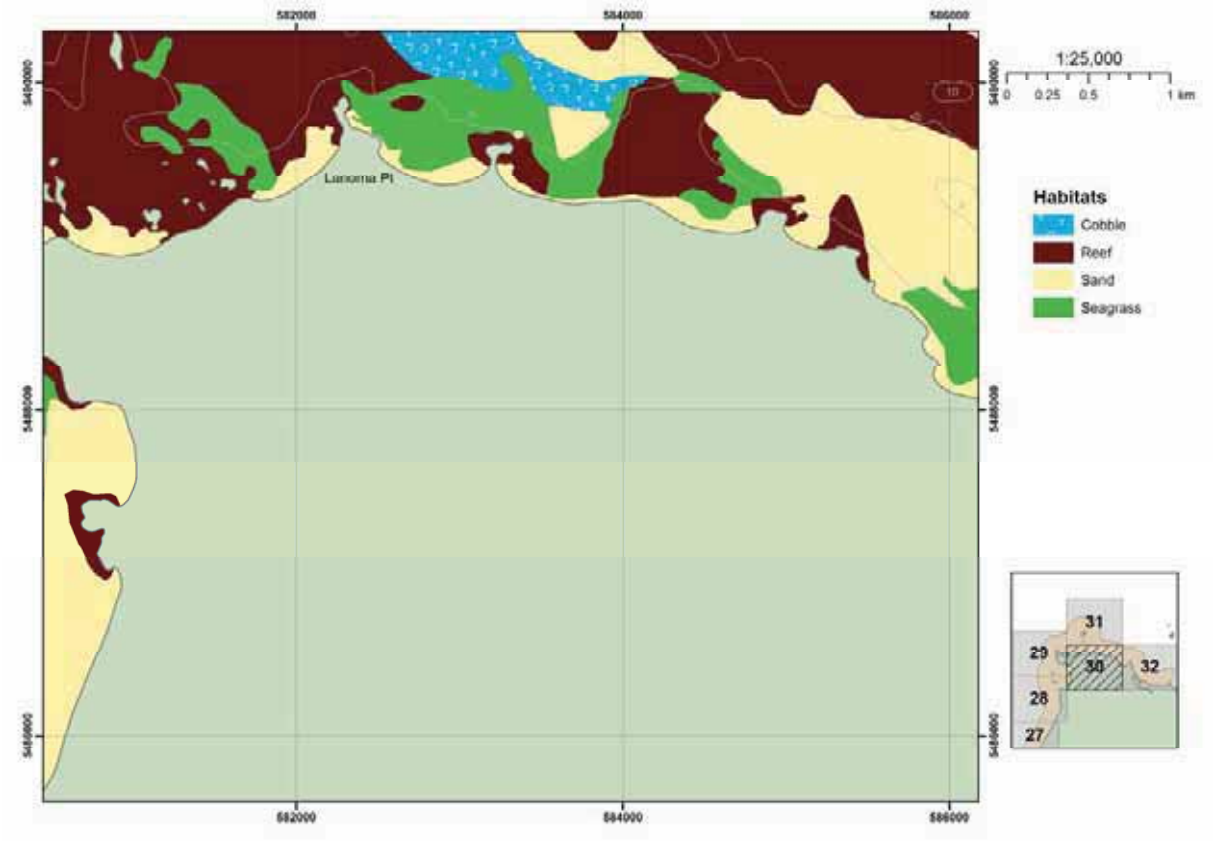


Figure 73. Tamar River to Swan Island map series map 30 showing habitats and bathymetry for Foster Inlet and Lanoma Point.

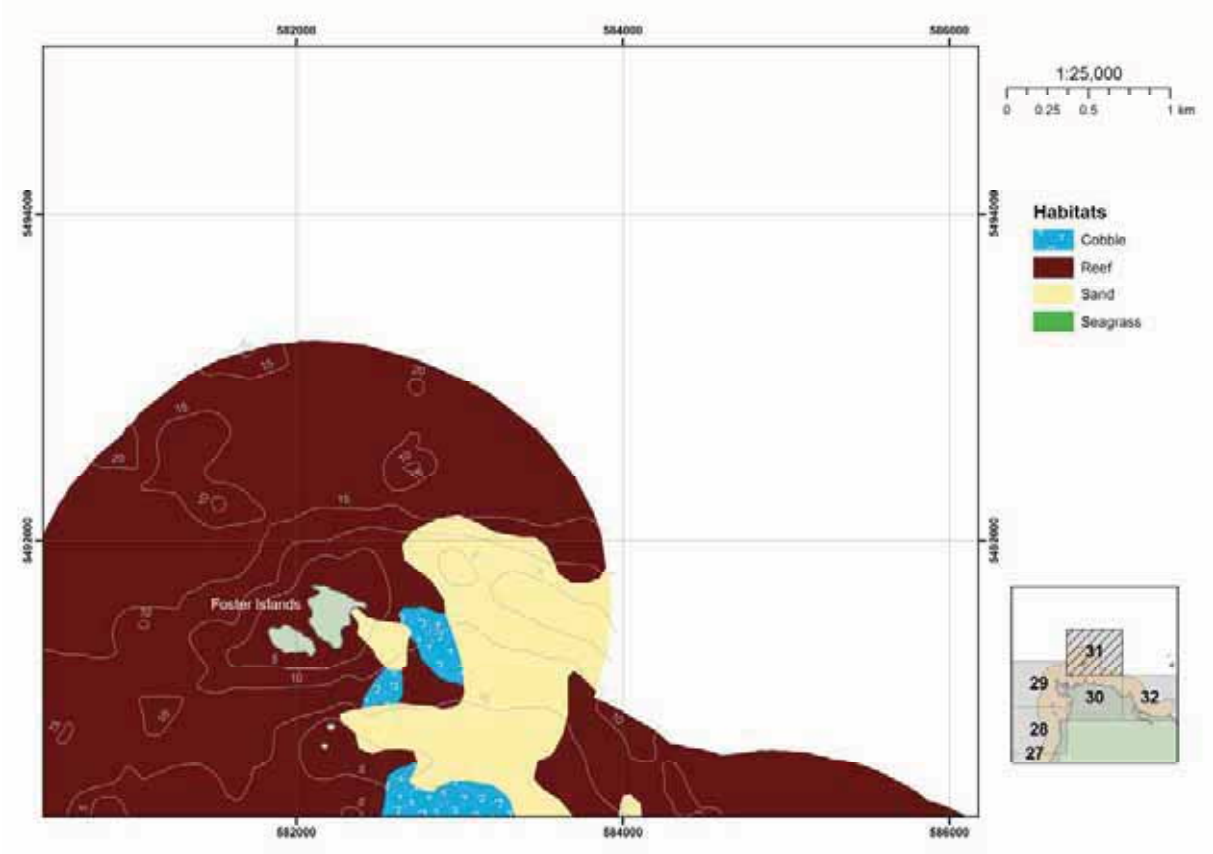


Figure 74. Tamar River to Swan Island map series map 31 showing habitats and bathymetry around Foster Island.

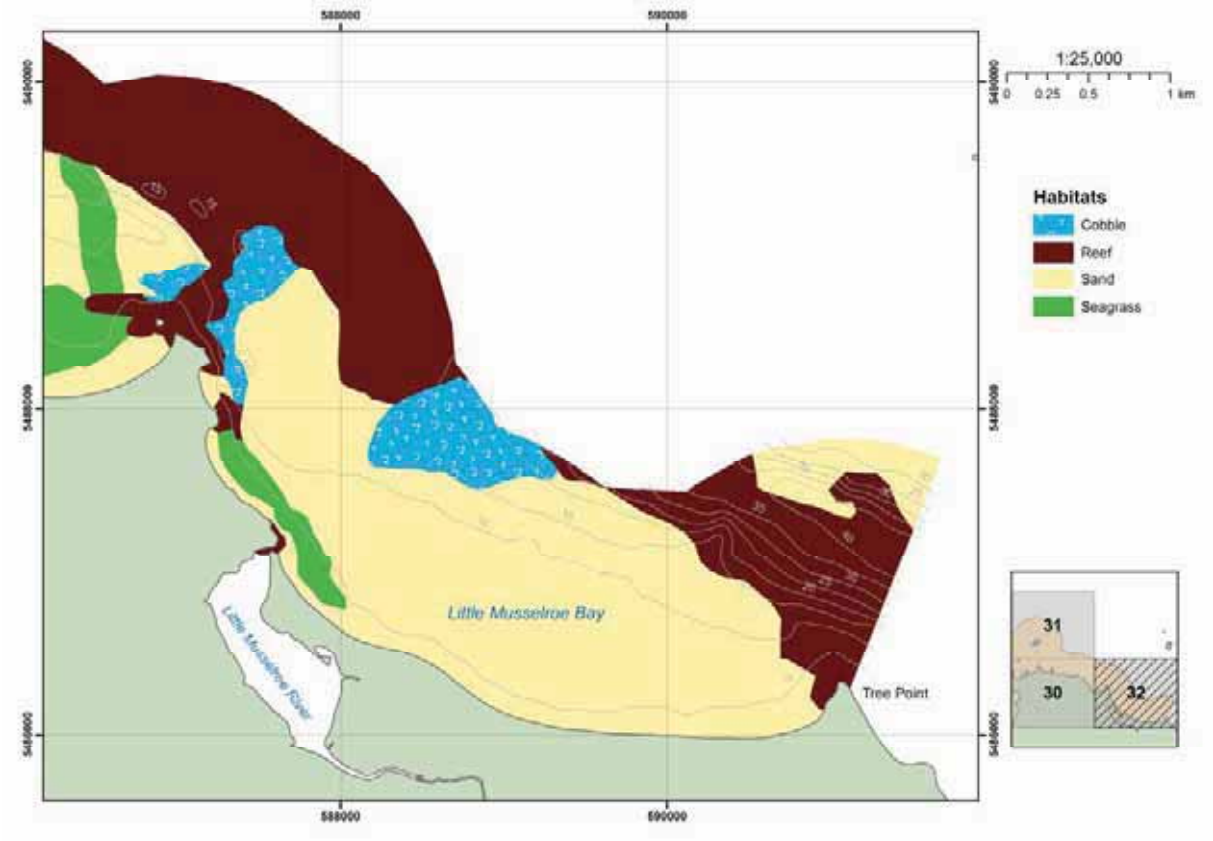
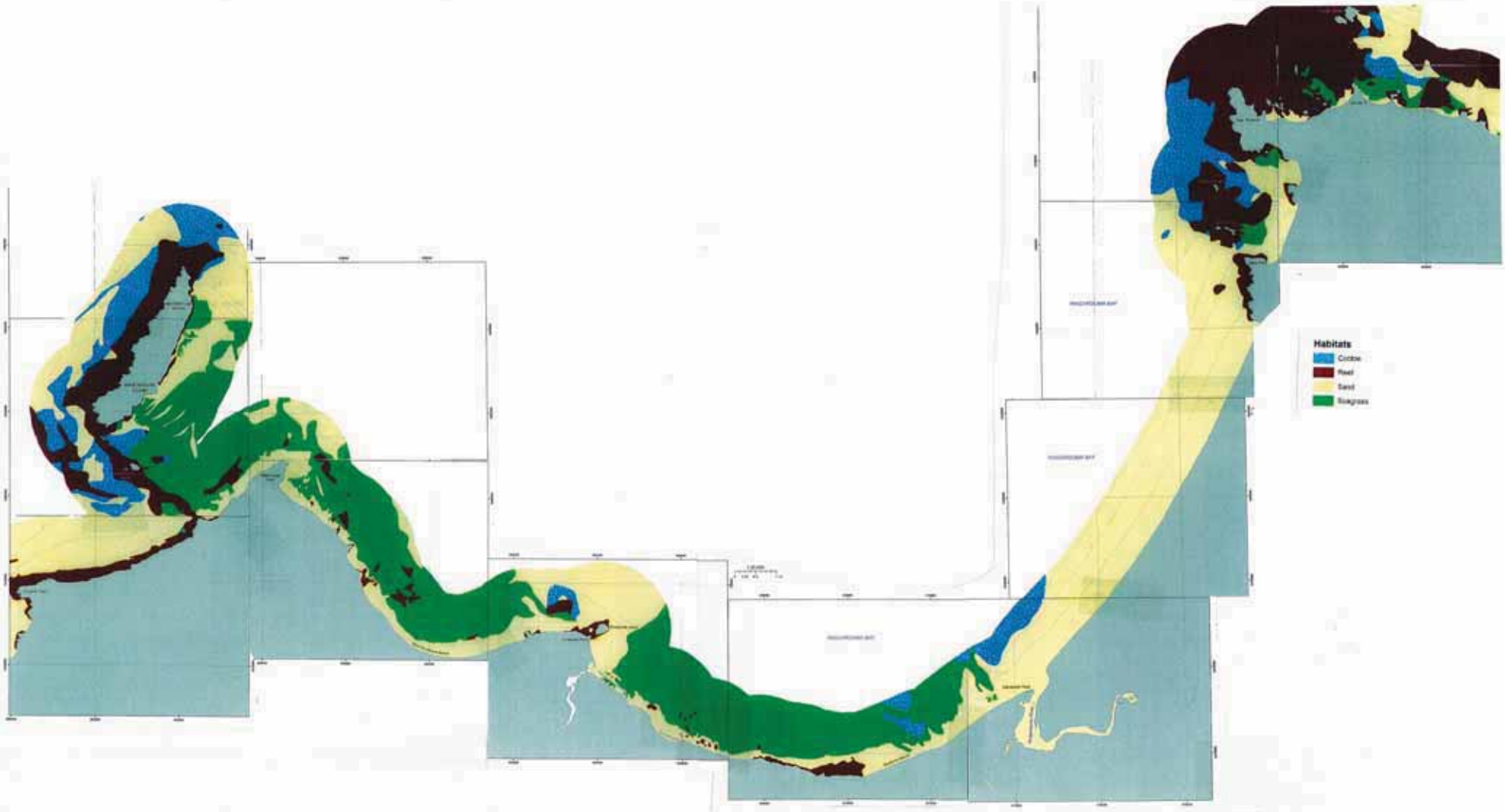


Figure 75. Tamar River to Swan Island map series map 32 showing habitats and bathymetry for Little Musselroe Bay.


Habitats
Cobble
Reef
Sand
Seagrass

Appendix F - Listed Species Habitat, Impact Likelihood Assessment and Management Requirements

Appendix F: Assessment of likelihood of occurrence and potential impact to *EPBC Act* 1999 and Tasmanian *Threatened Species Protection Act* 1995 listed species that may occur or are known to occur in the Exploration Licence (ELs) areas

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Threatened Ecological Communities					
Lowland Native Grasslands of Tasmania	CR	Community likely to occur within area	A terrestrial ecological community of lowland areas of Tasmania. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Birds					
Apus pacificus fork-tailed swift	LMS	Species or species habitat may occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). Occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Ardea alba great egret	MWS, LMS	Species or species habitat may occur within area	A migratory wetland bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). Occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Ardea ibis cattle egret	MWS, LMS	Species or species habitat may occur within area	A migratory wetland bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). Occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Arenaria interpres ruddy turnstone	MWS, LMS	Roosting known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours rocky and stony beaches with seaweed and other marine debris. Occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Aquila audax fleayi wedge-tailed eagle (Tas)	EN	Species or species habitat may occur within area	A non-migratory raptor (subspecies endemic to Tasmania) that rarely flies over large distances of water. There are no nest locations known from the land area that would be situated within 500m and 1km line of sight of the proposed exploration activities.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Botaurus poiciloptilus Australasian bittern	EN	Breeding likely to occur in area. Species or species habitat known to occur within area	A mainly freshwater habitat bird that inhabits most wetlands and farm dams which have a reed and rush bed. Species may occur in wetlands and to the south of Ringarooma Bay. Given the species' preference to freshwater habitats to forage and breed the species' occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Calidris acuminata sharp-tailed sandpiper	MWS, LMS	Roosting known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours mudflats and estuaries. The species may occur in the mudflats associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Calidris canutus red knot	MWS, LMS	Roosting known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours mudflats and estuaries. The species may occur in the mudflats associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Calidris ferruginea curlew sandpiper	MWS, LMS	Roosting known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours mudflats and estuaries. The species may occur in the mudflats associated with the Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Calidris melanotos pectoral sandpiper	LMS	Roosting known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours mudflats and estuaries. The species may occur in the mudflats associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Calidris ruficollis red-necked stint	MWS	Roosting known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours mudflats and estuaries. The species may occur in the mudflats associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Catharacta skua great skua	LMS	Species or species habitat may occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding and very rare migrant to Tasmania (i.e. it does not breed in Tasmania). Its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Ceyx azureus diemenensis Tasmanian azure kingfisher	EN	Species or species habitat may occur within area	A non-migratory bird (subspecies endemic to Tasmania) that occurs in riparian forest and scrub vegetation mainly in the west of Tasmania.	Nil likelihood of any impact.	No
Charadrius bicinctus double-banded plover	MWS, LMS	Roosting known to occur within area	A migratory bird that breeds in New Zealand in summer. It is a non-breeding common winter migrant to Tasmania (i.e. it does not breed in Tasmania). It favours mudflats, beaches, estuaries and lakes. The species may occur in the mudflats associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory. The survey operation is to occur in the open marine environment with no use of the beach or Boobyalla Inlet.	Nil likelihood of any impact.	No
Charadrius mongolus Mongolia plover	MWS, LMS	Roosting known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours mudflats and estuaries. The species may occur in the mudflats associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Charadrius ruficapillus red-capped plover	LMS	Roosting known to occur within area	A Tasmanian resident that inhabits sandy beaches, estuaries, saltmarsh and inland lakes. The species may utilise the Ringarooma Bay beach or be associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory. The survey operation is to occur in the open marine environment with no use of the beach or Boobyalla Inlet.	Nil likelihood of any impact.	No
Diomedea epomophora (senu stricto) southern royal albatross	VU, MMB, LMS	Species or species habitat may occur within area	A marine bird that breeds on sub-Antarctic islands. A rare visitor to the coastline of Tasmania. The species may be an occasional migratory visitor to the Ringarooma Bay area, but its occurrence there would only be transitory.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Diomedea exulans amsterdamensis Amsterdam albatross	EN, MMB, LMS	Species or species habitat may occur within area	A marine bird that breeds only on Amsterdam Island in the Indian Ocean. A very rare visitor to the coastline of Tasmania. The species is very unlikely to be a migratory visitor to the Ringarooma Bay area. Its occurrence there would only be transitory.	Nil likelihood of any impact.	No
Diomedea exulans antipodensis Antipodean albatross	VU, MMB, LMS	Species or species habitat may occur within area	A marine bird that breeds only on the Falkland Islands, Campbell Island and Antipodes Islands. A very rare visitor to the coastline of Tasmania. The species is very unlikely to be a migratory visitor to the Ringarooma Bay area. Its occurrence there would only be transitory.	Nil likelihood of any impact.	No
Diomedea exulans exulans Tristan albatross	EN, MMB, LMS	Feeding, foraging or related behaviour may occur within area	A marine bird that breeds on sub-Antarctic islands. A very rare visitor to the coastline of Tasmania. The species is very unlikely to be a migratory visitor to the Rtingarooma Bay area. Its occurrence there would only be transitory.	Nil likelihood of any impact.	No
Diomedea exulans gibsoni Gibson's albatross	VU, MMB, LMS	Species or species habitat may occur within area	A marine bird that breeds only on Marion and Crozet Islands. A very rare visitor to the coastline of Tasmania. The species is very unlikely to be a migratory visitor to the Ringarooma Bay area. Its occurrence there would only be transitory.	Nil likelihood of any impact.	No
Diomedea exulans (sensu lato) wandering albatross	VU, MMB, LMS	Species or species habitat may occur within area	A marine bird that breeds on sub-Antarctic islands. A common visitor to the coastline of Tasmania. The species is very unlikely to be a migratory visitor to the Ringarooma Bay area. Its occurrence there would only be transitory.	Nil likelihood of any impact.	No
Diomedea sanfordi northern royal albatross	EN, MMB, LMS	Species or species habitat may occur within area	A marine bird that breeds on sub-Antarctic islands. A rare visitor to the coastline of Tasmania. The species may be an occasional migratory visitor to the Ringarooma Bay area, but its occurrence there would only be transitory.	Nil likelihood of any impact.	No
Fregetta grallaria grallaria white-bellied storm-petrel	VU	Species or species habitat likely to occur within area	A common marine bird that breeds in the Atlantic, New Zealand, southern mainland Australia and Tasmania (mainly on rocky islands). A marine feeder this species can cover large distances to forage. Its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Eudyptula minor fairy penguin	LMS	Breeding known to occur within area	A resident marine bird that breeds in sand dunes and coastal vegetation around the Tasmanian coastline. No colonies are known to occur in Ringarooma Bay or immediate areas to Ringarooma Bay.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Gallinago hardwickii Latham's snipe	MWS, LMS	Roosting may occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours wetlands with a dense cover of sedges and rushes and also the margins of lakes and rivers. The species may occur in the mudflats and along the riverbanks of Ringarooma River (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Gallinago megala swinhoe's snipe	LMS	Roosting likely to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding very rare migrant (i.e. it does not breed in Tasmania). It favours wetlands with a dense cover of sedges and rushes and also the margins of lakes and rivers. The species may occur in the mudflats and along the riverbanks of Ringarooma River (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Gallinago stenura pin-tailed snipe	LMS	Roosting likely to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours wetlands with a dense cover of sedges and rushes and also the margins of lakes and rivers. The species may occur in the mudflats and along the riverbanks of Ringarooma River (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Haliaeetus leucogaster white-bellied sea eagle	MTS, LMS	Species or species habitat likely to occur within area	A migratory raptor that often flies over large distances of water and occasionally nests in coastal scrub and amongst rocks on headlands. There are no nest locations known from the land area that would be situated within 500m and 1km line of sight of the proposed exploration activities.	Nil likelihood of any impact.	No
Halobaena caerulea blue petrel	VU, LMS	Species or species habitat may occur within area	A marine bird that breeds on sub-Antarctic islands. A rare visitor to the coastline of Tasmania.	Nil likelihood of any impact.	No
Heteroscelus brevipes grey-tailed tattler	MWS, LMS	Roosting known to occur within area	A migratory bird that breeds in the Northern Hemisphere (eastern and south-eastern Asia). In Tasmania they winter on muddy flats and coastal tidal zones where they feed by sight on insects, crustaceans and other invertebrates. The species may occur in the mudflats and along the riverbanks of Ringarooma River (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Hirundapus caudacutus white-throated needletail	MTS, LMS	Species or species habitat may occur within area	A migratory bird that breeds in the Northern Hemisphere (eastern and south-eastern Asia). In Tasmania it inhabits a variety of terrestrial habitats including wet and dry forest and woodland, heathland, scrubs, rainforest, agricultural lands and associated remnant native and exotic vegetation types.	Nil likelihood of any impact.	No
Larus novaehollandiae silver gull	LMS	Breeding known to occur within area	A widespread and generalist species occurring in coastal and inland areas of Tasmania. The species is likely to occur in Ringarooma Bay however the proposed survey operations are not likely to have any effect on their behaviour or feeding patterns.	Nil likelihood of any impact.	No
Larus pacificus Pacific gull	LMS	Breeding known to occur within area	A common Tasmanian resident that inhabits beaches, coastal areas and offshore islands. The species is likely to occur in Ringarooma Bay however the proposed survey operations are not likely to have any effect on their behaviour or feeding patterns.	Nil likelihood of any impact.	No
Lathamus discolor swift parrot	EN, LMS	Species or species habitat may occur within area	A migratory parrot that breeds in south-eastern and central-north Tasmania where it forages on *Eucalyptus ovata* and *E. globulus*. The species over-winters on mainland Australia from South Australia through to south-eastern Queensland.	Nil likelihood of any impact.	No
Limnodromus semipalmatus Asian dowitcher	LMS	Roosting known to occur within area	A non-breeding migratory coastal marine bird in Australia. The species may not extend its wintering range to Tasmania. It forages in coastal estuaries and tidal flat where it feeds on small invertebrates.	Nil likelihood of any impact.	No
Limosa lapponica bar-tailed godwit	MWS, LMS	Roosting known to occur within area	A non-breeding migrant in Australia (i.e. it does not breed in Australia), this wader occurs during the summer months in Tasmania in coastal estuaries and tidal flats where it feeds on small invertebrates.	Nil likelihood of any impact.	No
Macronectes giganteus southern giant-petrel	EN, MMB, LMS	Species or species habitat may occur within area	A marine bird that breeds on sub-Antarctic islands. A common visitor to the coastline of Tasmania. The species may occur in Ringarooma Bay however the proposed survey operations are not likely to have any effect on their behaviour or feeding patterns.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Macronectes halli northern giant-petrel	VU, MMB, LMS	Species or species habitat may occur in area	A marine bird that breeds on sub-Antarctic islands. A common visitor to the coastline of Tasmania. The species may occur in Ringarooma Bay however the proposed survey operations are not likely to have any effect on their behaviour or feeding patterns.	Nil likelihood of any impact.	No
Myiagra cyanoleuca satin flycatcher	MTS, LMS	Breeding likely to occur within area	A small bird found in Australia, Indonesia, New Zealand, and Papua New Guinea. Its natural habitats are temperate forests and subtropical or tropical moist lowland forests. In Tasmania the species mainly breeds in eucalypt forest and woodland, scrub and riparian vegetation. Any occurrence of this species in the Ringarooma Bay area would be transitory.	Nil likelihood of any impact.	No
Numenius madagascariensis eastern curlew	MWS, LMS	Roosting known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours mudflats and estuaries. The species may occur in the mudflats associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Numenius minutus little curlew	MWS, LMS	Roosting known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours mudflats and estuaries. The species may occur in the mudflats associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Numenius phaeopus whimbrel	MWS, LMS	Roosting known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania). It favours mudflats and estuaries and is a rare migrant to Tasmania. The species may occur in the mudflats associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory.	Nil likelihood of any impact.	No
Pachyptila turtur ssp. *subantarctica* fairy prion	e VU	NA	An uncommon migrant to Tasmania that breeds on Macquarie Island. Any occurrence of this species in the Ringarooma Bay area would be transitory.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Pelagodroma marina white-faced storm-petrel	LMS	Breeding known to occur within area	A resident marine bird that may breed in Tasmania (it lays a single egg in rocky areas where birds congregate in colonies near the sea). The species may breed on the rocky shorelines and headlands near Ringarooma River. The survey operation is to occur in the open marine environment with no use of the beach or Boobyalla Inlet.	Nil likelihood of any impact.	No
Phalacrocorax fuscescens black-faced cormorant	LMS	Breeding known to occur within area	A resident exclusively marine bird that breeds in Tasmania. The species may breed on the rocky shorelines and headlands near Ringarooma River. The survey operation is to occur in the open marine environment with no use of the beach, rocky headlands or Boobyalla Inlet.	Nil likelihood of any impact.	No
Pluvialis fulva Pacific golden plover	MWS, LMS	Roosting known to occur within area	A migratory bird that breeds in New Zealand in summer. It is a non-breeding common winter migrant to Tasmania (i.e. it does not breed in Tasmania). It favours mudflats, beaches, estuaries and lakes. The species may occur in the mudflats associated with Boobyalla Inlet (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory. The survey operation is to occur in the open marine environment with no use of the beach or Boobyalla Inlet.	Nil likelihood of any impact.	No
Puffinus tenuirostris short-tailed shearwater	MMB, LMS	Breeding known to occur within area	A resident marine bird that breeds in sand dunes and coastal vegetation around the Tasmanian coastline. No colonies are known to occur in Ringarooma Bay or immediate areas to Ringarooma Bay.	Nil likelihood of any impact.	No
Sterna albifrons ssp. *sinensis* little tern	e LMS, MS	Species or species habitat known to occur within area	A migratory bird that spends summer in the Northern Hemisphere. It is a non-breeding migrant (i.e. it does not breed in Tasmania).	Nil likelihood of any impact.	No
Sterna caspia caspian tern	MMB, LMS	Breeding known to occur within area	An uncommon Tasmanian resident that inhabits beaches, coastal areas and offshore islands. The species may occur in Ringarooma Bay however the survey operations are not likely to have any effect on their behaviour or feeding patterns.	Nil likelihood of any impact.	No
Sternula nereis nereis fairy tern (Australian)	VU	Species or species habitat known to occur within area	An uncommon Tasmanian resident that inhabits beaches, coastal areas and offshore islands. The species is likely to occur in Ringarooma Bay however the proposed survey operations are not likely to have any effect on their behaviour or feeding patterns.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Thalassarche bulleri Buller's albatross	VU, MMB, LMS	Species or species habitat may occur within area	A migratory marine bird that breeds in New Zealand (offshore islands). Adults forage between Tasmania and the Chatham Rise. Non-breeding adults and juveniles disperse across the South Pacific, occasionally as far as the Humboldt current near Peru and Chile. Any occurrence of this species within the Ringarooma Bay area would be transitory.	Nil likelihood of any impact.	No
Thalassarche cauta (sensu stricto) shy albatross	VU, MMB, LMS	Species or species habitat may occur within area	A migratory marine bird that is endemic to Australia and breeds on three island colonies; Albatross Island, Pedra Branca, and the Mewstone. During the breeding season, adults concentrate around southern Australia and Tasmania. Juvenile birds are known to fly as far as South Africa otherwise, non-breeding birds can be found throughout the southern oceans, but specifics are rare due to their similarity to the other species. It is sometimes found off the Pacific coast of the United States. Any occurrence of this species within the Ringarooma Bay area would be transitory.	Nil likelihood of any impact.	No
Thalassarche cauta steadi white-capped albatross	VU, MMB	Species or species habitat may occur within area	A migratory marine bird endemic to the islands off the coast of New Zealand with a population of 75,000 breeding pairs, estimated in 2007 and 350,000 to 375,000 total birds. Juvenile and non-breeding birds are believed to forage in the southwestern Atlantic and as far as the south Atlantic and the southwestern Indian Ocean. Any occurrence of this species within the Ringarooma Bay area would be transitory.	Nil likelihood of any impact.	No
Thalassarche chrysostoma grey-headed albatross	EN, MMB, LMS	Species or species habitat may occur within area	A migratory marine bird that nests in colonies on several islands in the Southern Ocean, with large colonies on South Georgia in the South Atlantic, and smaller colonies on Islas Diego Ramírez, Kerguelen Islands, Crozet Islands, Marion Island, and Prince Edward Island in the Indian Ocean, Campbell Island and Macquarie Island south of New Zealand, and Chile. While breeding, they will forage for food within or south of the Antarctic Polar Frontal Zone. Birds that roost in the Marion Island area forage for food in the sub-tropical zone. Juveniles or non-breeding adults fly freely throughout all the southern oceans, north to 35°S. Any occurrence of this species within the Ringarooma Bay area would be transitory.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Thalassarche impavida Campbell albatross	VU, MMB, LMS	Species or species habitat may occur within area	A migratory marine bird that breeds on the northern and western coastline of Campbell Island and the islet Jeanette Marie. When breeding they forage from South Island (NZ) and the Chatham Rise to the Ross Sea. Juveniles and non-breeders will go only through south Australian water, the Tasman Sea, and southwestern Pacific Ocean. Any occurrence of this species within the Ringarooma Bay area would be transitory.	Nil likelihood of any impact.	No
Thalassarche melanophris black-browed albatross	VU, MMB, LMS	Species or species habitat may occur within area	A migratory marine bird that is circumpolar in the southern oceans, and it breeds on 12 islands throughout the southern oceans. In the Pacific Ocean it breeds on Islas Ildefonso, Diego De Almagro, Isla Evangelistas, Campbell Island, Antipodes Islands, Snares Islands, and Macquarie Island. Any occurrence of this species within the Ringarooma Bay area would be transitory.	Nil likelihood of any impact.	No
Thalassarche salvini Salvin's albatross	VU, MMB	Species or species habitat may occur within area	A migratory marine bird that breeds colonially on three disparate island groups in the Southern Ocean, Île des Pingouins, in the Crozet Islands in the Indian Ocean and the Bounty Islands and The Snares to the south of New Zealand, The Pyramid, and Forty-Fours Island. At sea, they range from South Africa across to Australia and as far east as the coast of South America. Any occurrence of this species within the Ringarooma Bay area would be transitory.	Nil likelihood of any impact.	No
Thinornis rubricollis hooded plover	LMS	Roosting known to occur within area	A small bird of coastal areas, it makes a nest on the sand within grasses and shrubs near the highwater mark along sandy beaches.	Nil likelihood of any impact.	No
Thinornis rubricollis rubricollis hooded plover (eastern)	LMS	Species or species habitat may occur within area	A marine bird endemic to Tasmania and mainland Australia it lives on sandy beaches, freshwater lakes and marshes and coastal saline lagoons. The bird breeds in Tasmania where it usually nests in dune vegetation and scrub around coastal lakes, lagoons and wetlands. The species may occur in the Boobyalla Inlet and coastal wetlands associated with the Ringarooma River (which flows into Ringarooma Bay) but its occurrence in the site would only be transitory. The proposed survey operations are to occur in the open marine environment with no use of the beach or Boobyalla Inlet.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Tyto novaehollandiae castanops masked owl (Tasmanian population)	VU	Species or species habitat known to occur within area	A nocturnal bird that breed as territorial and monogamous pairs. They nest in large tree hollows with a floor of decaying wood debris. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Mammals					
Arctocephalus forsteri New Zealand fur-seal	LMS	Species or species habitat may occur within area	A fur seal found around the south coast of Australia, the coast of the South Island of New Zealand, and some of the small islands to the south and east of there. Male-only colonies are also located on the Cook Strait coast of the North Island near Wellington and vagrants are found as far north as New Caledonia. In Tasmanian waters, it mainly occurs on the west and south coasts. Only a small number of New Zealand fur seals breed on remote islands off the south coast. Any occurrence of this species within the Ringarooma Bay area would be transitory.	Minor likelihood of impact.	Yes
Arctocephalus pusillus Australian fur-seal	LMS	Species or species habitat likely to occur within area	A fur seal that lives in Bass Strait, at for islands off Victoria in southeastern Australia and five islands off Tasmania (in Bass Strait). They prefer to haul out and breed on rocky islands, rock ledges and reefs and pebble and boulder beaches. However some large colonies can be found on sandy beaches. They spend most of the year at sea but not too far from land, and have been recorded 160km from land, but this is not common. They generally feed at lower water depths, diving on average 120m and can reach as deep as 200m. There is a small colony of this species located to the west of Ringarooma Bay.	Minor likelihood of impact.	Yes
Balaenoptera acutorostrata minke whale	WOC	Species or species habitat may occur within area	Minke whales tend to migrate in wide migration paths from cold water feeding grounds to warmer waters to breed during the winter period. The mating period occurs from August to September and calving occurs from June to July. Their distribution is worldwide and oceanic but not restricted to deep waters.	The exploration activities will occur when the species may be in Tasmanian waters. Minor likelihood of impact.	Yes

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Balaenoptera musculus blue whale	EN, WOC, MMS	Species or species habitat likely to occur within area	The world's largest marine mammal occurs occasionally in Tasmania waters, which is confirmed by the occurrence of a number of strandings of animals on the Tasmanian coastline. The species breeds and over-winters in warm waters and migrates to Antarctic waters during spring and summer.	The exploration activities will occur when the species may be in Tasmanian waters. Minor likelihood of impact.	Yes
Caperea marginata pygmy right whale	WOC, MMS	Species or species habitat may occur within area	A small whale that is found in the Southern Ocean in the lower reaches of the Southern Hemisphere, and feeds on copepods and euphausiids. The species lives in the Southern Hemisphere and is believed to be circumpolar, living in a band from about 30°S to 55°S, in areas with surface water temperature between 5 and 20 °C (41 and 68 °F). The species is generally found in temporal subantarctic waters, and oceanic, pelagic and inshore sightings have also been made. There have been sightings of this whale from Tasmania and South Australia, and the frequency of stranding occurrences (two or three a year) suggests that it is not rare in southern Australian waters (Bannister et *al.,* 1996).	The exploration activities will occur when the species may be in Tasmanian waters. Minor likelihood of impact.	Yes
Dasyurus maculatus maculatus spotted-tail quoll	VU	Species or species habitat likely to occur within area	Terrestrial mammal of wet eucalypt forest, rainforest, wet scrubs and degraded agricultural lands. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Delphinus delphis common dolphin	WOC	Species or species habitat may occur within area	A marine mammal that occurs in groups where they forage in shallow coastal waters around Tasmania. The species is likely to inhabit the marine environment in and around Ringarooma Bay.	The exploration activities will occur when the species is in Tasmanian waters. Minor likelihood of impact.	Yes
Eubalaena australis southern right whale	EN, WOC, MMS	Species or species habitat known to occur within area	Southern right whales travel north from Antarctica during June to September to the waters of southern mainland Australia and return southward between September and late October. A proportion of the population gives birth in Tasmanian waters. Most sightings occur on the east coast. Several strandings have occurred in Tasmania.	The exploration activities will occur when the species is not in Tasmanian waters. Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Globicephala macrorhynchus short-finned pilot whale	WOC	Species or species habitat may occur within area	A highly social cetacean that occurs in groups of 10 to 30 animals. Several strandings have occurred in Tasmania. The species may inhabit the marine environment in and around Ringarooma Bay.	The exploration activities will occur when the species is likely to occur in Tasmanian waters. Minor likelihood of impact.	Yes
Grampus griseus Risso's dolphin	WOC	Species or species habitat may occur within area	Usually found in deep water rather than coastal waters, this dolphin occurs worldwide in temperate and tropical waters. Strandings are infrequent, possibly due to the deep water habitats used by the species rather than shallow coastal waters.	The exploration activities will occur in shallow waters and the species prefers deeper waters near the continental shelf. Nil likelihood of any impact.	No
Lagenorhynchus obscurus dusky dolphin	WOC, MMS	Species or species habitat may occur within area	A species that prefers cool upwelling waters. They appear to have no well-defined seasonal migration patterns but can travel over large distances between inshore waters and the continental shelf. The species occurs in pods and forages on a variety of fish and squid species.	The exploration activities will occur when the species may be in Tasmanian waters. Minor likelihood of impact.	Yes
Megaptera novaeangliae humpback whale	VU, WOC, MMS	Species or species habitat likely to occur within area	A whale that feeds in polar waters during summer and then migrates to equatorial and tropical waters to give birth in the winter months. During winter whales fast and survive off their fat reserves accumulated during the summer months foraging on krill and small fish.	The exploration activities will occur when the species may be in Tasmanian waters. Minor likelihood of impact.	Yes
Orcinus orca orca	WOC, MMS	Species or species habitat may occur within area	Orcas are commonly found in cold deep waters. Off Australia, they are often seen along the continental slope and on the shelf as well as often being seen near seal colonies (Bannister *et al.,* 1996). Concentrations of the species are believed to occur around Tasmania and South Australia (Bannister *et al.,* 1996). Although not a migratory species, their movements vary seasonally and are related to food supply (Bannister *et al.,* 1996).	The exploration activities will occur when the species may be in Tasmanian waters. Minor likelihood of impact.	Yes

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Perameles gunnii gunnii eastern barred bandicoot	VU	Species or species habitat likely to occur within area	Terrestrial mammal of grassy woodlands and forest, grasslands, heaths and degraded agricultural lands. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Sarcophilus harrisii Tasmanian devil	EN	Species or species habitat likely to occur within area	Terrestrial mammal of numerous natural and man-made habitats in Tasmania, including forest and woodland, scrub, heathlands, grasslands and agricultural lands. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Tursiops truncatus s. str. bottlenose dolphin	EN	Species or species habitat may occur within area	A marine mammal that occurs in small pods across from equatorial to cool temperate zones. A common dolphin species that occasionally is seen around the coastal and inshore waters of Tasmania. The species may inhabit the marine environment in and around Ringarooma Bay.	The exploration activities will occur when the species is likely to occur in Tasmanian waters. Minor likelihood of impact.	Yes
Ray-finned Fishes					
Galaxiella pusilla dwarf galaxias	VU	Species or species habitat likely to occur within area	A freshwater fish of streams, rivers, dams and lakes. The species does not migrate to salt water during its life cycle which is wholly completed within freshwater habitats. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Heraldia nocturna upside-down pipefish	LMS	Species or species habitat may occur within area	A marine fish of coastal New South Wales, the species is not likely to occur in the Ringarooma Bay area.	Nil likelihood of any impact.	No
Hippocampus abdominalis big-belly seahorse	LMS	Species or species habitat may occur within area	A seahorse of rock pools in the inter-tidal zones along rocky shorelines. Juveniles can be pelagic or associated with floating seaweed mats.	Nil likelihood of any impact.	No
Hippocampus breviceps short-head seahorse	LMS	Species or species habitat may occur within area	Endemic to Australia this species occurs in open seas, shallow seas, sub-tidal aquatic beds, coral reefs, estuarine waters and intertidal flats. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Hippocampus minotaur bullneck seahorse	LMS	Species or species habitat may occur within area	Endemic to Australia this species occurs in open seas, shallow seas, sub-tidal aquatic beds, coral reefs, estuarine waters and intertidal flats. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Histiogamphelus briggsii crested pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Bass Strait region) this species occurs in open seas, shallow seas, sub-tidal aquatic beds, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Histiogamphelus cristatus rhino pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Bass Strait region through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Hypselognathus rostratus knifesnout pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Bass Strait region through to South Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Kaupus costatus deepbody pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Bass Strait region through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Kimblaeus bassensis trawl pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Eastern Indian Ocean region through to the Tasman Sea) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Leptoichthys fistularius brushtail pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Bass Strait region through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Lissocampus caudalis Australian smooth pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (New South Wales through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Lissocampus runa javelin pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Bass Strait region through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Maroubra perserrata sawtooth pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (New South Wales through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Mitotichthys semistriatus halfbanded pipefish	LMS	Species or species habitat may occur within area	Occurs in the Eastern Indian Ocean through to Australia (Victoria and Tasmania) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Mitotichthys tuckeri Tucker's pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (New South Wales through to Tasmania) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Notiocampus ruber red pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (New South Wales through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Phycodurus eques leafy seadragon	LMS	Species or species habitat may occur within area	The leafy seadragon is found only in the waters of Australia from Kangaroo Island on the Southern shoreline to Jurien Bay in the Western shoreline. It was once thought to be very limited in its range; however, further research has discovered that the seadragon will actually travel several hundred metres from its habitat, returning to the same spot using a strong sense of direction. They are mostly found around clumps of sand in waters up to 50 metres (164 feet) deep, hiding among rocks and seagrass. The species may utilise the Ringarooma Bay marine environment.	Minor to nil likelihood of any impact.	Yes
Phyllopteryx taeniolatus common seadragon	LMS	Species or species habitat may occur within area	Endemic to Australia (New South Wales through to Western Australia) this species inhabits coastal waters down to at least 50 metres deep. It is associated with rocky reefs, seaweed beds, seagrass meadows and structures colonised by seaweed. The species may utilise the Ringarooma Bay marine environment.	Minor to nil likelihood of any impact.	Yes
Prototroctes maraena Australian grayling	VU	Species or species habitat likely to occur within area	A predominantly marine fish that breeds in coastal estuaries in brackish to freshwater. A common fish around the Tasmanian coastline where it is referred to as 'white bait'. The species is very likely to utilise the Ringarooma Bay marine environment when not breeding, and possibly uses Boobyalla Inlet and freshwater stretches of the Ringarooma River to breed.	Minor to nil likelihood of any impact.	Yes
Pugnaso curtirostris pugnose pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Victoria through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Solegnathus robustus robust pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (South Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. The species is not likely to occur in the Ringarooma Bay area.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Solegnathus spinosissimus spiny pipefish	LMS	Species or species habitat may occur within area	South-eastern Australia, from Bass Strait region and Tasmania, just ranging into southern Queensland. Occurs on soft-bottom in depth over 30 m to 250 m, usually rubble substrate, and near rich invertebrate platform reefs. Only seen in shallower depths in the southern part of its range in estuaries that are shaded or the water darkened by tannins. The Ringarooma River is not a tannin-rich or tannin-producing river due to the paucity of tannin-producing vegetation within its catchment. The species is very unlikely to occur in Ringarooma Bay.	Nil likelihood of any impact.	No
Stigmatopora argus spotted pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Queensland through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Stigmatopora nigra widebody pipefish	LMS	Species or species habitat may occur within area	Occurs in New Zealand and Australia (New South Wales through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Stipecampus cristatus ringback pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Victoria through to Western Australia) this species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Urocampus carinirostris hairy pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Queensland through to Western Australia) this species occurs in association with seagrass beds and algal rubble reefs at shallow depth (usually to 5m). There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Vanacampus margaritifer Mother-of-pearl pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Queensland through to Western Australia) this species occurs in association with open seabeds, seagrass beds and submerged mudflats. There are seagrass beds, areas of open sandy seabed and submerged mudflats in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Vanacampus phillipis Port Phillip pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (New South Wales through to Western Australia) this common species occurs in shallow seas, estuarine waters and intertidal flats mainly in association with seagrass beds. There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Vanacampus poecilolaemus longsnout pipefish	LMS	Species or species habitat may occur within area	Endemic to Australia (Queensland through to Western Australia) this species occurs in association with seagrass beds and algal rubble reefs at shallow depth (usually to 5m). There are seagrass beds and areas of open sandy seabed in Ringarooma Bay and surrounds, the species may occur in the area of the proposed survey activity.	Minor to nil likelihood of any impact.	Yes
Frogs					
Litoria raniformis green and gold bell frog	VU	Species or species habitat known to occur in area	A cryptic semi-aquatic/terrestrial frog of wetlands, farm dams, slow moving waterways and wet soaks/springs with aquatic vegetation.	Nil likelihood of any impact.	No
Crabs, lobsters, shrimps, woodlice					
Astacopsis gouldi giant freshwater crayfish	VU	Species or species habitat known to occur within area	An aquatic invertebrate that occurs in slow moving north-flowing streams of the central north of Tasmania (e.g. Forth, Wilmot, Inglis, Flowerdale, Meander and Mersey Rivers), and also in the north-flowing streams of the north-east (e.g. Ringarooma), and Arthur River catchment (north-western Tasmania). Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Sharks					
Carcharodon carcharias great white shark	VU, MMS	Species or species habitat likely to occur in area	Occurs in coastal waters and offshore waters of continental and island shelves. Often seen close inshore and sometimes in shallow bays. Migrates across oceans with sharks from Australian waters have been known to migrate to South Africa. Usually solitary or in pairs but sometimes in larger feeding groups. Found at depths to 1,280m.	The exploration activities will occur when the species is likely to occur in Tasmanian waters. Nil to minor likelihood of impact.	Yes

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Isurus oxyrinchus shortfin mako shark	MMS	Species or species habitat likely to occur in area	A shark that inhabits offshore temperate and tropical seas worldwide. It is a pelagic species that can be found from the surface down to depths of 150 m, normally far from land, though occasionally closer to shore, around islands or inlets. Species may occasionally use the marine environment around Ringarooma Bay.	The exploration activities will occur when the species is likely to occur in Tasmanian waters. Nil to minor likelihood of impact.	Yes
Lamna nasus mackerel shark	MMS	Species or species habitat likely to occur in area	This species has an almost global amphitemperate distribution but populations in the Northern and Southern Hemispheres appear to be completely separate. Offshore fishing banks are the favored habitat of the species where it can be found anywhere from a depth of 1,360 m in oceanic basins to littoral waters less than 1 m deep, over the entire water column.	Species is unlikely to occur in the proposed survey area.	No
Terrestrial plants					
Caladenia caudata tailed-spider orchid	VU	Species or species habitat likely to occur within area	Terrestrial flora species (orchid) that grows in a variety of habitats, including heathy and grassy woodland and forest, heathlands and open scrub (mainly on sandy to well drained gravely soils). Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Conospermum hookeri variable smoke-bush	VU	Species or species habitat likely to occur within area	Terrestrial flora species (small shrub) of well drained sandy soils dominated by coastal heathland and eucalypt woodland and forest along the east coast of Tasmania. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Glycine latrobeana purple clover	VU	Species or species habitat likely to occur within area	Terrestrial flora species (herb) that grows in grassy eucalypt woodlands and forests and occasionally extends into grasslands (high and low altitude) mainly on soils derived from dolerite or basalt. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Prasophyllum apoxychilum tapered leek-orchid	EN	Species or species habitat known to occur within area	Terrestrial flora species (orchid) that grows in coastal heathland or grassy and scrubby open eucalypt forest on sandy and clay loams, often among rocks in 4 disjunct coastal occurrences in the south-east and northern coast of Tasmania. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Prasophyllum secutum northern leek-orchid	EN	Species or species habitat likely to occur within area	Terrestrial flora species (orchid) that grows in dense coastal scrub in the swales of stabilised sand dunes on white to grey sands and sandy loam on the northern and western coasts of Tasmania. Nil likelihood of occurrence.	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Pterostylis atriola snug greenhood	EN	Species or species habitat may occur within area	Terrestrial flora species (orchid) known from widely separated localities ranging from near-coastal lowland and hinterlands in the north and east to 600 m above sea level in the southeast of Tasmania. Grows in dry sclerophyll forest, typically with an open understorey (e.g. shrubby *Eucalyptus obliqua* forest, shrubby/heathy *Eucalyptus amygdalina* forest). Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Pterostylis ziegeleri grassland greenhood	VU	Species or species habitat likely to occur within area	Terrestrial flora species (orchid) that grows in a variety of habitats, including coastal scrub, grasslands (coastal and inland) and open grassy woodlands (mainly on sandy to well drained gravely soils). Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Thelymitra jonesii sky-blue sun-orchid	EN	Species or species habitat likely to occur within area	Terrestrial flora species (orchid) known from 4 widely distributed coastal localities including Rocky Cape, Cape Barren Island, Southport Bluff and the Tasman Peninsula. Grows in moist coastal heath on sandy to peaty soils and in *Eucalyptus obliqua* forest in deep loam soil over dolerite. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Xanthorrhoea arenaria sand grasstree	VU	Species or species habitat may occur within area	Terrestrial flora species (sedge) that has been recorded on sandy soils (sometimes acidic) of low fertility along Tasmania's north and north-east coastal plains. Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Xanthorrhoea bracteata shiny grasstree	EN	Species or species habitat likely to occur within area	Terrestrial flora species (sedge) that has been recorded on sandy soils (acidic) of low fertility along Tasmania's north, north-east coastal plains and in isolated patches along the east coast (e.g. Freycinet Peninsula). Nil likelihood of occurrence.	Nil likelihood of any impact.	No
Invasive Species					
Felis catus domestic cat	IS	Species or species habitat likely to occur within area	Terrestrial species, not likely to occur within ELs	Nil likelihood of any impact.	No
Oryctolagus cuniculus rabbit	IS	Species or species habitat likely to occur within area	Terrestrial species, not likely to occur within ELs	Nil likelihood of any impact.	No
Vulpes vulpes red fox	IS	Species or species habitat likely to occur within area	Terrestrial species, not likely to occur within ELs	Nil likelihood of any impact.	No

Species	Status[1]	Type of Presence	Habitat descriptions and Likelihood of Occurrence in ELs	Likelihood of impact assessment	Management Actions Required?
Chrysanthemoides monilifera bitou bush, boneseed	IS	Species or species habitat likely to occur within area	Terrestrial species, not likely to occur within ELs	Nil likelihood of any impact.	No
Rubus fruticosus agg. blackberry	IS	Species or species habitat likely to occur within area	Terrestrial species, not likely to occur within ELs	Nil likelihood of any impact.	No
Salix spp. Except *S.babylonica, S.x calodendron & S.x reichardtiji* Willows, except weeping willow, pussy willow and sterile pussy willow	IS	Species or species habitat likely to occur within area	Terrestrial species, not likely to occur within ELs	Nil likelihood of any impact.	No
Ulex europaeus gorse, furze	IS	Species or species habitat likely to occur within area	Terrestrial species, not likely to occur within ELs	Nil likelihood of any impact.	No

Key: EN – endangered, VU – vulnerable, LMS – listed marine species, OMA –, MS – migratory species, WOC – whales and other cetaceans. MMS – migratory marine species, MTS – migratory terrestrial species, MMB – migratory marine birds, MWS – migratory wetland species, IS – Invasive Species